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The Impact of Complexity and Ambiguity of Accounting Disclosures on Corporate Cash Holdings

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Abstract

This work aims to investigate the association of complex and vague information of accounting disclosures with firms' cash holdings policy. The sample includes firm year observations from the annual reports of U.S. firms (10-Ks) for the period 1999 to 2016. Financial data obtained from the Compustat/Center for Research in Security Prices (CRSP) database are merged with qualitative data from textual analysis of the reports. The main finding of the study indicates that companies with complex and ambiguous reports tend to retain a higher level of cash to overcome the higher cost of raising external capital. This is in line with the agency motive and the precautionary motive theories from the cash holdings literature. The results of this research work provide further knowledge to researchers, managers, financial analysts, and investors as they contribute to the deeper analysis and comprehension of corporate cash holdings policy shedding the light on its association with accounting information quality. This work contributes to two growing strands of accounting literature: cash holdings literature and literature on the quality of corporate disclosures. Specifically, it adds empirical evidence to research questions that are not widely examined in the relevant literature, expanding the range of measures of complexity and ambiguity of accounting information that are used.

Keywords: Accounting disclosures, Cash holdings, Textual analysis, Complexity, Ambiguity

JEL Classification: M41

1. Introduction

The aim of this study is to examine the association between complexity and ambiguity of information that managers disclose in annual reports and the level of cash that they choose to hold. Reports that are more complex and therefore difficult to read indicate a managers' attempt to obfuscate accounting information. According to the management obfuscation hypothesis, managers disclose more complex and vague information to hide poor performance from stakeholders and to act opportunistically for their interests (Schrand & Walther, 2000; Bloomfield, 2002; de Souza et al., 2019; Li, 2008). After reviewing the literature in the field extensively, we find that there is lack of empirical research that examines whether and how complexity and ambiguity of 10-Ks are associated with corporate liquidity policy.

Consequently, this work draws on two distinct literature streams, the cash holdings theory and the readability and ambiguity of accounting disclosures literature, adopting a comprehensive textual analysis framework. In this light, the main research questions of the paper are postulated as: first, "Is there a significant relationship among complexity of financial reporting and firms' cash holdings?" and second: "Is ambiguity of accounting information related with corporate cash holdings policy?".

This study adopts a methodology that combines econometric and algorithmic analysis. The database constructed after the textual analysis of 10-Ks was merged with financial data from the Compustat database. The final sample includes 29 994 observations from U.S. companies that file their annual reports in the SEC's EDGAR database for the years 1999 to 2016.

The findings of this paper suggest that managers that disclose more complex and vague information tend to hoard cash. Specifically, the empirical evidence of this research work indicates that firms with higher number of words in their disclosures, as well as larger reports retain higher amount of cash. The same holds for firms that include a higher percentage of words that denote ambiguity (percentage of uncertain words and percentage of modal weak words) in their annual reports. This empirical evidence is in line with the agency and the precautionary motives coming from the corporate finance literature. Following the agency motive, managers that obfuscate accounting information tend to hoard cash to obtain private benefits rather than pay dividends to shareholders. According to the precautionary motive, prior findings suggest that firms with less readable or ambiguous reports have difficulties to raise external capital and borrowing is likely to be more expensive for them (Rjiba et al., 2021; Xu et al., 2020; Ertugrul et al., 2017). Therefore, empirical evidence indicates that firms with less access to external financing and with higher costs of borrowing tend to hold more cash (Kim et al., 1998).

The empirical results of this study could provide important implications for researchers, financial analysts, and investors as they contribute to the better comprehension and analysis of corporate cash holdings policy. Researchers might gain a better insight into the relationship between complexity, ambiguity, and cash holdings as the empirical evidence is limited. Financial analysts and investors can interpret the decisions of managers concerning liquidity policy and thus, they may conduct more efficient prospective analysis and firm valuation.

This study contributes to two leading strands of accounting and corporate finance literature: cash holdings literature and literature on the quality of accounting information. Specifically, this work augments the existing empirical evidence in the cash holdings research field by adopting alternative measures of complexity and ambiguity of accounting disclosures, to examine their association with cash holdings. Particularly, the number of words that are included in a 10-K is used to measure complexity and the percentage of modal weak words (along with other measures) is used to measure ambiguity. To our knowledge, these measures are used for the first time to investigate these research questions. The methodology is replicable, and the results have been tested for accuracy and robustness.

The remainder of the study is structured as follows: Section 2 presents the prior literature and develops the hypotheses. Section 3 describes data collection and the sample, while in Section 4 variable measurements and the research design can be found. The empirical results and the discussion are presented in Section 5. Finally, Section 6 concludes the paper.

2. Literature Review and Hypotheses Development

2.1 Cash Holdings Literature

In recent decades, research findings indicate that both U.S. and international firms tend to hoard cash (Opler et al., 1999; Foley et al., 2007; Bates et al., 2009; Pinkowitz et al., 2012). Many theories and motives have been formulated to explain firms' decision to hold excess cash. Originally, Modigliani and Miller (1958) suggested that in a perfect financial market (a market with no taxes, information asymmetries, and agency costs) the value of a firm is not affected by its capital structure. Hence, there is no association between a firm's financial policies (paying dividends and retaining cash) and its market value.

However, several years later, researchers indicated three main cash holdings theories that attempt to interpret managers' decision about the level of cash that they choose to retain. First, in 1977, Myers introduced the trade-off theory that indicated that there is an optimum level between debt and retaining cash. The second theory, the pecking order theory by Myers and Majluf (1984), suggested that there is a hierarchical order that managers follow to finance their activities: first, they use firm's cash, then debt and finally, they issue new shares. According to this theory, information asymmetries play a crucial role in managers decisions. Later, in 1986, Jensen proposed the free cash flow theory that defined free cash flow as the excess cash flow that can be used for investments with net present values discounted at the cost of capital. Furthermore, this theory states that managers tend to hoard cash for future opportunities than pay dividends to shareholders.

Moreover, literature suggests five main motives that lead firms to hold cash. The first motive is the transaction cost motive according to which firms hoard cash to deal with the transaction costs that may occur (Keynes, 1936). Second, the precautionary motive states that managers decide to hold more cash to confront unexpected future events (Keynes, 1936). According to the empirical evidence, the precautionary motive is the main motive behind managers' decision to accumulate cash (e.g. Lins et al., 2010; Francis et al., 2014). Third, the speculative motive is based on the idea that firms hoard cash to be able to seize future investment opportunities

(Keynes, 1936). The agency motive focuses on the conflict of interest between managers and shareholders, indicating that managers accumulate cash to achieve their personal interests. In specific, they prefer to accumulate cash than pay dividends to shareholders for self-serving purposes (Jensen, 1986; Easterbrook, 1984). Finally, the tax motive concerns the multinational firms that repatriate foreign earnings and have to deal with the tax consequences. Thus, these firms tend to hoard cash to anticipate higher tax costs (Foley et al., 2007).

2.2 Complexity and Ambiguity of Accounting Disclosures and Corporate Cash Holdings

In the research field of accounting and finance, readability is the ability of analysts and investors to interpret value-relevant information from financial disclosures (Loughran and McDonald, 2014). Thus, a complex report is less readable, and it requires higher attempt from the receiver of information in order to comprehend it. The definition of readability goes back to 1949, when Dale and Chall focused on the manner that information is presented to the receiver.

Low readability of accounting reports is associated with the obfuscation hypothesis. Obfuscation of accounting disclosures indicates the intentional attempt to misguide the users of accounting information by implementing distracting writing methods (Courtis, 2004). Specifically, according to management obfuscation hypothesis, managers overshadow poor performance by disclosing complex information in accounting reports (Schrand & Walther, 2000; Bloomfield, 2002). This managers' behavior arises from the agency problem from the information asymmetry theory (de Souza et al., 2019).

Moreover, prior findings suggest that less readable financial reports result in higher information risk and higher cost of external financing because investors cannot easily comprehend the content of the reports. This leads to higher cost of equity capital (Rjiba et al., 2021). On the contrary, higher readability enables firms to have easier access to external sources of financing such as trade credit from suppliers (Xu et al., 2020). Dalwai et al. (2023) state that less readable auditor reports decrease firm's liquidity and increase the cost of debt. Furthermore, empirical evidence indicates that higher complexity of accounting disclosures, results in an increase in the processing costs of information and this affects negatively the efficiency of the stock markets as stock prices do not reveal the value of the firm on time (Lee, 2012; Callen et al., 2013; You & Zhang, 2009). In addition, prior literature suggests that more readable reports lead to lower agency costs and information asymmetry between managers and investors (Aymen et al., 2018).

The association between readability of accounting disclosures and the level of corporate cash holdings is not widely explored by the research in the field of accounting. Recent empirical evidence has stated that firms that disclose complex accounting information in their reports tend to accumulate more cash. In addition, this relationship is more intense for firms that are poorly governed, more constrained, and have to deal with higher refinancing risks (Hasan & Habib, 2020). Moreover, findings suggest that cash holdings of firms with more obfuscated information in their reports are valued lower by the market. In other words, market value of cash holdings is higher for firms with more readable reports (Choi et al., 2021). Furthermore, literature has shown that firms that disclose material weakness in their annual reports hold more valuable cash (Huang et al., 2015).

Moreover, the U.S. Securities and Exchange Commission (SEC) in 1998 adopted the plain English disclosure rules that included two arguments: a) information asymmetry arises from the complexity of financial reports that the average investor cannot comprehend and b) managers tend to hide poor performance by disclosing vague information in their reports (SEC, 1998). The SEC encouraged the use of simple and understandable language in financial disclosures and made the use of plain language in firm's prospectuses obligatory with this regulation.

The empirical evidence concerning the association between ambiguity of accounting information and corporate cash holdings is also scarce. Prior research indicates that SEC rules of 1998 were relevant as managers choose intentionally to disclose vague information to reduce the transparency of reporting (Li, 2008). Furthermore, stock return volatility is positively associated with uncertain tone of annual reports (Loughran & McDonald, 2011). In addition, uncertainty of accounting disclosures increases the cost of external financing as well as the stock price crash risk (Ertugrul et al., 2017). Finally, empirical evidence indicates that higher ambiguity in firms' annual reports is related to greater amount of cash holdings (Friberg & Seiler, 2017).

2.3 Hypotheses Development

Prior literature suggests different motives to interpret the decision of managers to hoard cash. Agency motive (Jensen, 1986; Easterbrook, 1984; Dittmar & Mahrt-Smith, 2007; Harford et al., 2008) and precautionary motive (Keynes, 1936; Bates et al., 2009; Opler et al., 1999) focus on information asymmetry and the difficulty of firms to raise external financing. Thus, we expect that firms with more obfuscated accounting information tend to hold more cash, according to the agency and the precautionary motive. Hence, this study attempts to examine whether managers that disclose more complex information tend to hoard or decrease corporate cash holdings. To respond to this research question, we structure the following hypothesis:

Hypothesis 1. *The complexity of information disclosed in 10-Ks has a significant association with corporate liquidity policy.*

Moreover, along with the complexity of the text of financial reports, we examine the degree of vagueness of information that managers disclose in annual reports and its association with their decisions concerning the level of corporate cash holdings. Prior literature suggests a positive relationship between 10-Ks ambiguity and cash holdings (Friberg & Seiler, 2017). In addition, firms that disclose more uncertain information and thus, make less transparent disclosures, tend to deal with higher cost of external financing (Ertugrul et al., 2017). Hence, we expect that according to the precautionary and agency motives, management adjusts the level of cash holdings to overcome possible liquidity problems in case that discloses vague accounting information. The empirical evidence about this research question is extremely scarce and, hence, in this research work, we attempt to shed more light on this association. Therefore, we propose the second hypothesis of this study:

Hypothesis 2. *The ambiguity of accounting information disclosed in annual reports has a significant relationship with firms' cash holdings policy.*

3. Data Collection and Sample

3.1 Data and Sample Formation

To investigate the above-mentioned hypotheses, we created a longitudinal database that includes U.S. firm-level data from 1999 to 2016. First, we obtained the annual reports from the SEC's Electronic Data Gathering, Analysis, and Retrieval (EDGAR) system for these years (www.sec.gov). Python programming language was used to automatically retrieve the reports per quarter and year from the EDGAR's site. When this procedure was completed, we had collected 145 024 raw files for the years 1999 to 2016. The 10-K files were then cleaned to proceed with textual analysis. Textual analysis of 10-Ks was conducted with Loughran and McDonald dictionary (Loughran & McDonald, 2011).

Following the textual analysis of annual reports, we merged this dataset (by CIK code and year) with financial data retrieved from the merged Compustat/Center for Research in Security Prices (CRSP) annual database. Companies with 2000 words or less in their 10-Ks were excluded from the final sample (Loughran & McDonald, 2011) along with financial and utility companies that operate in specific regulatory environments. Moreover, observations were deleted if there were missing data on main variables and therefore, the final sample includes 29 994 observations or 4 875 firms.

Table 1 provides information on the procedure for constructing the final sample for this study. Table 2 presents firm-year observations by fiscal year.

Table 1. Sampling procedures

Distribution	Net count
SEC annual reports 1999-2016	145 024
Net after exclusion of:	
Annual reports with equal or less than 2000 words (10 636)	134 388
Missing values of CIK after merging with Compustat (98 627)	35 761
(excluding duplicates per CIK and year)	
Missing data on main variables (5 767)	29 994
Firm-year observations in the final sample	29 994

Note: This table reports the procedure of the creation of the final sample after the implementation of the data selection criteria on the initial sample of 10-Ks.

Table 2. Observations per year

Fiscal Year	Observations	Percent (%)	Cumulative Percent (%)
1999	182	0.61	0.61
2000	266	0.89	1.49
2001	483	1.61	3.10
2002	1 202	4.01	7.11
2003	1 764	5.88	12.99
2004	1 988	6.63	19.62
2005	1 953	6.51	26.13
2006	1 912	6.37	32.51
2007	1 923	6.41	38.92
2008	1 954	6.51	45.43
2009	2 023	6.74	52.18
2010	2 166	7.22	59.40
2011	2 083	6.94	66.34
2012	2 055	6.85	73.19
2013	2 014	6.71	79.91
2014	2 060	6.87	86.78
2015	2 017	6.72	93.50
2016	1 949	6.50	100.00
Total	29 994	100	

Notes: This table presents the distribution of the companies of this study. The sample contains 29 994 observations for the years 1999 to 2016, including 4 875 unique firms.

3.2 Textual Analysis - Dictionary Method

In this work, the dictionary method was used to proceed with textual analysis of 10-Ks. This method was used to parse the 10-Ks and to obtain the sentiment of the U.S. annual accounting disclosures. This methodology was introduced by Loughran and McDonald in 2011 and is called Loughran and McDonald dictionary (Loughran & McDonald, 2011). This dictionary includes word lists specially constructed to interpret the sentiment of the report

(Loughran & McDonald, 2016).

Python programming language was used to analyze the 10-Ks and to parse the text according to the dictionary. After this procedure, the algorithm classified the words of annual reports into sentiment categories. We extracted the measure of complexity from the results of the textual analysis procedure. As complexity measures that denote the obfuscation of accounting information, we used file size which is the natural logarithm of the size of the annual report in megabytes and length of the file which is a proxy of the natural logarithm of the number of words that are included in a 10-K. To measure ambiguity of information of 10-Ks, we used two variables originated from textual analysis procedure, the percentage of uncertain words (e.g., ambiguous, doubtful, uncertain, and vague) and the percentage of modal weak words (almost, might, perhaps, and possibly) included in the report.

4. Variable Measurement and Research Design

4.1 Variable Measurements

In this section, we present in detail the dependent, independent, and control variables that are included in the empirical models of this study.

Cash holdings which are the dependent variable are measured as cash and cash equivalents divided with total assets. Furthermore, we include the complexity measures which are *lnfilesize* and *length. Lnfilesize* is the natural logarithm of net size of the annual report in megabytes and *length* of the file is a proxy of the natural logarithm of the number of words that are included in a 10-K. To measure the ambiguity of the tone of 10-Ks we use two variables: *uncertainty*, which is the percentage of uncertain words in annual reports and *modalweak*, which is the percentage of modal weak words in annual reports following Loughran and McDonald (2011).

Moreover, to empirically investigate the impact of complexity and ambiguity of accounting information on cash holdings, we control for several variables derived from prior literature in the field.

Leverage ratio is measured as company's total debt divided by total assets. *Natural logarithm of total assets* is used as a proxy for firm size. We calculate *cash flow* as net cash flow from operating activities divided by total assets. *Net working capital* is measured as current assets minus cash minus current liabilities divided by total assets. *Capital expenditures* are scaled by total assets. In addition, we control for *sales growth rate*. To calculate the *equity issuance*, we divide sale of common and preferred stock minus purchase of common and preferred stock by total assets. We control for *debt issuance*, which is the issuance of long-term debt minus long-term debt reduction to total assets. *Market-to-book ratio* is measured as the firm's stock current closing price divided by the book value per share. Finally, we create a dummy variable equal to 1 if the firm pays *dividends*. All continuous control variables are winsorized at 5% and 95%. Following prior literature, complexity and ambiguity proxies as well as control variables are lagged by one year (Ertugrul et al., 2017). All variables are presented in the Appendix.

4.2 Research Design

4.2.1 Complexity of Information and Cash Holdings

Complexity of annual disclosures is expected to have a significant association with the level of firm's cash holdings. Specifically, it is examined whether managers that disclose more complex information in annual reports tend to hold more cash, by using the following model:

$$CASH\_HOLDINGS_{i,t} = \beta_0 + \beta_1 LNFILESIZE_{i,t-1} + \beta_2 LEVR_{i,t-1} + \beta_3 LNAT_{i,t-1} + \beta_4 CASHFLOW_{i,t-1} + \beta_5 NWC_{i,t-1} + \beta_6 CAPX_{i,t-1} + \beta_7 SGR_{i,t-1} + \beta_8 EQUITYISS_{i,t-1} + \beta_9 DEBTISS_{i,t-1} + \beta_{10} MTB_{i,t-1} + \beta_{11} DIV_{i,t-1} + \varepsilon_{i,t} \quad (1)$$

In equation (2), we replace the natural logarithm of net file size of the report that is used in equation (1) with the natural logarithm of the number of words as a measure of report's readability to investigate the impact of complexity of accounting information on firm's cash holdings.

$$CASH\_HOLDINGS_{i,t} = \beta_0 + \beta_1 LENGTH_{i,t-1} + \beta_2 LEVR_{i,t-1} + \beta_3 LNAT_{i,t-1} + \beta_4 CASHFLOW_{i,t-1} + \beta_5 NWC_{i,t-1} + \beta_6 CAPX_{i,t-1} + \beta_7 SGR_{i,t-1} + \beta_8 EQUITYISS_{i,t-1} + \beta_9 DEBTISS_{i,t-1} + \beta_{10} MTB_{i,t-1} + \beta_{11} DIV_{i,t-1} + \varepsilon_{i,t} \quad (2)$$

4.2.2 Ambiguity of Information and Cash Holdings

To examine the second research question of this study, whether ambiguity of information of financial reports is related with the amount of cash holdings that managers decide to hold, we structure the following models:

$$CASH\_HOLDINGS_{i,t} = \beta_0 + \beta_1 UNCERTAINTY_{i,t-1} + \beta_2 LEVR_{i,t-1} + \beta_3 LNAT_{i,t-1} + \beta_4 CASHFLOW_{i,t-1} + \beta_5 NWC_{i,t-1} + \beta_6 CAPX_{i,t-1} + \beta_7 SGR_{i,t-1} + \beta_8 EQUITYISS_{i,t-1} + \beta_9 DEBTISS_{i,t-1} + \beta_{10} MTB_{i,t-1} + \beta_{11} DIV_{i,t-1} + \varepsilon_{i,t} \quad (3)$$

$$CASH\_HOLDINGS_{i,t} = \beta_0 + \beta_1 MODALWEAK_{i,t-1} + \beta_2 LEVR_{i,t-1} + \beta_3 LNAT_{i,t-1} + \beta_4 CASHFLOW_{i,t-1} + \beta_5 NWC_{i,t-1} + \beta_6 CAPX_{i,t-1} + \beta_7 SGR_{i,t-1} + \beta_8 EQUITYISS_{i,t-1} + \beta_9 DEBTISS_{i,t-1} + \beta_{10} MTB_{i,t-1} + \beta_{11} DIV_{i,t-1} + \varepsilon_{i,} \quad (4)$$

In the third model, the percentage of uncertain words that are included in 10-Ks is used as a measure of ambiguity of accounting information, while in the fourth model the percentage of modal weak words of 10-Ks is used. For both models, a significant relation between uncertain information and the amount of cash that a firm holds is expected.

5. Results and Discussion

5.1 Descriptive Statistics

The results of the descriptive statistics of the study variables are reported in table 3. In specific, the mean, the standard deviation, and minimum and maximum values of the variables are revealed in this table.

The table shows that the typical U.S. firm holds cash and cash equivalents equal to 21% of total

assets. Focusing on the independent variables, the mean size of the report is 12.438 with a standard deviation of 0.495, while the alternative measure of complexity, length of the report, has a mean value of 10.392. Moreover, the percentage of uncertain words in 10-Ks is higher than the percentage of modal weak words.

As regards the control variables, the average leverage ratio of the U.S. firms is approximately 54 and the average size of the firms (measured by the natural logarithm of total assets) of the sample is 5.711 (estimated in millions) with a standard deviation of 2.067. The average firm for the period 1999 to 2016 generates a positive cash flow (CASHFLOW= 0.025). Average short-term liquid assets measured by the ratio of net working capital to total assets are 8%. Furthermore, the average firm uses resources for investment (CAPX= 0.044). The average sales growth ratio is 9.5%. The mean equity issuance and debt issuance of the sample are 2.2% and 1.1% of total assets, respectively. Market-to-book ratio has a mean value of 2.666, indicating that the average company of the sample is trading at a premium.

Table 3. Descriptive statistics

Variables	Mean	SD	Min	Max
CASH_HOLDINGS	0.21	0.222	-0.05	1
LNFILESIZE	12.438	0.495	9.769	15.955
LENGTH	10.392	0.507	7.708	13.79
UNCERTAINTY	1.381	0.295	0.104	2.798
MODALWEAK	0.539	0.221	0	1.662
LEVR	0.541	0.319	0.117	1.423
LNAT	5.711	2.067	1.605	9.213
CASHFLOW	0.025	0.194	-0.647	0.23
NWC	0.08	0.219	-0.486	0.475
CAPX	0.044	0.044	0.002	0.174
SGR	0.095	0.29	-0.419	1.013
EQUITYISS	0.022	0.101	-0.093	0.402
DEBTISS	0.011	0.069	-0.104	0.218
MTB	2.666	3.009	-2.482	11.545

Notes: This table reports the results of the descriptive analysis of the variables of this study. For variable definitions see the Appendix.

5.2 Empirical Results and Discussion

5.2.1 Complexity of Information and Cash Holdings

Table 4 presents the estimation results of the linear regression model that investigates the association between the complexity of annual reports (measured by their size) and cash holdings.

Table 4. Complexity of information (measured by the size of the report) and cash holdings

CASH_HOLDINGS	Coef.	T-stat	p-value	
LNFILESIZE(t-1)	0.007	2.12	0.034	**
LEVR(t-1)	-0.033	-3.96	0	***
LNAT(t-1)	-0.031	-10.48	0	***
CASHFLOW(t-1)	0.025	2.07	0.039	**
NWC(t-1)	0.065	5.82	0	***
CAPX(t-1)	-0.231	-6.65	0	***
SGR(t-1)	-0.012	-3.69	0	***
EQUITYISS(t-1)	0.08	5.81	0	***
DEBTISS(t-1)	-0.009	-0.76	0.445	
MTB(t-1)	0.001	1.25	0.21	
DIV(t-1)	-0.004	-1.22	0.223	
Constant	0.323	8.87	0	***
R^2 within 0.038				
F-statistic 28.564				
P(F-statistic) 0.000				
Number of obs. 29 994				

Notes: This table presents the regression results of the relation of complexity (measured as the natural logarithm of net size of the report) with cash holdings. *** p<0.01; ** p<0.05; * p<0.1. Robust standard errors and fixed effects are included.

The coefficient of the variable *lnfilesize* (that is used as complexity measure) is positive and statistically significant. Recall that this is an inverse readability measure, and thus, the findings reveal that firms with less readable and therefore more complex 10-Ks have a higher level of cash holdings. The economic interpretation of the results indicate that a 1% increase in complexity and obfuscation of information of annual reports leads to a 0.007% increase in the level of cash.

The results of this regression analysis indicate that firms that disclose more complex information tend to hold more cash, confirming the findings of Hasan and Habib (2020). Prior literature suggests that managers that disclose more complex reports tend to act opportunistically (Huang & Zhang, 2012) by hoarding cash according to the agency motive of the cash holdings theory.

The significance and the direction of control variables are generally in line with previous research (Cheung, 2016; Opler et al., 1999). For example, cash holdings are lower for levered and capital-intensive firms. In addition, they are lower for large firms and firms with higher sales growth rate.

Firms that hold more cash have higher equity issuance. Moreover, they tend to have higher net working capital as well as cash flow from operating activities. Finally, debt issuance, market-to-book ratio, and dividend payments are not statistically significant.

Table 5 shows the results of the second regression analysis, which examines the impact of complex accounting information on the level of cash holdings using as a measure of complexity the natural logarithm of the number of words that are contained in 10-Ks. The results hold the same, confirming that obfuscation of accounting information has a positive association with cash holdings.

All in all, findings of tables 4 and 5 support the hypothesis of this study that states that managers that disclose more complex information tend to hoard cash, and this result is both statistically and economically significant.

Table 5. Complexity of information (measured by the number of words of the report) and cash holdings

CASH_HOLDINGS	Coef.	T-stat	p-value	
LENGTH(t-1)	0.007	2.24	0.025	**
LEVR(t-1)	-0.033	-3.97	0	***
LNAT(t-1)	-0.031	-10.49	0	***
CASHFLOW(t-1)	0.025	2.08	0.038	**
NWC(t-1)	0.065	5.83	0	***
CAPX(t-1)	-0.23	-6.63	0	***
SGR(t-1)	-0.012	-3.68	0	***
EQUITYISS(t-1)	0.08	5.82	0	***
DEBTISS(t-1)	-0.009	-0.75	0.454	
MTB(t-1)	0.001	1.26	0.209	
DIV(t-1)	-0.004	-1.22	0.222	
Constant	0.335	11.10	0	***
R^2 within 0.038				
F-statistic 28.609				
P(F-statistic) 0.000				
Number of obs. 29 994				

Notes: This table presents the regression results of the relation of complexity (measured as the natural logarithm of number of words of the report) with cash holdings. *** p<0.01; ** p<0.05; * p<0.1. Robust standard errors and fixed effects are included.

5.2.2 Ambiguity of Information and Cash Holdings

Tables 6 and 7 present the results of the second hypothesis of this work, which attempts to shed light on the association between ambiguity of information that managers disclose in 10-Ks and cash holdings policy.

Table 6. Ambiguity of information (measured by the percentage of uncertain words of the report) and cash holdings

CASH_HOLDINGS	Coef.	T-stat	p-value	
UNCERTAINTY(t-1)	0.014	2.48	0.013	**
LEVR(t-1)	-0.032	-3.85	0	***
LNAT(t-1)	-0.031	-10.47	0	***
CASHFLOW(t-1)	0.025	2.06	0.04	**
NWC(t-1)	0.065	5.79	0	***
CAPX(t-1)	-0.233	-6.75	0	***
SGR(t-1)	-0.012	-3.67	0	***
EQUITYISS(t-1)	0.082	5.90	0	***
DEBTISS(t-1)	-0.011	-0.93	0.353	
MTB(t-1)	0.001	1.24	0.214	
DIV(t-1)	-0.004	-1.19	0.235	
Constant	0.386	23.41	0	***
R^2 within 0.038				
F-statistic 28.404				
P(F-statistic) 0.000				
Number of obs. 29 994				

Notes: This table presents the regression results of the relation of ambiguity (measured as the percentage of uncertain words of the report) with cash holdings. *** p<0.01; ** p<0.05; * p<0.1. Robust standard errors and fixed effects are included.

Table 7. Ambiguity of information (measured by the percentage of modal weak words of the report) and cash holdings

CASH_HOLDINGS	Coef.	T-stat	p-value	
MODALWEAK(t-1)	0.032	3.43	0.001	***
LEVR(t-1)	-0.033	-3.95	0	***
LNAT(t-1)	-0.031	-10.77	0	***
CASHFLOW(t-1)	0.025	2.08	0.037	**
NWC(t-1)	0.065	5.79	0	***
CAPX(t-1)	-0.231	-6.70	0	***
SGR(t-1)	-0.012	-3.56	0	***
EQUITYISS(t-1)	0.082	5.93	0	***
DEBTISS(t-1)	-0.011	-0.92	0.359	
MTB(t-1)	0	1.19	0.233	
DIV(t-1)	-0.004	-1.20	0.229	
Constant	0.393	23.63	0	***
R^2 within 0.039				
F-statistic 28.697				
P(F-statistic) 0.000				
Number of obs. 29 994				

Notes: This table presents the regression results of the relation of ambiguity (measured as the percentage of modal weak words of the report) with cash holdings. *** p<0.01; ** p<0.05; * p<0.1. Robust standard errors and fixed effects are included.

The coefficient for the variable *uncertainty* is positive and statistically significant and the same holds for the alternative measure of ambiguity, the variable *modalweak*. In specific, the coefficient of *uncertainty* is 0.014. The economic interpretation of the results indicates that a 1% increase in ambiguity of information of annual reports (measured by the percentage of uncertain words) leads to a 0.01% increase in the level of cash. The coefficient of *modalweak* is 0.032 indicating that a 1% increase in ambiguity of information of annual reports (measured by the percentage of modal weak words) leads to a 0.03% increase in the level of cash. The empirical results suggest that managers that disclose more vague information in their reports tend to accumulate more cash.

The control variables of the regressions in tables 6 and 7 are in line in terms of the direction and significance with the results in tables 4 and 5.

6. Conclusion

This study aims to shed light on the quality of accounting information that managers disclose in their annual reports and the level of cash that they choose to hold. In specific, this work examines the impact of complexity and vagueness of information of firms' 10-Ks on the level of cash holdings. To measure the complexity and ambiguity of U.S. annual reports for the period 1999 to 2016, the dictionary method is used, an algorithmic approach in Python programming language.

The findings of the empirical analysis indicate that managers that use more complex and ambiguous language in their reports tend to accumulate cash. Less readable and uncertain accounting narratives could be interpreted as a managerial initiative to reduce the transparency of firm's activities and make more difficult the control from the outsiders. Prior research has shown that shareholders consider complexity and ambiguity of 10-Ks information as a management's attempt to use discretionally corporate's cash or hide poor performance. Therefore, external financing becomes more expensive for firms with less readable reports and thus, managers tend to retain more cash according to the precautionary motive of the cash holdings theory.

The contribution of this study is that, firstly, it introduces measures of complexity and ambiguity of accounting disclosures that have not been used in the relevant research field so far. Moreover, this study augments the empirical evidence to the scarce existing literature that investigates the relationship between complexity and tone ambiguity of financial reporting and cash holdings. Furthermore, the dictionary method of Loughran and McDonald (2011) that is implemented for the purpose of textual analysis was constructed especially for the content of financial reports. Thus, this textual analysis approach is replicable, and the findings are robust and accurate, contributing empirical evidence from a longitudinal sample for the years 1999 to 2016.

In a nutshell, the findings of this study support that the enhancement of accounting information could play a critical role in holding the ideal amount of cash not only for the company's interests but for the shareholders', as well.

Finally, there are two limitations regarding this research work. The first limitation is that it focuses exclusively on annual accounting disclosures of U.S. firms (10-Ks) to investigate the research questions. Future research could include in the analysis quarterly reports (10-Qs). Therefore, research in the field could also examine quarterly and unaudited data, as 10-Qs are unaudited reports, unlike 10-Ks. This approach would provide a deeper insight on the association between complexity and ambiguity of accounting information and corporate cash holdings. The second limitation arises from the methodology of textual analysis that is implemented in this paper (the dictionary method). Further research could possibly use artificial intelligence methods to measure the complexity and ambiguity of accounting disclosures. This may add valuable empirical evidence to the literature strands regarding the

quality of accounting information and cash holdings.

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Appendix . Variable Definitions

Type	Code	Explanation
DV	CASH_HOLDINGS	Cash and cash equivalents divided by total assets.
IV	LNFILESIZE	Natural logarithm of net size of the annual report in megabytes.
IV	LENGTH	Natural logarithm of the number of words that are included in a 10-K.
IV	UNCERTAINTY	Percentage of uncertain words in a 10-K.
IV	MODALWEAK	Percentage of modal weak words in a 10-K.
CV	LEVR	Leverage ratio, total debt divided by total assets.
CV	LNAT	Natural logarithm of total assets.
CV	CASHFLOW	Net cash flow from operating activities divided by total assets.
CV	NWC	Current assets minus cash minus current liabilities divided by total assets.
CV	CAPX	Capital expenditures divided by total assets.
CV	SGR	Sales growth rate.
CV	EQUITYISS	Equity issuance-Sale of common and preferred stock minus purchase of common and preferred stock divided by total assets.
CV	DEBTISS	Debt issuance-Issuance of long-term debt minus long-term debt reduction to total assets.
CV	MTB	Market-to-book ratio. Calculated by dividing the closing price of the stock by the book value per share.
CV	DIV	Dummy variable equals to 1 if the firm pays dividends.

Note: *DV= dependent variable, **IV= independent variable, ***CV= control variable.