

CAN CEO ACTIVITIES IN SOCIAL MEDIA NETWORKS AFFECT
THE FIRM VALUE AND THE FIRM PERFORMANCE?

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Abstract

In the light of rapidly engagement of politicians and increasingly noticeable speeches in social media networks, this paper aims at detecting the influences of Chief Executive Officers' social media network activities have on their firm financial performance. Twitter is used as the representative of the social media networks in the examination. This study includes observations on firms in S&P 500 index from 2009 till the February of 2017, time periods are classified into entire period, recession period and stable period, specific numbers of observations used varies up to the required analysis. The results demonstrate that the number of tweets & retweets per day significantly affect both short-medium and long-term firm value, instead of the firm performance. Registering a social media account results nothing significantly, both in recession and in stable periods.

Keywords: social media networks, CEO behaviors, firm performance

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1. Introduction

As John Reed said at the time he was CEO of Citicorp: “In the old days I would have said it was capital, history, the name of the bank. Garbage – It’s about the guy at the top”, the criticality of Chief Executives Officers in companies shall never been looked down in the public gaze, nor more demanding as a result of changing corporate structure. And accompanied by the wide spread of social media, people would expect to have a more in-depth understanding on corporate updates through CEOs ‘activities in social media networks. Therefore, the main purpose of this paper is to test if there are any effect that CEO’s social media activities could have on their enterprise value and firm performance.

According to Chen, H., Hwang, B. H., & Liu, B. (2013) and the report of Weber Shandwick from 2010 to 2015, SEC filings, print releases and public conference calls are used to state announcements by companies for a long time, executives hardly stand out before the public directly. However, since 2012, a sharp increase in the usage of social media channels by CEO/CFO came into public attention. Twitter, Facebook, YouTube, LinkedIn and so on rapidly socialized top CEOs and increased their social engagements with public communication networks. As they are considered as not merely managers but rather flags, and brands of the companies, every move of them attracts attentions. It is seemingly risky to expose themselves to the public, while on the other hand, it is worth conveying some information making the use of CEOs to expand the influences as well. And the destination of the social activities of people standing out as CEOs are nothing more than increasing their firm value and facilitating their firm performance. Thus, this paper is going to observe and analyze the way that social activities coming into real influences.

To summarize, the study will process the analysis in depth on following questions:

(1) For what reason CEOs are preferred as an indispensable part of firms’ information dissemination? What is the added value and how it could be presented and interpreted

once taking into analysis?

(2) Is there any influence that CEO's social activities have on his/her firm value and/or firm performance? In what way and to what extent social media exerting the effect on the firm value and/ or firm performance?

(3) Does more actively updated CEO contributes more to the firm value? Is that possible to measure the marginal increments caused by the rapidly changing social media activities? What kind of contents or emotions that CEOs presenting on the social media platform advertise and spread the intended information more efficiently? How could these social media activities be translated to the signals that the public wanted to perceive in final? Moreover, what are the differences with the official website spreading, in the audience groups and in the way they perceiving and reacting to the information CEOs conveying?

(4) As social media platform differ from each other in the main function, do different types of social media platforms generate correspondingly diversifications to the firm value and to what extent of differences they make? Are there any conditions constraining the platforms that shall not be overlooked in considering the diverse impacts, such as the "wall" certain governments built?

(5) Since the study considers using three indicators representing firm value (short-term and long-term) as well as firm performance respectively, how they differ from each other? What enlightenment could be derived from both the similarities and diversifications to the future CEOs social media behaviors? Besides the demographic characteristics commonly take into considerations, does the length of time that CEOs active in social media platform also predict the impact to the firm value?

(6) Last but not the least, along with certain people in power show their activism in social media communication, the trend becomes increasingly irresistible. However, as one coin have two sides, firm value also pays for improper speaking, which could be seen as the risk of using social media platform. Therefore, to what extent CEOs think of the benefits that social activities of CEOs could produce at the risk of misbehave and possible wrong implications? Is there any empirical practice that later CEOs could learn

lessons from?

To find the answers and dig into deeper interpretation of CEO social media activities, this study would focus on the associations between the social media activism and firm value as well as performance.

Thus, below are the research questions this study is going to concentrate on

- I. *Do CEOs' social media activities affect their firm value and/ or firm performance?*
- II. *Do CEOs that display higher activism on social media platform affect firm value/firm performance to a higher degree?*

Finally, to better analyzing the data in a slightly longer period than previous studies', which are typically three to five years, the macro environment has been controlled as well. Specifically, the entire periods are consisted of recession period (year 2009, year2011) and stable periods (year 2010, and year2012-year2017). To avoid the skewness originated from certain periods that containing higher fluctuation, all of three periods would be analysed and compared in reaching a more accurate and robust conclusion.

The thesis is structured as follows: Chapter 2 summarizes the previous literature. Chapter 3 elaborates the development of hypotheses, Chapter 4 describes the methodology applied for analysis, data obtained and used is depicted in Chapter 5 and the analysis results are presented in Chapter 6. Chapter 7 thereafter give the overall conclusion of the thesis.

2. Literature Review

In this section I shall elaborate the theoretical background and basis underlying the activism in social media networks, behaviors of Chief Executive Officers and factors contributing to the firm value as well as the firm performance, and further demonstrate the rationale behind the concept constructed on the previous researches.

2.1 Social, Professional and Commercial impacts of social media networks

Accompanied by rapidly construction of communication networks, social media has become increasingly popular and attracted a large amount of attention among analysts, thereafter being researched in recent years (Gan and Wang, 2015). It started at a platform in which users are able to express their personal point of views, share posts they are interested in and interact with other users. And those platforms vary in forms and concentrated functions (Bernabe-Moreno, 2015). Well-known platforms include blogs (Huffington Post), microblogs (Twitter), social networking sites (Facebook), image sharing (Instagram), content communities (YouTube), collaborative projects (Wikipedia), professional networking sites (LinkedIn), virtual social world (Second Life) and virtual game worlds (CS: GO) (Olsen and Christensen, 2015). Hanna, Rohm and Crittenden (2011) pointed out that the way people have interactions with each other and even companies have been altered by the social media. Internet users have their choices in selecting the social media sites owing to the thousands and hundreds of availabilities, various characteristics and target user groups (Zolkepli and Kamarulzaman, 2015). Internet users obtain the usefulness of contents in social media, acquire the acknowledgement over the selected updates, which further affecting their concentration and behaviors (Durukan, Bozaci and Hamsioglu, 2012).

Nic Newman (2009) points out in his paper that social media is closely associated with the mainstream of journalism, and primarily reflected as the reaction of newspaper and

broadcaster in UK and US to the growing participation of social media platforms. Moreover, individual turns out to show his/her controls over these impacts. And unlike Facebook and other social networking services, twitter is much preferred owing to its features-interacting with news and user-generated contents. Diakopoulos, and Shamma, in the light of the first U.S. presidential debate in 2008 and rapid development of social micro-blogging, estimated the dynamic of sentiment in social media platforms owing to the observed activities, and observed the reaction customized by users after timely informing the changes in audiences' sentiment. Results demonstrated that social media do have impacts and further influencing the activities at a later time.

2.2 Social media communication and financial performance

Activism in social media networks affects not merely firm's financial performance, but the operational and corporate social performance (Paniagua and Sapena, 2014). Since various former studies has concentrated on the WOM implications and negative impacts that owing to the information generated throughout the networks, Schniederjans, Cao and M. Schniederjans illustrate that specific strategies might affect a firm's financial performance and the firm's communication with internal as well as external shareholders could be strengthened through the interactions in the social media networks. And the research from Waddock and Graves indicated that social issue related management seems to impose more pressure on the corporate strategies, rather than those coming from traditional areas does. Management, therefore, is expected to enhance their allocation of resources in order for a satisfying financial performance. Bruhn, Schoenmueller and Schäfer's study has further provided basis for this opinion, as they found, since traditional media impress the consumers with their brands, social media network communication get the firm image strongly enhanced. That is to say, traditional way of socialisation affect the firm's performance differently from the activities in present social media platforms, and this differentiation is increasingly recognized and valued. Moreover, significant diversifications among the industries are highlighted by the authors in the process of testifying their hypotheses.

While we still follow the traditional sense in thinking the business, communication in social media network has already altered and magnified the concept of marketplace. Schultz, Utz and Göritz (2011) argues that social media networks act as a hybrid factor nowadays, encouraging customers to speak directly with the managers, instead of staying still and wait for the hierarchy process. Compared to the updates on the official websites and statements in the SEC filings, managers stand out directly and learn to engage with their followers and whom they concern “face to face”.

Paniagua and Sapena did their research on Twitter platform and found out that, social media networking not only influence firm’s financial performance via the distinctive channels, but also through providing business opportunities. Though the links between are consistently unexploited, financial analysts and management, who closely associated with the opportunities have gradually realized the opportunities. Therefore, they adopted four standards: social capital, social marketing, social networking and followers’ preferences in measuring the performance, demonstrating that financial performance, represented by firm value, are positively affected by Twitter followers and the number of “likes” under each tweet, though occurring after a large amount of followers’ attachment. Finally, they indicated that, comparing to Facebook, Twitter is a more powerful channel and more widely used in enhancing firm’s financial performance. Zheludev, Smith, and Aste (2014) explored further through a sentiment analysis methodology and illustrated that social media could lead the financial markets.

2.3 CEO activities with firm value and firm performance

Chief Executive Officer is widely recognised as one of the most powerful organisational member. Previous researches and press release have commonly conveyed the opinion that a strong CEO potentially affect his/her firm financial performance largely, and the study in 1997 revealed that aspects of CEO power is intercorrelated with financial performance (Daily and Johnson, 1997).

The question on the association between social performance of CEO as well as board

of directors and firm's financial performance have been analysed over more than 40 years (Margolis and Walsh, 2001). Using return on assets and return on investment as financial performance data, Erhardt, Werbel, and Shrader (2003) examined 127 big US firms, the correlation and regression results suggested that the characteristics of board of directors are associated with the financial performance that represented by the indicators above. The diversity especially shows positive associations.

Furthermore, former researches has conducted many studies on the correlations between CEO characteristics and the organisational factors; for instance, the CEO characteristics with the R&D investment (Barker and Mueller, 2002), CEO overconfidence with the firm investment (Malmendier and Tate, 2005), CEO compensation and firm performance (Core, Holthausen, and Larcker, 1999) and CEO characteristics and industry structures (Datta and Rajagopalan, 1998).

Few researchers have focused on the causality between CEO characteristics and firm value. Vashisht Bhatt (2012) has researched the influence of CEO characteristics on the firm value and the firm performance, using a quantitative and empirical methodology. The author has divided the research period into upturn and downturn, which, providing firm basis for the construction of hypotheses in this study.

However, no empirical researches has been conducted to detect the impacts of CEO activities in social media networks on the firm value as well as firm performance, nor the specific study on macro environment factor consideration. Which would also be the start point and innovation of this study.

2.4 The negativity of social media networks and financial performance

However, there are several obvious dilemmas confused both Twitter users as well as the market it influences. Firstly, growing amounts of false messages and noises, especially the ones made up on purpose, are generated and disseminated throughout the

network, largely affecting social consensus condition and concentration of public opinions. Next, the dominance of Twitter usages contributed to an unbalanced situation with other social networks and this has been maintained until now. Furthermore, influences from the first situation might be exaggerated with the facilitation of the second condition.

2.4.1 Discussion on United Express Flight 3411 incident in 2017

A recently well-known case this study has to refer to is how the American Chief Executive Officer of United Airline-Oscar Munoz, who was appointed in September 2015, dealt with the “Dragging Gate” incident and accompanying fierce reactions from social media networks. On April 9th of 2017, after one passenger refusing to depart the United Express Flight 3411 voluntarily owing to his personal condition, polices from O'Hare International Airport forcibly pulled him out of his seat and which, directly injured the passenger physically. The video recorded by same-flight passengers are later published and rapidly spread on social media, resulting the mass outrage in a international scale, and even the concerns from politicians. However, situations of United Airlines could not be worse if United Airlines and their newly appointed CEO Oscar Munoz could display a more appropriate attitude and determination in reconciliation.

The first statement from CEO Oscar Munoz was published on UA’s official Twitter account on the next day of the incident, demonstrated his cognition at the “forcible removal”, as “re-accommodation”, which is “an upsetting event” to avoid the possible litigation. And a more aggressive wording, in his email to the staff, towards the injured passenger was subsequently disclosed in the social media channels. United Airlines, afterwards received an even severe criticism and witnessed a sharp downturn in their stock price. As shown in **Graph 1**, after closing at \$71.52 on April 10th, just before the video becoming widely disseminated in the social media, UA experienced a 4 percent

decrease and ended up at \$69 on April 13th. Firm value was reduced by \$770 million to \$21.5 billion. Stakeholders lost their value correspondingly and, if the customer satisfaction falls, Oscar Munoz himself might lose up more than \$500,000 in his compensation.



Graph 1 United Continental Holdings, Inc. 5-day Stock Price (7th April-13th April 2017)

The second statement from CEO was released on Twitter two days after the incident, his wording contrasts the previous phrases and showing sensitively to public's disappointment and sharp market move.

The incident not only drew the mass attention from American social media platforms, but from the social media networks of the People's Republic of China and the Vietnam, revealing the close connections of every social media channels as well as the rapidly growing concerns of individual behaviours of CEOs. And there is no doubt that social media encouraged the diffusion of public sentiments, which in turns imposing pressures on the individuals that are in the centre of focus.

Furthermore, CEO activities in social media networks, during this incident, directly displays the probable associations with the firm value and the firm performance, which worth exploring and studying specifically.

3. Hypothesis development

In this section, the paper shall state the constructions of hypotheses, the rationales behind and the considerations extended. As the representative of short-term firm value as well as medium-term firm value, Market Value would be discussed in the first part. Likewise, Market-To-Book Value plays the main role in the second part as the representative of long-term firm value. Return on Assets, in the third part, will act as the indicator of firm performance and discussed in depth.

As mentioned in previous chapters, the main objective of this paper is to examine if CEO activities in social media networks could impact firm financial performance, including short-medium term as well as long-term firm value and firm performance. To conduct empirical estimations on both firm value and firm performance, Market Value (MV), Market-to-Book Value (MTBV) and Return on Assets (ROA) are respectively adopted as indicators.

There are three main hypotheses in the study:

3.1 The first hypothesis-CEO activities in social media network and short-medium term firm value

Referring to the market capitalisation of a publicly-traded companies, market value is generally perceived as the business prospects of companies. Instead directly using market value, I calculated the rate of changes in the market value comparing to the last intraday, demonstrating the percentage of daily fluctuations. Moreover, as no research has estimated the social media network activities' influence on the firm financial performance previously, the study would introduce new indicators as the critical independent variables in facilitating the examinations. The first one is ACC, denoting whether a CEO has Twitter account or not and is indicated in binary value. The second indicator is TWS that means the total number of tweets & retweets of a CEO in each

calendar day. Two indicators together consist the measurement of CEO activities in social media network, which is also named as social media activism in this paper.

Besides, looking back to previous researches, CEO characteristics and factors associated with their behaviours are commonly taken into account as control variables. This study would also introduce CEO characteristics to control the influences; and it is worth mentioning that this study targets at testing if CEO social activism matters, instead of if their characteristics matters, on the firm value. Thus, the performance of CEO characteristics would not be the major concern and specifically discussed, they are in turn included in the Cross Terms to testify the possible moderation effects.

Moreover, lagged explained variables are applied as explanatory variables as well, since they are closely associated with the explained variables, and the problems regarding endogeneity shall be considered and enclosed in the Methodology Chapter. Another point might be covered later but still worth saying here is, the aim of constructing the model is to better examine the hypotheses, instead of building the perfect model.

Additionally, year 2009 and year 2011 are defined as less-stable economic environment, while other periods are stable economic environment (Leopold et al., 2014). Less-stable period is renamed as recession period, corresponding is stable periods. The entire period under study are composed of recession period and stable period, they are indicated as dummies in the estimation.

After clarifying the considerations above, the first hypothesis is displayed as below and followed by the sub-hypotheses with the purpose of better facilitating and providing firm bases for the conclusion.

There are four sub-hypotheses under the first and the second main hypothesis, and two for the third hypothesis. General Models shown after each hypothesis differs up to certain hypothesis and the differentiations would be demonstrated in Research Design session. Typically, sub-hypothesis A concentrates on the existence of Twitter account as well as the number of daily tweets & retweets, sub-hypothesis B focuses on the

possible moderation effects of CEO characteristics, C questions what would occur to explained variables if CEO join in Twitter one day, sub-hypothesis D, additionally put an emphasis on the discussion of posting frequencies.

Two further considerations need clarify here are:

1) One CEO who has Twitter account while another does not at time t , is considered differently from a CEO who does not have account at time $t-1$ but register one at time t ;

2) Likewise, one CEO who tweets & retweets more than another CEO at time t , is thought distinctively with a CEO who tweets & retweets more at time t than at time $t-1$.

These, are the starting points of sub-hypothesis C and sub-hypothesis D as well.

Thereafter, the first hypothesis and its sub-hypotheses are (Main model is displayed in Chapter 4):

H1: The social media network activities of Chief Executive Officers have certain impacts on their short-medium term firm value

- ◆ H_{1A}: The higher activism a CEO presents on Twitter per day, the higher degree short-medium term firm value will be influenced the next intraday
- ◆ H_{1B}: CEO characteristics affect the extent of social media activities' influences have on their short-medium term firm value
- ◆ H_{1C}: CEOs who changed the status of social media accounts have larger impacts on their short-medium term firm value that CEOs who did not on next intraday
- ◆ H_{1D}: The more frequently CEOs speak out on social media platform, the higher degree short-medium firm value would be affected

3.2 The second hypothesis-CEO activities in social media network and long-term firm value

Market-to-book ratio, also known as P/B ratio, is considered as the indicator of long-term firm value and the dependent variable in the second hypothesis. The paper assumes that social media activities produce distinctive impacts on a short and long-run perspectives. Hence bellows are the second hypothesis with its sub-hypotheses. Slightly different from the first hypothesis, I did not calculate the percentage of changes

compared to time t-1, but using subtraction directly, as MTBV itself is generated as a ratio already.

H2: The social media activities of Chief Executive Officers have certain impacts on their long-term firm value

- ◆ H_{2A}: The higher activism a CEO presents on Twitter per day, the higher degree long-term firm value will be influenced the next intraday
- ◆ H_{2B}: CEO characteristics affect the extent of social media activities' influences have on their long-term firm value
- ◆ H_{2C}: CEOs who changed the status of social media accounts have larger impacts on their long-term firm value than CEOs who did not on next intraday
- ◆ H_{2D}: The more frequently CEOs speak out on social media platform, the higher degree long- firm value would be affected

Main model is displayed in Chapter 4.

3.2 The third hypothesis-CEO activities in social media network and firm performance

As the measurement of firm performance, indicator Return on Assets is introduced to show how well management is employing the firm's total assets to make a profit. Considerations towards this hypothesis exclusively are:

- 1) Two forms of indicators are applied, firstly the changes in ROA over the last firm year, and secondly the ROA of this year. The usage of the former aims at detecting the impacts of changed CEO social media activism, while the latter one focuses on the contribution of CEO social activism to firm's profitability in corresponding firm year.
- 2) Explanatory variable TWS is replaced by variable sumTWS, generated by adding all the tweets and retweets up in each firm year. The status of account is determined by the situation in the last day of each firm year.
- 3) Taking the situations above into account, it is meaningless to discuss the change of account status and frequency of posting as ROA can neither reflect the sudden changes nor promptly react to such changes.

Therefore, the third hypothesis and its sub-hypotheses are (Main model is displayed in Chapter 4):

H3: The social media activities of Chief Executive Officers have certain impacts on their firm performance

- ◆ H_{3A}: The more CEO tweets in one year, the higher degree their firm performance will be influenced in the end of the year
- ◆ H_{3B}: CEO characteristics affect the extent of social media activities' influences have on their firm performance

Last but not the least, different indicators both in dependent and in independent variables do not only satisfy the requirements of the study, but simultaneously facilitate the results as well as the conclusions in providing robustness checks.

4 Methodology

4.1 Variable Definition

To better understand models constructed in a later stage, this section would provide the definition of all the variables, which are allocated to three panels and followed by its complete explanation.

Named as Dependent Variable, Panel A shows three regressands to be explained in **Table 1**. Correspondingly, Panel B and Panel C provide an overview of regressors, Key regressors, which represent the CEO social media network activism and are of only concern to this study are defined in Panel B. Regressors included in Panel C are regarded as control variables that target at facilitating the regression as well as further analysis.

Table 1 Variable Definition

Variable	Definition
<u>Panel A Dependent Variable</u>	
$\log\left(\left \frac{MV_{i,t}-MV_{i,t-1}}{MV_{i,t-1}}\right \right)$	Change in market value of firm i from time t-1 to time t. Value of market share is obtained by multiplying the current share price by the number of shares outstanding, measuring the market capitalization of the firm discussed in the study
$\log(MTBV_{i,t} - MTBV_{i,t-1})$	Change in market-to-book ratio of firm i from time t-1 to time t, also named price-to-book ratio, or P/B ratio. Value of market-to-book-ratio is obtained by dividing firm's total book value by its market capitalization, indicating the ability of the firm in generating profits/cash for shareholders.
$\log(ROA_{i,t} - ROA_{i,t-1})$	Change in Return on assets of firm i from time t-1 to time t
$ROA_{i,t}$	Return on assets of firm i at time t-1, an indicator of firm's profitability. Obtained by dividing the firm's net income by

its total assets, ROA presents a firm's performance, that is how well management is employing the firm's total assets to make a profit.

Panel B Key Independent Variable-CEO Social Media Activities

ACCOUNT	Dummy variable, indicating the registration status of a CEO's Twitter account, equals 1 if the CEO has Twitter account, otherwise 0; measuring if a CEO has intention to get in touch with social media activities
TWEETS_{i,t-1}	Daily tweets of CEO from firm i at time t-1, retweets are included and replies as well as comments are excluded
sumTWEETS_{i,t}	Yearly total Tweets & Retweets of CEO from firm i at time t, retweets are included while replies and comments are excluded
L. ACC_{i,t} - ACC_{i,t-1} 	First order lagged dummy variable, has a value of 1 if the status of CEO Twitter account is changed (registered / closed), 0 otherwise
L. TWS_{i,t} - TWS_{i,t-1} 	First order lagged daily variation of Twitter posts from CEO at time t, compared to time t-n. The variations are obtained by subtracting tweets posted at time t from those at time t-n, measuring to what extent the social media activism changes everyday

Panel C Control Variables

AGE_{i,t}	Control variable: CEO Age in years
GENDER	Dummy variable, equals 1 if CEO is male, 0 if CEO is female
TENURE_{i,t}	Control variable's Tenure in years
ORG_{i,t}	Control variable: CEO's familiarity to the organization, which is denoted by the years CEO have been in the firm, years in Board are excluded
BOARD_{i,t}	Control variable: Board experience before becoming CEO,

	recorded in years
logEMPLOYEE	Control variable: total employee of the firm
NATIONALITY	Dummy variable that divided into five groups, equals 1 if the CEO's nationality is included in the group, 0 if in another groups
SECTOR	Dummy variables, equals 1 if a firm belongs to the sector, 0 if other sectors, indicating fixed effect in the regression
YEAR	Dummy variables, indicating the fixed effect in the regression in order to eliminate the time effect
RECESSION	Dummy variables, indicating the fixed effect in the regression to eliminate the time effect from recession period
STABLE	Dummy variables, indicating the fixed effect in the regression to eliminate the time effect from stable period
L. log $\left(\left \frac{MV_{i,t} - MV_{i,t-1}}{MV_{i,t-1}} \right \right)$	First order lagged term of explained variable, functioning as one of the control variables
L. log $(MTBV_{i,t} - MTBV_{i,t-1})$	First order lagged term of explained variable, functioning as one of the control variables
L. log $(ROA_{i,t} - ROA_{i,t-1})$	First order lagged term of explained variable, functioning as one of the control variables
L. ROA_{i,t}	First order lagged term of explained variable, functioning as one of the control variables

Moreover, Pearson Correlation is checked in a purpose of ensuring multicollinearity-free. Please see corresponding output in **Appendix C Pearson Correlation for the estimation on Firm Value** and **Appendix D Pearson Correlation for the estimation on Firm Performance** in **Appendix** for detailed results

4.2 Constructing Dummy Variables

Three sets of and three individual dummy variables in total are created in this study,

each dummy variable is constructed in binary. Independent variable Gender equals 1 if the CEO is male and 0 while female. If the CEO owns his/her personal Twitter account, variable ACC equals 1, otherwise 0. Dummy variable chgACC is closely related to but slightly different from variable ACC since it is obtained according to the changed status of CEO account, having a value of 1 at time t if the CEO joined Twitter at time t, 0 if not. One point need to note is, the join date is not equal to date of first tweet/ retweet posted since a large percent of CEO account started posting several days after registration.

As the first set of dummy variables to be explained, YEAR is defined to be an indicator of fixed effect, aims to eliminate the time effect, and is divided into eight dummy variables-YEAR2009, YEAR2010, YEAR2011, YEAR2012, YEAR2013, YEAR2014, YEAR2015 and YEAR2016. Each dummy variable owns a value of 1 if the observation falls into the period represented. Since observations in 2009 and in 2011 are included into recession period and others belong to stable period. Consequently, entire period is denoted by dummy variable YEAR with YEAR2009 as the reference, recession period is denoted by dummy variable RECESSION with YEAR2009 as the reference in the same way, dummy variable STABLE represents stable period with YEAR2010 as the reference.

4.2.1 Nationality

Nationalities of CEO are indicated by dummy variables as well, for instance, “US Nationality” has a value of 1 if the CEO is American. However, there are more than 20 CEO nationalities are recorded in S&P 500 companies, certain nationalities own extremely less CEO than others do, it makes relatively less sense to perform analysis on the detailed differences of CEO nationality. Therefore, this study divides CEO nationalities into five groups, largely basing on the ties of blood, region and language. The divided groups of five nationality dummy variables are shown as follows:

$$\mathbf{USSA} = \sum_{i=1}^n (\text{American} + \text{Canadian} + \text{Brazilian} + \text{Venezuelan} + \text{Cuban}) \quad (\mathbf{Group1})$$

$$\mathbf{ASIA} = \sum_{i=1}^n (\text{Chinese} + \text{Indian}) \quad (\mathbf{Group2})$$

$$\mathbf{MENA} = \sum_{i=1}^n (\text{African} + \text{Iranian} + \text{South African}) \quad (\mathbf{Group3})$$

$$\mathbf{EU} = \sum_{i=1}^n (\text{Dutch} + \text{Finnish} + \text{French} + \text{German} + \text{Greek} + \text{Irish} + \text{Norwegian} + \text{Swedish} \\ + \text{Polish} + \text{Austrian} + \text{Italian} + \text{Spanish} + \text{Swiss}) \quad (\mathbf{Group4})$$

$$\mathbf{UKAU} = \sum_{i=1}^n (\text{British} + \text{Australian}) \quad (\mathbf{Group5})$$

4.2.2 Sector

To better present the results applied to firms in different sectors from S&P500 index, this study further created dummy variable SECTOR. According to Global Industry Classification Standard (GICS), which consists of 11 sectors, 24 industry groups, 68 industries and 157 sub-industries, dummy variable SECTOR are created as 1 if the firm is clubbed into certain sector, 0 otherwise. 11 sectors in GICS are defined as Energy, Materials, Industrials, Consumer Discretionary, Consumer Staples, Health Care, Financials, Real Estate, Information Technology, Utilities and Telecommunication Services. Correspondingly, I constructed 11 dummy variables, namely *SECENER*, *SECMAT*, *SECIND*, *SECDIS*, *SECSTAP*, *SECHEALTH*, *SECFIN*, *SECRE*, *SECIT*, *SECUTILITY* and *SECTELE*.

The objective of the study does not concentrate on the different sectors, rather, overserving the specific influences that certain sectors have on CEO social media network activities, dummy variable SECTOR is control variable in this study as well.

4.3 Research Design

4.3.1 Market Value

To test the hypotheses constructed in this study, three main general models are built, with separated extensions on the firm value and the firm performance to further examine specific conditions correspondingly. The first model examines the impacts of the existence of CEO social media account and daily amount of Twitter posts, together with various CEO characteristics have on daily variation of the firm value (**Eq.1.1**). Since eight years' research period, from 2009 till 2016, is relatively longer and more unsettled than short-term relationships tested in previous researches, this study further tests the influences under different economic environments. Which, could be also seen as a way to guarantee the robustness of the results. Thus, the first and the second extension consider the impacts under recession environment (**Eq.1.1.1**) and under stable environment (**Eq.1.1.2**), which would be reflected by the coefficients β_{111} and β_{112} .

Main model:

$$\log\left(\left|\frac{MV_{i,t} - MV_{i,t-1}}{MV_{i,t-1}}\right|\right) = \beta_0 + \beta_{1(1)}ACC_{i,t} + \beta_{1(2)}TWS_{i,t-1} + \beta_{1(3)}L \cdot |ACC_{i,t} - ACC_{i,t-1}| + \beta_{1(4)}L \cdot |TWS_{i,t} - TWS_{i,t-1}| + \beta_{2-8}CEOCharas_{i,t} + \beta_9Sector_{Dummy} + \beta_{10}YEAR_{Dummy} + \beta_{11-19}Cross\ Terms + \beta_{20}L \cdot \log\left(\left|\frac{MV_{i,t} - MV_{i,t-1}}{MV_{i,t-1}}\right|\right) + \beta_{21} \log(|MTBV_{i,t} - MTBV_{i,t-1}|) + \varepsilon_{i,t} \quad (\mathbf{Eq. 1})$$

H_{1A}:

$$\log\left(\left|\frac{MV_{i,t} - MV_{i,t-1}}{MV_{i,t-1}}\right|\right) = \beta_0 + \beta_1 ACC_{i,t} + \beta_2 TWS_{i,t-1} + \beta_3 Age_{i,t} + \beta_4 Gender + \beta_5 Tenure_{i,t} + \beta_6 Org + \beta_7 Board + \beta_8 \log(Employee) + \beta_9 Nationality_{Dummy} + \beta_{10} Sector_{Dummy} + \beta_{11} YEAR_{Dummy} + \beta_{12} L \cdot \log\left(\left|\frac{MV_{i,t} - MV_{i,t-1}}{MV_{i,t-1}}\right|\right) + \beta_{13} \log(|MTBV_{i,t} - MTBV_{i,t-1}|) + \varepsilon_{i,t} \quad (\mathbf{Eq. 1. 1})$$

H_{1A}(RECESSION):

$$\log\left(\left|\frac{MV_{i,t}-MV_{i,t-1}}{MV_{i,t-1}}\right|\right) = \beta_0 + \beta_1 ACC_{i,t} + \beta_2 TWS_{i,t-1} + \beta_3 Age_{i,t} + \beta_4 Gender + \beta_5 Tenure_{i,t} + \beta_6 Org + \beta_7 Board + \beta_8 Employee + \beta_9 Nationality_{Dummy} + \beta_{10} Sector_{Dummy} + \beta_{11} RECESSION * YEAR_{Dummy} + \beta_{12} L \cdot \log\left(\left|\frac{MV_{i,t}-MV_{i,t-1}}{MV_{i,t-1}}\right|\right) + \beta_{13} \log(|MTBV_{i,t} - MTBV_{i,t-1}|) + \varepsilon_{i,t} \quad (\mathbf{Eq. 1.1.1})$$

H_{1A}(STABLE):

$$\log\left(\left|\frac{MV_{i,t}-MV_{i,t-1}}{MV_{i,t-1}}\right|\right) = \beta_0 + \beta_1 ACC_{i,t} + \beta_2 TWS_{i,t-1} + \beta_3 Age_{i,t} + \beta_4 Gender + \beta_5 Tenure_{i,t} + \beta_6 Org + \beta_7 Board + \beta_8 \log(Employee) + \beta_9 Nationality_{Dummy} + \beta_{10} Sector_{Dummy} + \beta_{11} STABLE * YEAR_{Dummy} + \beta_{12} L \cdot \log\left(\left|\frac{MV_{i,t}-MV_{i,t-1}}{MV_{i,t-1}}\right|\right) + \beta_{13} \log(|MTBV_{i,t} - MTBV_{i,t-1}|) + \varepsilon_{i,t} \quad (\mathbf{Eq. 1.1.2})$$

In order to present the effect of registering an account in social media platform by CEO, a test on registration threshold would be appropriate, that is, testing the impacts of changed status of social media account on firm value variations (**Eq.1.2**). In this model, “changed” is defined as a CEO opening or closing an account, the status of “keeping” or “without” any account is defined as “unchanged”.

H_{1C}:

$$\log\left(\left|\frac{MV_{i,t}-MV_{i,t-1}}{MV_{i,t-1}}\right|\right) = \beta_0 + \beta_1 L \cdot |ACC_{i,t} - ACC_{i,t-1}| + \beta_2 Age_{i,t} + \beta_3 Gender + \beta_4 Tenure_{i,t} + \beta_5 Org + \beta_6 Board + \beta_7 \log(Employee) + \beta_8 Nationality_{Dummy} + \beta_9 Sector_{Dummy} + \beta_{10} YEAR_{Dummy} + \beta_{11} L \cdot \log\left(\left|\frac{MV_{i,t}-MV_{i,t-1}}{MV_{i,t-1}}\right|\right) + \beta_{12} \log(|MTBV_{i,t} - MTBV_{i,t-1}|) + \varepsilon_{i,t} \quad (\mathbf{Eq. 1.3})$$

The more CEOs post in one day, the higher frequency they behave on social media platform, thus the cross-sectional impacts of social activism from different CEO could be reflected in **Eq.1.1**. However, we are unable to test time-series influences without looking at frequency alternations of CEOs as individuals. As a result, the fourth extension replaces $TWS_{i,t}$ by $L \cdot |TWS_{i,t} - TWS_{i,t-1}|$ (**Eq.1.3**).

H_{1D}:

$$\log\left(\left|\frac{MV_{i,t}-MV_{i,t-1}}{MV_{i,t-1}}\right|\right) = \beta_0 + \beta_1 L \cdot |TWS_{i,t} - TWS_{i,t-1}| + \beta_2 Age_{i,t} + \beta_3 Gender +$$

$$\beta_4 Tenure_{i,t} + \beta_5 Org + \beta_6 Board + \beta_7 \log(Employee) + \beta_8 Nationality_{Dummy} + \beta_9 Sector_{Dummy} + \beta_{10} YEAR_{Dummy} + \beta_{11} L. \log\left(\left|\frac{MV_{i,t} - MV_{i,t-1}}{MV_{i,t-1}}\right|\right) + \beta_{12} \log(|MTBV_{i,t} - MTBV_{i,t-1}|) + \varepsilon_{i,t} \quad (\text{Eq. 1.4})$$

As the final extension to primary hypothesis, Hypothesis H_{1B} introduces moderator variables that possibly affect the direction and/ or strength of the relationship between short-medium term firm value and CEO social media network activism. And it is important that this study would not pay attention to what and/ or how CEO characteristics affect short-medium term firm value, instead, whether the characteristics would generate effects on the direction and/ or strength of the relationship shall be the center of focus. Corresponding with the intention, the fifth model is presented as follows:

H_{1B}:

$$\log\left(\left|\frac{MV_{i,t} - MV_{i,t-1}}{MV_{i,t-1}}\right|\right) = \beta_0 + \beta_1 ACC_{i,t} + \beta_2 TWS_{i,t-1} + \beta_3 Age_{i,t} + \beta_4 Gender + \beta_5 Tenure_{i,t} + \beta_6 Org + \beta_7 Board + \beta_8 \log(Employee) + \beta_9 Nationality_{Dummy} + \beta_{10} Sector_{Dummy} + \beta_{11} YEAR_{Dummy} + \beta_{12-20} ACC_{i,t} * (CEOCharas_{i,t} + Nationality_{Dummy} + Sector_{Dummy}) + \beta_{21-39} TWS_{i,t-1} * (CEOCharas_{i,t} + Nationality_{Dummy} + Sector_{Dummy}) + \beta_{40} L. \log\left(\left|\frac{MV_{i,t} - MV_{i,t-1}}{MV_{i,t-1}}\right|\right) + \beta_{41} \log(|MTBV_{i,t} - MTBV_{i,t-1}|) + \varepsilon_{i,t} \quad (\text{Eq. 1.2})$$

4.3.2 Market to Book Value

Similarly, this study tests the effects that CEO social activities have on long term firm value, namely, market to book value. Followings are the primary models with four extensions:

Main model:

$$\log(|MTBV_{i,t} - MTBV_{i,t-1}|) = \beta_0 + \beta_{1(1)} ACC_{i,t} + \beta_{1(2)} TWS_{i,t-1} + \beta_{1(3)} L. |ACC_{i,t} - ACC_{i,t-1}| + \beta_{1(4)} L. |TWS_{i,t} - TWS_{i,t-1}| + \beta_{2-8} CEOCharas_{i,t} + \beta_9 Sector_{Dummy} + \beta_{10} YEAR_{Dummy} +$$

$$\beta_{11-19} \text{Cross Terms} + \beta_{20} L. \log(|MTBV_{i,t} - MTBV_{i,t-1}|) + \varepsilon_{i,t} \quad (\text{Eq. 2})$$

H_{2A}:

$$\log(|MTBV_{i,t} - MTBV_{i,t-1}|) = \beta_0 + \beta_1 ACC_{i,t} + \beta_2 TWS_{i,t-1} + \beta_3 Age_{i,t} + \beta_4 Gender + \beta_5 Tenure_{i,t} + \beta_6 Org + \beta_7 Board + \beta_8 \log(Employee) + \beta_9 Nationality_{Dummy} + \beta_{10} Sector_{Dummy} + \beta_{11} YEAR_{Dummy} + \beta_{12} L. \log(|MTBV_{i,t} - MTBV_{i,t-1}|) + \varepsilon_{i,t} \quad (\text{Eq. 2. 1})$$

H_{2A}(RECESSION):

$$\log(|MTBV_{i,t} - MTBV_{i,t-1}|) = \beta_0 + \beta_1 ACC_{i,t} + \beta_2 TWS_{i,t-1} + \beta_3 Age_{i,t} + \beta_4 Gender + \beta_5 Tenure_{i,t} + \beta_6 Org + \beta_7 Board + \beta_8 \log(Employee) + \beta_9 Nationality_{Dummy} + \beta_{10} Sector_{Dummy} + \beta_{111} RECESSION * YEAR_{Dummy} + \beta_{12} L. \log(|MTBV_{i,t} - MTBV_{i,t-1}|) + \varepsilon_{i,t} \quad (\text{Eq. 2. 1. 1})$$

H_{2A}(STABLE):

$$\log(|MTBV_{i,t} - MTBV_{i,t-1}|) = \beta_0 + \beta_1 ACC_{i,t} + \beta_2 TWS_{i,t-1} + \beta_3 Age_{i,t} + \beta_4 Gender + \beta_5 Tenure_{i,t} + \beta_6 Org + \beta_7 Board + \beta_8 \log(Employee) + \beta_9 Nationality_{Dummy} + \beta_{10} Sector_{Dummy} + \beta_{112} STABLE * YEAR_{Dummy} + \beta_{12} L. \log(|MTBV_{i,t} - MTBV_{i,t-1}|) + \varepsilon_{i,t} \quad (\text{Eq. 2. 1. 2})$$

H_{2C}:

$$\log(|MTBV_{i,t} - MTBV_{i,t-1}|) = \beta_0 + \beta_1 L. |ACC_{i,t} - ACC_{i,t-1}| + \beta_2 Age_{i,t} + \beta_3 Gender + \beta_4 Tenure_{i,t} + \beta_5 Org + \beta_6 Board + \beta_7 \log(Employee) + \beta_8 Nationality_{Dummy} + \beta_9 Sector_{Dummy} + \beta_{10} YEAR_{Dummy} + \beta_{11} L. \log(|MTBV_{i,t} - MTBV_{i,t-1}|) + \varepsilon_{i,t} \quad (\text{Eq. 2. 3})$$

H_{2D}:

$$\log(|MTBV_{i,t} - MTBV_{i,t-1}|) = \beta_0 + \beta_1 L. |TWS_{i,t} - TWS_{i,t-1}| + \beta_2 Age_{i,t} + \beta_3 Gender + \beta_4 Tenure_{i,t} + \beta_5 Org + \beta_6 Board + \beta_7 \log(Employee) + \beta_8 Nationality_{Dummy} + \beta_9 Sector_{Dummy} + \beta_{10} YEAR_{Dummy} + \beta_{11} L. \log(|MTBV_{i,t} - MTBV_{i,t-1}|) + \varepsilon_{i,t} \quad (\text{Eq. 2. 4})$$

H_{2B}:

$$\log(|MTBV_{i,t} - MTBV_{i,t-1}|) = \beta_0 + \beta_1 ACC_{i,t} + \beta_2 TWS_{i,t-1} + \beta_3 Age_{i,t} + \beta_4 Gender + \beta_5 Tenure_{i,t} + \beta_6 Org + \beta_7 Board + \beta_8 \log(Employee) + \beta_9 Nationality_{Dummy} + \beta_{10} Sector_{Dummy} + \beta_{11} YEAR_{Dummy} + \beta_{12-20} ACC_{i,t} * (CEO_{Charas_{i,t}} + Nationality_{Dummy} + Sector_{Dummy}) + \beta_{21-39} TWS_{i,t-1} * (CEO_{Charas_{i,t}} + Nationality_{Dummy} + Sector_{Dummy}) + \beta_{40} L. \log(|MTBV_{i,t} - MTBV_{i,t-1}|) + \varepsilon_{i,t} \quad (\text{Eq. 2. 2})$$

4.3.3 Return on Assets

Different from the examinations on the firm value, this part put heavier effort into cross-sectional comparisons presented by Return on Assets of each firm, namely, firm performance. As explained variable Return on Assets are obtained from yearly firm financial statement, the immediate change in CEO social media account and posting frequency could not be captured and reflected immediately. This section consequently leave out the discussion on explanatory variable $L. |ACC_{i,t} - ACC_{i,t-1}|$ and $L. |TWS_{i,t} - TWS_{i,t-1}|$.

Furthermore, the registration status of CEO social media account is determined by the status in the end of the financial year. While variable $TWS_{i,t}$ is replaced by $sumTWS_{i,t}$, showing the total amount that CEO from each firm posted yearly.

In this regard, one fundamental model and three extended models are constructed as below:

Main model:

$$\begin{aligned} \log(|ROA_{i,t} - ROA_{i,t-1}|) = & \\ & \beta_0 + \beta_{1(1)}ACC_{i,t} + \beta_{1(2)}sumTWS_{i,t} + \beta_{2-8}CEOCharas_{i,t} + \beta_9SectorDummy + \\ & \beta_{10}YEARDummy + \beta_{11-19}Cross\ Terms + \beta_{20}L.\log(|ROA_{i,t} - ROA_{i,t-1}|) + \\ & \varepsilon_{i,t} \quad (\mathbf{Eq. 3 - 1}) \end{aligned}$$

$$\begin{aligned} ROA_{i,t} = & \\ & \beta_0 + \beta_{1(1)}ACC_{i,t} + \beta_{1(2)}sumTWS_{i,t} + \beta_{2-8}CEOCharas_{i,t} + \beta_9SectorDummy + \\ & \beta_{10}YEARDummy + \beta_{11-19}Cross\ Terms + \beta_{20}ROA_{i,t-1} + \varepsilon_{i,t} \quad (\mathbf{Eq. 3 - 2}) \end{aligned}$$

H_{3A}:

$$\begin{aligned} \log(|ROA_{i,t} - ROA_{i,t-1}|) = & \beta_0 + \beta_1ACC_{i,t} + \beta_2sumTWS_{i,t-1} + \beta_3Age_{i,t} + \beta_4Gender + \\ & \beta_5Tenure_{i,t} + \beta_6Org + \beta_7Board + \beta_8\log(Employee) + \beta_9NationalityDummy + \\ & \beta_{10}SectorDummy + \beta_{11}YEARDummy + \beta_{12}L.\log(|ROA_{i,t} - ROA_{i,t-1}|) + \varepsilon_{i,t} \quad (\mathbf{Eq. 3.1}) \end{aligned}$$

H_{3A}(RECESSION):

$$\begin{aligned} \log(|ROA_{i,t} - ROA_{i,t-1}|) = & \beta_0 + \beta_1ACC_{i,t} + \beta_2sumTWS_{i,t-1} + \beta_3Age_{i,t} + \beta_4Gender + \\ & \beta_5Tenure_{i,t} + \beta_6Org + \beta_7Board + \beta_8\log(Employee) + \beta_9NationalityDummy + \end{aligned}$$

$$\beta_{10}Sector_{Dummy} + \beta_{111}RECESSION * YEAR_{Dummy} + \beta_{12} L. \log(|ROA_{i,t} - ROA_{i,t-1}|) + \varepsilon_{i,t} \quad (\text{Eq. 3.1.1})$$

H_{3A}(STABLE):

$$\log(|ROA_{i,t} - ROA_{i,t-1}|) = \beta_0 + \beta_1 ACC_{i,t} + \beta_2 sumTWS_{i,t-1} + \beta_3 Age_{i,t} + \beta_4 Gender + \beta_5 Tenure_{i,t} + \beta_6 Org + \beta_7 Board + \beta_8 \log(Employee) + \beta_9 Nationality_{Dummy} + \beta_{10}Sector_{Dummy} + \beta_{111}STABLE * YEAR_{Dummy} + \beta_{12} L. \log(|ROA_{i,t} - ROA_{i,t-1}|) + \varepsilon_{i,t} \quad (\text{Eq. 3.1.2})$$

H_{3B}:

$$\log(|ROA_{i,t} - ROA_{i,t-1}|) = \beta_0 + \beta_1 ACC_{i,t} + \beta_2 sumTWS_{i,t-1} + \beta_3 Age_{i,t} + \beta_4 Gender + \beta_5 Tenure_{i,t} + \beta_6 Org + \beta_7 Board + \beta_8 \log(Employee) + \beta_9 Nationality_{Dummy} + \beta_{10}Sector_{Dummy} + \beta_{11}YEAR_{Dummy} + \beta_{12-20} ACC_{i,t} * (CEOCharas_{i,t} + Nationality_{Dummy} + Sector_{Dummy}) + \beta_{21-39} sumTWS_{i,t-1} * (CEOCharas_{i,t} + Nationality_{Dummy} + Sector_{Dummy}) + \beta_{40} L. \log(|ROA_{i,t} - ROA_{i,t-1}|) + \varepsilon_{i,t} \quad (\text{Eq. 3.2})$$

Where,

Table 2 Specifications to the models

MTBV_{i,t}	$= \frac{\text{Market Value}_{i,t}}{\text{Book Value}_{i,t}}$
MV_{i,t}	$= \text{Shares Outstanding} * \text{current market price of one share}$
ROA_{i,t}	$= \frac{\text{Net Income}_{i,t}}{\text{Total Assets}_{i,t}}$
β_0	$=$ Intercept term
MV_{i,t}	$=$ Market Value of Firm i from at time t
MTBV_{i,t}	$=$ Market to Book ratio of Firm i at time t
ROA_{i,t}	$=$ Return on Assets of Firm i at time t
Age_{i,t}	$=$ Age of the CEO in Firm i at time t
Gender	$=$ Gender of the CEO in Firm i, dummy variable
Tenure_{i,t}	$=$ Tenure of the CEO in Firm i at time t
Org	$=$ Years in Firm i before entering Board
Board	$=$ Years in Board
Employee	$=$ Total number of employees in Firm i
Nationality	$=$ Dummy variable for different nationality of the CEO
Sector	$=$ Dummy variable for different sector of the Firm i
Year	$=$ Dummy variable for each year, YEAR2009-YEAR2016
Recession	$=$ Dummy variable for recession period, YEAR2009 and YEAR2011

Stable =	Dummy variable for stable period, YEAR 2010, 2012, 2013, 2014, 2015, 2016
ACC =	Whether CEO has his/her Twitter account at time t, dummy variable
TWS_{i,t} =	The number of twitter posted at time t by CEO in Firm i
sumTWS_{i,t}	Total number of twitters posted by CEO in Firm i from time t-1 to t
ACC_{i,t} – ACC_{i,t-1} =	Equals 1 if CEO of Firm i joined Twitter at time t, 0 if CEO does not have Twitter account or has joined Twitter already, in other words, status unchanged
TWS_{i,t} – TWS_{i,t-1} =	The increased/decreased number of Twitter posted by CEO of Firm i from time t-1 to t
ε_{i,t} =	Error term at time t
L.Term_{i,t} =	The form for the first-order lagged term

4.3.4 Specifications on modeling

There would be some issues in variables constructed above, which I would briefly explain as follows and explicitly elaborate in Data Chapter as well as the very start of Regression Analysis Chapter.

Firstly, considering log transformation would not change the properties of the variables, dependent variables, lagged dependent variables as well as the number of employee that are transformed in logged form; moreover,

- 1) eliminating the large magnitude among independent variables,
- 2) reducing the probabilities of the occurrence of multilinearity and heteroskedasticity, and
- 3) obtaining the results that can be effectively interpreted.

Secondly, Since the presence of lagged terms--variable $L.log\left(\left|\frac{MV_{i,t}-MV_{i,t-1}}{MV_{i,t-1}}\right|\right)$, $L.log(|MTBV_{i,t} - MTBV_{i,t-1}|)$ and $L.log(|ROA_{i,t} - ROA_{i,t-1}|)$ raise problems in introducing and/or increasing endogeneity of the models, Hausman test is utilized to detect endogeneity in each model. If the null hypothesis is rejected, endogeneity exists and thus instrumental variable estimates would be taken into consideration, otherwise logical explanation as well as other estimates are preferred. Similarly, tests for

groupwise heteroskedasticity, serial autocorrelation, spatial autocorrelation are also being used before further implementing the appropriate regression.

However, the models would not be estimated as simple Dynamic Panel Data model, on the one hand, several dummy variables are introduced, on the other hand, variables that are not representatives of CEO social media activism are not of primary interests or concerns to the study. In other words, finding out whether firm value and/ or firm performance are affected by CEOs' social media network activities has higher importance than constructing the most fitted model does. Nevertheless, the model matters to some degree in reaching a more appropriate explanation on

- 1) to what extent the impacts have been coming into being, and
- 2) if the influence is positive or negative. The model built in the study, therefore might not be the best one for the generality, but helps the most in getting the results the study wants.

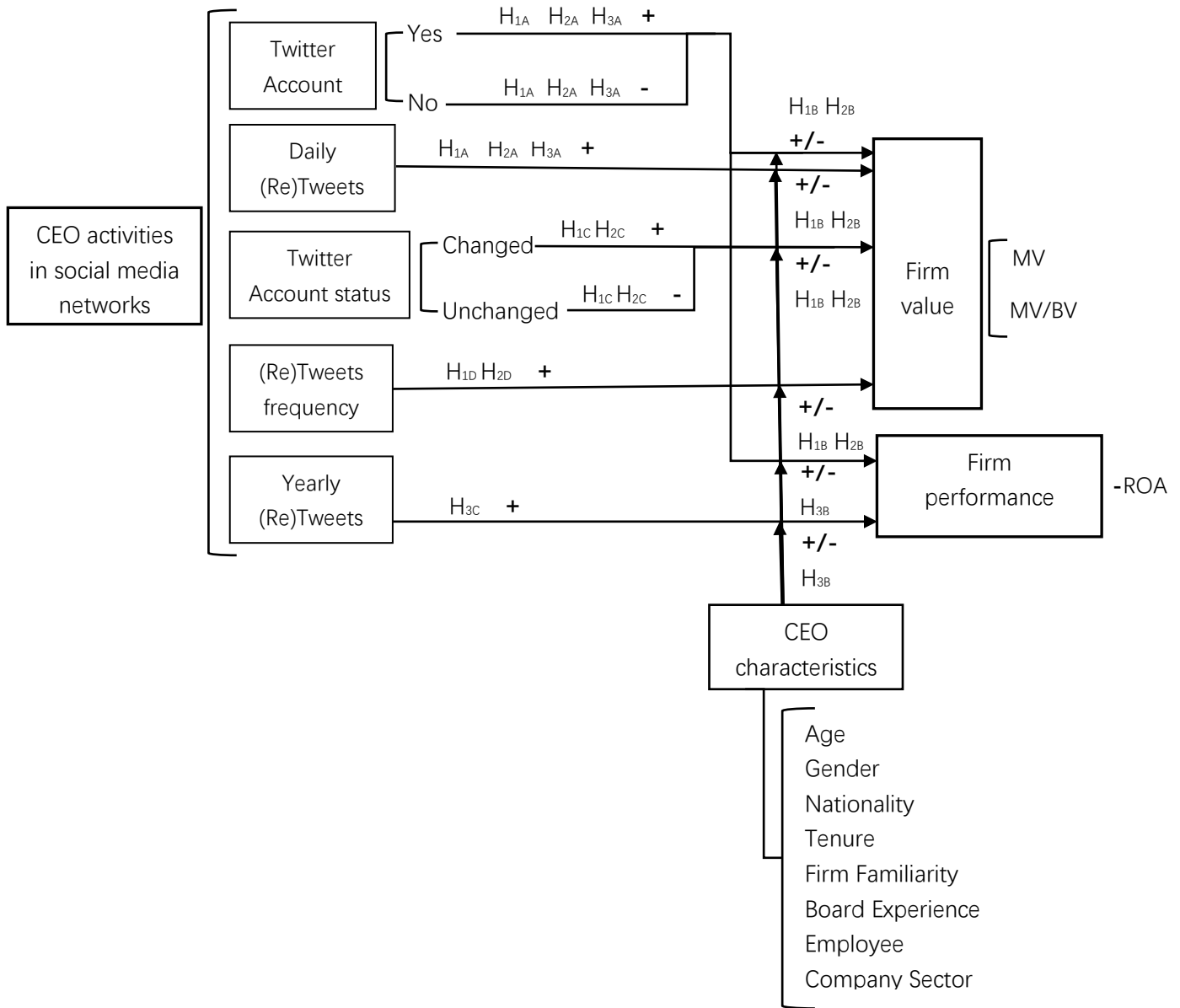
Moreover, as indicator ACC and $TWS_{i,t}$ are simultaneously representatives of social media platform activism, the stepwise regression would be adopted in order for an accurate estimation. Likewise, the entire period was cut off to control the different circumstances that probably established by macroeconomic environments.

Finally, variables standing for CEO characteristics are, on the one hand, act as control variables, on the other hand, introduced to interact with critical explanatory variables, aiming at the estimation on the mediation effects that CEO personal characteristics may take.

All the hypotheses are tested using t-tests of significance in the end. The effects beyond the controls, which could not be explained by variables in this study, are represented with error term $\varepsilon_{i,t}$ in the models.

4.4 Conceptual Model

To explicitly illustrate the relationships within models in 2.1, a conceptual model is constructed as follows,



Graph 2 Conceptual Model

5. Data

In this section the paper shall elucidate the data sources of each variable utilized. Furthermore, the observations under consideration and the reason for their inclusion as well as exclusion shall be explicated in the following section. After that an overview of sample characteristics followed by a descriptive analysis would put an end.

5.1 Data Sources and Selection procedures

The data utilised for explained and explanatory variables in this paper was procured via DataStream (Thomson Reuters), BoardEx (Socioeconomic characteristics of the CEOs) and Twitter, LinkedIn, Bloomberg as well as Annual Report for the other variables. **Table 3** gives the description on exact data source per variable and further notes.

The entire time period under consideration ranges from 1st Jan 2009 till the 20th of Feb 2017, containing all the observations used by each descriptive and regression analysis. For certain analysis, time range will be adjusted to be shorter since some observations and/ or time periods simply are not available and/ or reliable to take into account.

Raw data files were merged based on their unique company codes, and were cleansed in a general perspective before a second selection which aims at customising data to specific analysis. For raw data from DataStream, the study firstly excluded the observations from firms that are no longer the constitutions of S&P500 index, and then observations from financial sectors because of its particularity. Moreover, observations without valid values and containing extreme values were excluded to avoid skewness. Ambiguities in demographic characteristics of CEOs, if the convincing results cannot be reached, were taken away as well.

Table 4 illustrates the details of cleaning and customising the data file.

Table 3 Data Resources

Data Source	Data	Period
DataStream	Market Value	1 st Jan, 2009 ~ 20 th Feb, 2017
	Market-to-Book ratio	1 st Jan, 2009 ~ 20 th Feb, 2017
	Return on Asset	2009~2016
BoardEx	Organisation Name, Current Sector, Number of Employees, Annual Report Date,	1 st Jan, 2009 ~ 20 th Feb, 2017
	CEO Name, Age, Gender, Tenure (Yrs), Nationality, Time on Board(Yrs),	1 st Jan, 2009 ~ 20 th Feb, 2017
Twitter	Personal account, Join time, Number of Tweets, Number of Retweets,	1 st Jan, 2009 ~ 20 th Feb, 2017
LinkedIn, Bloomberg, Annual Report	CEO Tenure, Nationality, Time of being CEO before joining current organisation	2009~2016

Table 4 Data Selection Procedures

Filtering Criteria	Num. of Obs. left
(1) Observations in DataStream from 1 st Jan 2009 till the 20 th of Feb 2017	3,130,500
(2) Exclude firms that are not constituents of S&P500 index presently	1,043,500
(3) Drop firms from financial sectors	989,236
(4) Drop observations that are found to be ambiguous and observations if missing value of any CEO characteristic,	952,707
(5) (Exclusively for regression analysis) Drop observations in 2017	940,185
(6.1) (Exclusively for Hypothesis ₁ and Hypothesis H ₂) Drop observations if missing Market Value, Market-to-Book ratio or log transformation of them from firm year 2009 till 2016	757,294
(7.1) (Exclusively for Hypothesis ₁ and Hypothesis H ₂) Drop top 1% and bottom 1% Outliers/Influential Data, which are predicted with to have a point with high leverage.	740,344
(6.2) (Exclusively for Hypothesis H ₃) Drop observations if missing Return on Assets or its log transformation, or more than one observation in same firm year from firm year 2009 till	3,492

2016

(7.2) (Exclusively for Hypothesis H₃)

2,973

Drop top 1% and bottom 1% Outliers/Influential Data, which are predicted with to have a point with high leverage.

After manually collecting CEO social activities information from Twitter site, 55 CEOs out of 51 firms in S&P500 are found to have personal Twitter accounts, eight CEOs of which belonging to Financial sector. Additionally, 2045 firm years are finally selected to be proceeded in subsequent analysis after cleansing raw data files, 43 non-financial sector firm having active CEOs are fortunately preserved. See **Graph 2** for further details on the distribution of CEO personal accounts in each sector.

5.2 Summary statistics

Table 5 displays the descriptive tabulation of three panels previously built. Since research period various towards different models, entire period is applied to observations contained in the table.

Under a total of 2045 firm years in the study, the mean value of delta MV, after log transformation, for entire period is -4.60287 with the standard deviation equals 0.9420504, while the highest and lowest value are 2.289783 and -11.45792 respectively. and it's worth noticing that the highest value locates in the defined recession period, while the lowest in the stable period on the contrary.

Ranging from -4.60572 to 7.294357, log value of changes in market-to-book ratio witnesses an average value of -3.398426 and accompanying standard deviation of 1.076392. Its highest and lowest observations, not surprisingly, correspondingly belong to the stable and recession periods.

As the only representative of firm performance in the study, Return on Assets ratio has much less observations and is summarized to have an average of 0.076468 with a 0.070272 standard deviation. Maximum and minimum value are found to be 0.4855 and -0.6137 respectively, both appeared in the recession period.

It could be expected that some extreme observations would skew the regression analysis and conclusions followed, which is one of the reasons the study is going to divide eight-year research period into recession period and stable period. Therefore, the extreme values originated from certain time periods would be solely considered.

Together with a defined recession period, which contain year2009 and year2011 and a defined stable period containing year 2010 and year 2012 till 2017, firm years of the whole period are separated into 479 firm years to Recession condition and 1566 firm years to Stable condition correspondingly.

Table 5 Summary statistics (For entire period)

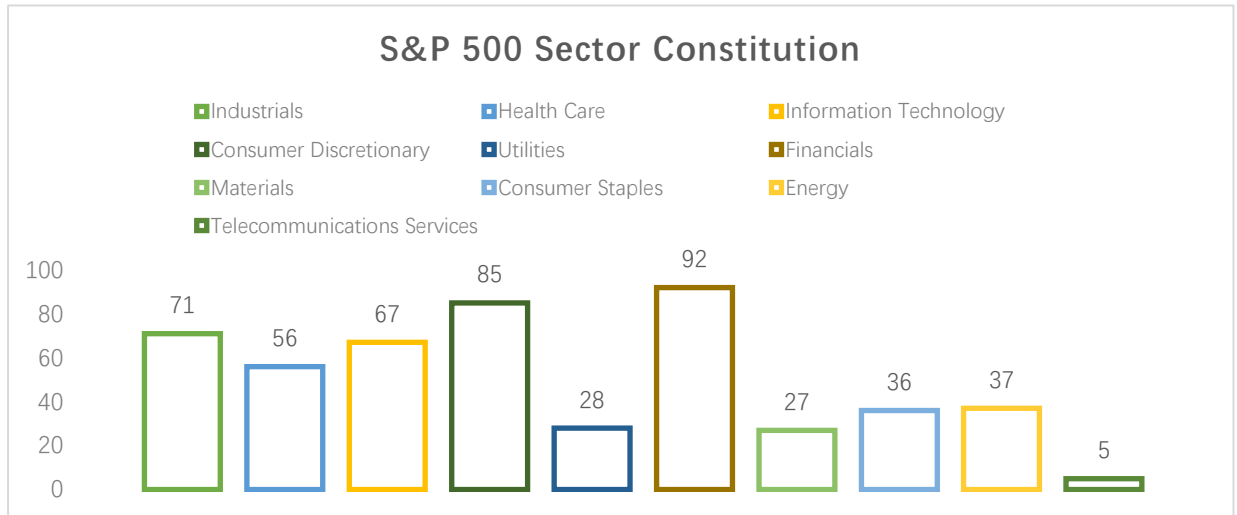
VARIABLES	OBS	MEAN	STD. DEV.	MIN	MAX
PANEL A FIRM VALUE & FIRM PERFORMANCE					
LOG.ABS.DMV	740344	-4.60287	0.9420504	-11.45792	2.289783
--(RECESSION)	172771	-4.300217	0.9605594	-9.496155	2.289783
--(STABLE)	567573	-4.696949	0.916073	-11.45792	2.215376
LOG.ABS.CMTBV	740344	-3.398426	1.076392	-4.60572	7.294357
--(RECESSION)	172771	-3.342335	1.039002	-4.605338	6.074334
--(STABLE)	567573	-3.417604	1.087217	-4.60572	7.294357
LOG.ABS.CROA	2973	-4.52895	1.48746	-9.21047	-0.41885
--(RECESSION)	537	-4.38151	1.463092	-9.21036	-0.41885
--(STABLE)	2436	-4.36981	1.516346	-9.21047	-0.41885
ROA	2973	0.076468	0.070272	-0.6137	0.4855
--(RECESSION)	537	0.083651	0.062117	-0.1723	0.375
--(STABLE)	2436	0.074885	0.07186	-0.6137	0.4855
PANEL B CEO SOCIAL MEDIA ACTIVITIES					
ACC	740344	0.0549137	0.227883	0	1
TWS _{T-1}	740344	0.0158345	0.2546676	0	43
SUMTWS	2973	2.180962	20.27422	0	395
CHGACC	740344	.0000712	.0097686	0	1
CHGTWS	740344	.0000376	.2764403	-43	43
PANEL C CONTROL VARIABLES					
AGE	740344	53.6438	6.656736	27	85
GENDER	740344	0.9528557	0.2119476	0	1
TEN	740344	2.369995	4.38209	0	46.1
ORG	740344	8.30342	9.293267	0	45.1

BOARD	740344	1.921255	4.901693	0	39.1
LOGEMP	740344	9.868303	1.429401	4.882802	14.64842
USSA	740344	0.2647796	0.4412161	0	1
MENA	740344	0.0065037	0.0803831	0	1
ASIA	740344	0.0037861	0.0614146	0	1
UKAU	740344	0.0160952	0.1258419	0	1
SECIND	740344	0.0486828	0.2152041	0	1
SECHEALTH	740344	0.0390737	0.1937705	0	1
SECIT	740344	0.0403677	0.1968203	0	1
SECUTILITY	740344	0.0224517	0.1481475	0	1
SECMAT	740344	0.0207444	0.1425276	0	1
SECSTAP	740344	0.0317636	0.1753703	0	1
SECENER	740344	0.0200366	0.1401256	0	1
SECTELE	740344	0.0022557	0.0474407	0	1
YEAR2009	740344	0.1045149	0.3059276	0	1
YEAR2010	740344	0.1220027	0.3272892	0	1
YEAR2011	740344	0.1288509	0.3350351	0	1
YEAR2012	740344	0.1219811	0.3272642	0	1
YEAR2013	740344	0.1252404	0.3309916	0	1
YEAR2014	740344	0.1288698	0.335056	0	1
YEAR2015	740344	0.1347468	0.3414532	0	1
YEAR2016	740344	0.1337932	0.3404302	0	1
L. LOG.ABS.DMV	740344	-4.835013	1.168686	-13.95706	6.618148
L. LOG.ABS.CMTBV	740344	-3.39953	1.076589	-4.60572	7.294357
L. LOG.ABS.CROA	2973	-4.3106	1.515886	-9.21047	-0.41885
L. ROA	2973	0.074923	0.070947	-0.5754	0.5544

5.3 Descriptive analysis

This subsection delineates the descriptive analysis on general conditions of S&P500 companies and their CEO Twitter user groups.

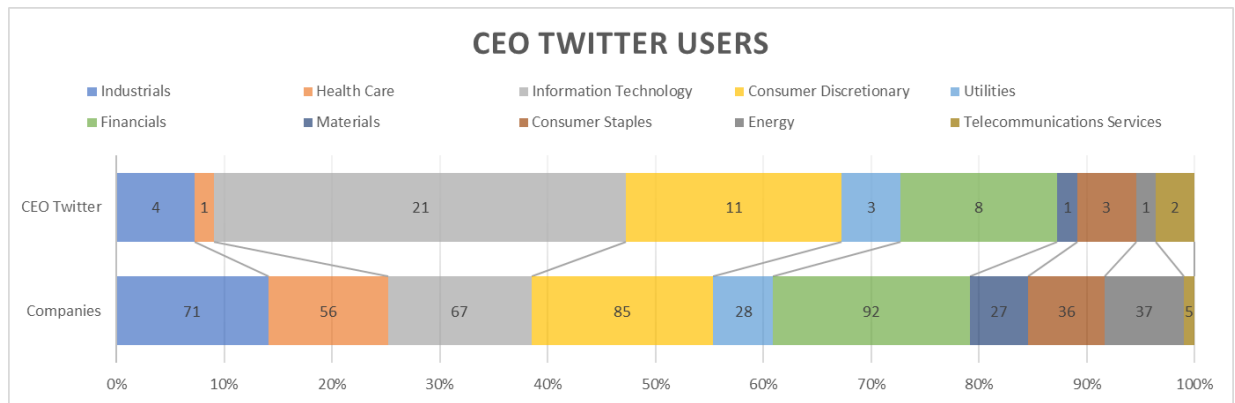
As **Graph 3** shows, companies currently constituting Standard & Poor's 500 Index come from all the sectors. Financial sector owns 92 companies and takes the lead, while Telecommunications Services has the least number of companies. Together with sector Financial, Consumer Discretionary, Industries, Information Technology and Health Care are the majorities.



Graph 3 The distribution of S&P 500 firms in each sector

As an extension to **Graph 3** above, **Graph 4** further looking into how many CEOs using personal Twitter account in each sector and if the proportion maintains at a comparable level. However, result differs from the expectation, as Information Technology topped the comparison, about one third CEOs out of IT sector presents positive attitude in communicating in social media platform. Not surprisingly, two CEOs of five firms from Telecommunication Service sector are users of Twitter. However, CEOs from Financial sector shows relatively less activism, so do those from sector Health Care, Material and Energy.

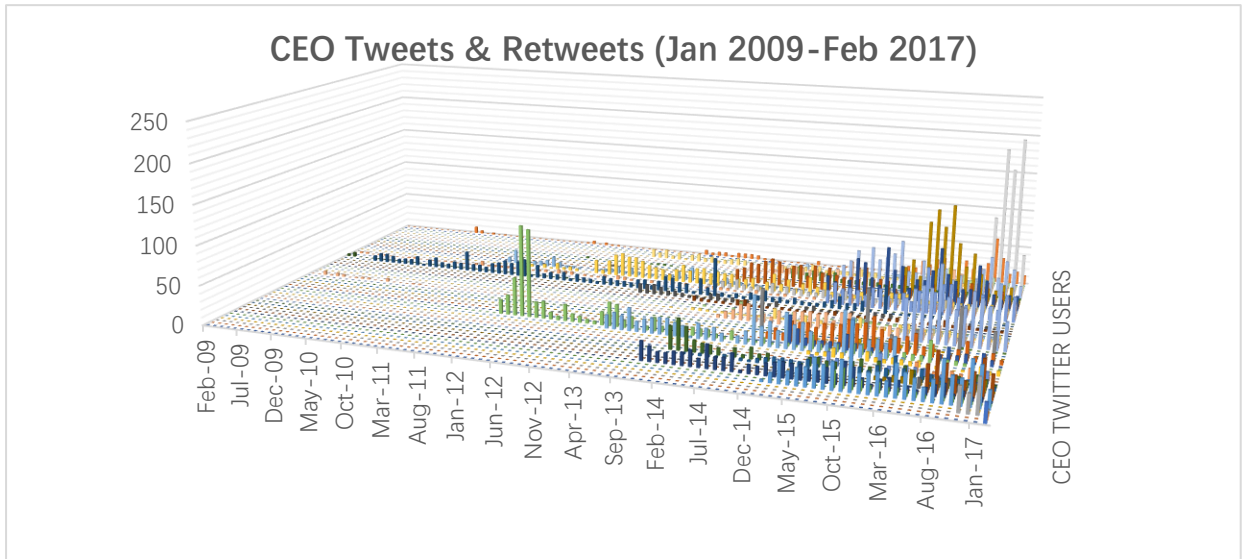
One phenomenon observed from manual collection process of CEO profiles worth mentioning, is that the majority of CEOs sitting in sector Health Care are simultaneously the leading researchers in correlated industry. Doesn't that suggest that activism of social media networks correlates with the specific functionality of the CEO?



Graph 4 The distribution of CEO Twitter Users in each sector

Graph 5 explicitly displays the tendency of 55 CEOs who have Twitter account throughout the entire period. It is noteworthy that certain companies have changed CEO once and/ or appointed two CEOs coinstantaneously, which is so-called “Co-CEO”. Considering this perspective, the study regards CEO as a role instead of an individual. In other words, I would not concentrate on if the CEO has ever changed, but on if any former CEO who registered Twitter in his/her former Tenure while present CEO has not. Which, would be recognized as the closure of CEO Twitter account and hence corresponding independent variable $chgACC$ equals -1, however, this never happened in the period under this study.

As for **Graph 5**, it is obvious that posting frequency and the numbers of tweets as well as retweets are increasingly climbing over time. The highest number of posts recorded is 43 of a CEO in just one day.



Graph 5 CEO Tweets & Retweets activities from Jan 2009 to Feb 2017

(the data is collected from <https://twitter.com/>, till Feb 20, 2017)

6. Regression Analysis

6.1 Explanation on regression analysis

As previously mentioned, I shall elaborate my consideration and corresponding explanation in the process of regression analysis, which was conducted in Stata14.0.

To avoid skewness, influential data (top 1% and bottom 1%) was removed at very first according to the leverage indicator Stata calculated. Likewise, adoption of log transformation on dependent variables and their lagged form helps in increasing the stationarity of data. While on the other hand facilitates in decreasing the probabilities of occurrence of heteroskedasticity.

To better further discussing every classical hypothesis, the test of poolability is implemented to find out if the coefficient means the same to each individual. The result shows that individual effect exists, thus pooled regression cannot be performed.

Moreover, Lagrange multiplier was applied in order to detect if the time effects shall be controlled as well, the answer of which appears to be yes and correspondingly, the two-way effects model is taken into account. Hausman test was further conducted to check if a random effects model could be better, yet the null hypothesis was rejected and fixed effects model are preferred. However, the dummy variable Nationality is static all the time and thus will be omitted during the regression. LSDV model (least-squares dummy variables model) therefore is preferred as an appropriate substitute.

Secondly, heteroskedasticity, endogeneity, serial correlation as well spatial correlation is examined in considering certain variables and requirements for explanation. Issues from heteroskedasticity are considered to be reduced by using log transformation and LSDV model, which also applying to dealing with endogeneity. Though instrumental variable might be recommended from a general view of point, I doubt if it applies to this study since:

- 1) endogeneity can be introduced for many reasons, for instance, omitted variable and sample selection;
- 2) the variable(s) can be the instrumental variable is questioned for lacking researches on this area;
- 3) lagged dependent variables and error terms are often suggested to pay more attentions in introducing/causing endogeneity. However, as mentioned before, the explanatory ability of lagged dependent variables is not the major concern, and individual as well as time specific effects are controlled in considering omitted variables. Therefore, two-way fixed effects model and LSDV estimator, together with clustered robust standard errors would be the most appropriate choice.

What's more, the control variables are multiplied by key explanatory variables, aiming at estimating the (possible) moderation effects of control variables on CEOs who are socializing with Twitter. The cross terms are generated after individual variables being centered.

Finally, robustness check is penetrating through each individual analysis by using various indicators standing for firm value/performance, different variables representing CEO Twitter activism and three time periods.

Follows are tables displaying the results of regression analysis, t-statistics are denoted under coefficients, ***, ** and * stand for statistical significance based on two-sided tests at the 1%, 5%, and 10% level, respectively. Individual and time effects are controlled.

6.2 CEO social media activities and short-medium term firm value

In this section I shall present the regression results on the changes of firm's market value. Estimations of Hypothesis H_{1A} and Hypothesis H_{1B} are separately explained in section 4.1.1 and section 4.1.2, while Hypothesis H_{1B} and Hypothesis H_{1D} are jointly

analyzed in explained in section 4.1.3. Results under recession and stable periods, along with three sessions, would be further compared in depth.

6.2.1 CEO tweets activities and the firm value

Table 6 below gives an overview on if the registration of Twitter account and/ or posting could produce influences on market value and market-to-book ratio, and if yes, will there be a positive or negative effect. To better demonstrate the results, full version of the results contains the regressions both on individuals and on all the variables.

The second and the fifth column of **Table 6** displays the estimation results on the market value of the firm. As denoted by regressions on the individual explanatory variables, regressions on variable Account and Lagged Tweets are statistically insignificant on their own, while Lagged tweets turns to be significant after regressing together with variable Account. This means, the number of tweets & retweets CEO published in personal Twitter account have significant effect on the firm's market value in the next intraday, though to an extreme tiny degree. However, the phenomenon that variable Lagged Tweets is solely insignificant is confusing, making the previous conclusion more or less improbable. Rather than interpreting it as the compound effects simply, I prefer to say it is caused by some CEOs who have Twitter account but never used, they never tweet after registering accounts. And such a decision was identified and distinguished while two indicators regressed at the same time. To sum it up, CEOs who have account but never put into use would not affect the market value significantly, on the contrary, CEOs who share information on their account do generate influences.

Column 3 in table can be of help to identify the nature of impacts. However, it appears to be statistically insignificant, reflecting the unpredictability as well as high volatility of firm's stock price. The number of employees, amongst all the CEO characteristics, are the only one found to function significantly negative in all estimations on market value, making a guess that firm employees might closely pay attention to and behave more sensitively on their CEOs' every move. Unexpectedly, it is not a positive sign to

the short-term firm value.

Comparing to short-term indicator, tests on market-to-book ratio illustrates a slightly different outcome. Though the nature cannot be witnessed, the impacts of variable Lagged tweets are extremely significant. Does it imply that social media activities, rather than short-lived and being quickly forgotten, producing longer and more profound influences on the firm value? Another point worth mentioning is that the number of employees and the sector firm staying affect insignificantly on the long-term firm value, while at the same time, gender is the only control variable having significant influence.

Table 6 The influences of CEO twitter activities on firm value

The table contains the regression results on hypotheses H_{1A} and H_{2A}. The dependent variables are short-medium term firm value and long-term firm value respectively, the degree of changes and the nature of changes are separately tested. Variable definitions are in **Table 1** above. t-statistics are denoted under coefficients. ***, ** and * stand for statistical significance based on two-sided tests at the 1%, 5%, and 10% level, respectively. Individual effects and time effects are controlled.

Time Periods	Entire period				
Variables	$\log\left(\left \frac{MV_{i,t} - MV_{i,t-1}}{MV_{i,t-1}}\right \right)$	$\log(MTBV_{i,t} - MTBV_{i,t-1})$	$\frac{MV_{i,t} - MV_{i,t-1}}{MV_{i,t-1}}$	MTBV _{i,t} - MTBV _{i,t-1}	
<u>Panel B CEO Social Media Activities</u>					
ACC	-0.092	0.115*	0.0001		0.003
	-1.29	1.95	1		1.42
L.TWS	0.034**	-0.0402***	-0.00001		0.001
	2.16	-3.16	-0.2		0.91
<u>Panel C Control Variables</u>					
Age	-0.00002	0.00009	-4.18E-07		-0.0004
	-0.01	0.04	-0.07		-0.93
Gender	-0.056	0.118**	0.0002		-0.0005
	-0.6	2.17	1.42		-0.27
Tenure	-0.0105*	0.006	7.86E-06		0.0008
	-1.73	1.24	1.24		1.25
Org	-0.003	-0.001	-8.79E-06**		0.0003
	-0.89	-0.67	-2.25		1.15
Board	0.005	0.002	0.00001**		-0.0006*
	0.77	0.32	2.5		-1.91

logEMP	-0.0299**	-0.006	-0.00004**	-0.0002
	-2.13	-0.64	-2.27	-0.43
USSA	0.038	0.056	-2.05E-06	0.0021
	0.52	1.18	-0.02	0.75
MENA	0.057	-0.084	-0.00005	0.0013
	0.4	-1.07	-0.2	0.55
ASIA	0.383	0.006	0.0007**	-0.0013
	0.82	0.03	2.38	-0.54
UKAU	-0.036	0.152	0.00004	-0.00012
	-0.19	0.94	0.19	-0.04
Industrials	0.065	-0.055	0.00018	-0.0028
	0.47	-0.59	1.1	-0.72
Health Care	0.115	-0.079	0.000056	-0.00113
	0.94	-0.92	0.38	-0.53
Information Technology	-0.144	-0.029	-0.0003***	0.0019
	-1.23	-0.42	-3.15	1.2
Utilities	-0.084	-0.046	-0.00004	0.002
	-0.59	-0.53	-0.22	1.02
Materials	-0.209	0.122	-0.0002	0.003
	-1.05	0.84	-1.25	1.4
Consumer Staples	0.082	-0.123	0.0001	-0.0013
	0.66	-1.43	1.02	-0.59
Energy	-0.299*	0.037	-0.0002	0.0019
	-1.65	0.31	-1.45	0.9
Telecommunication Services	0.053	-0.079	-0.00039***	-0.005
	0.64	-1.42	-3.63	-1.02
$L. \log\left(\left \frac{MV_{i,t} - MV_{i,t-1}}{MV_{i,t-1}}\right \right)$	0.086***			
	16.27			
$\log(MTBV_{i,t} - MTBV_{i,t-1})$	0.489***			
	17.23			
$L. \log(MTBV_{i,t} - MTBV_{i,t-1})$		0.508***		
		21.98		
$\frac{MV_{i,t} - MV_{i,t-1}}{MV_{i,t-1}}$			-0.00016*	
			-1.75	
$MTBV_{i,t} - MTBV_{i,t-1}$			0.0003	
			0.52	
$L. (MTBV_{i,t} - MTBV_{i,t-1})$				0.0089
				1.55
_cons	-1.776***	-1.734***	0.0037***	0.032
	-7.59	-10.57	10.35	1.35

Time fixed effect	Yes	Yes	Yes	
Individual fixed effect	Yes	Yes	Yes	
Adj. R-Square	0.272	0.276	0.0001	0.0001

6.2.1.1 CEO social media activism and firm value in recession and stable periods

Table 7 further looks into the performance of key indicators in the recession period and stable period. As stated in Chapter Literature Review and Chapter Hypothesis Development, dividing time periods probably brings up a more meaningful estimation, and at the same time provides a firm base for the main results.

Concentrating on the short-term firm value, the significance of the impacts taken by tweets obviously decreases from the recession period to the stable period, so do the coefficients. Variable Account experienced the similar results. On the contrary, some control variables estimated in stable period, e.g. company employee, certain CEO nationalities and sectors affect rather significantly on the market value. In combination with the output in entire period, the study finds out that

- 1) The public focuses on the move of critical man in a more unstable period;
- 2) Sector attracts distinctive attentions as the macro economic environment differs and
- 3) Tweets in recession period seems to have higher influences on the entire period estimations, so do the control variables in the stable period. Thus less observations in recession period may not take the responsibility.

Moreover, tweets activity displays an extremely significant impact on market-to-book ratio both in recession and in stable environment. Though significant at 5% level in recession period, the openings of Twitter account received a decreasing concentration in stable time. Both results observed corresponds to the opinions came up above, and worth exploring the reasons why Twitter registration matters to the long-term firm value.

Looking at the table from another perspective on divided time periods, the properties of market values are much impacted by the CEO characteristics, while those of market-to-book ratio did not.

Table 7 The influences of CEO twitter activities on firm value in recession period and stable period

The table contains the regression results on hypotheses H_{1A} and H_{2A}. The dependent variables are short-medium term firm value and long-term firm value respectively, the degree of changes and the nature of changes are separately tested in recession period and in stable period. Variable definitions are in **Table 1** above. t-statistics are denoted under coefficients. ***, ** and * stand for statistical significance based on two-sided tests at the 1%, 5%, and 10% level, respectively. Individual effects and time effects are controlled.

Time Periods		RECESSION				STABLE			
Indicators		Short-medium term firm value		Long-term firm value		Short-medium term firm value		Long-term firm value	
Variable	$\log\left(\left \frac{MV_{i,t} - MV_{i,t-1}}{MV_{i,t-1}}\right \right)$	$\frac{MV_{i,t} - MV_{i,t-1}}{MV_{i,t-1}}$	$\log(MTBV_{i,t} - MTBV_{i,t-1})$	$MTBV_{i,t} - MTBV_{i,t-1}$	$\log\left(\left \frac{MV_{i,t} - MV_{i,t-1}}{MV_{i,t-1}}\right \right)$	$\frac{MV_{i,t} - MV_{i,t-1}}{MV_{i,t-1}}$	$\log(MTBV_{i,t} - MTBV_{i,t-1})$	$MTBV_{i,t} - MTBV_{i,t-1}$	
Panel B CEO Social Media Activities									
ACC	-0.267*	-0.00027	0.287**	-0.0114	-0.075	0.0001	0.096*	0.0047*	
	-1.93	-0.74	2.49	-1.61	-1.08	1.08	1.72	1.78	
L.TWS	0.097**	-0.00098	-0.135***	-0.0038	0.029*	-0.00001	-0.035***	0.0009	
	2.11	-1.47	-3.45	-1	1.89	-0.15	-2.86	0.75	
Panel C Control Variables									
Age	0.003	9.95E-06	-0.0015	0.0004	-0.0012	-4.69E-06	0.0006	-0.0007	
	0.85	0.94	-0.58	0.84	-0.32	-0.7	0.19	-1.11	
Gender	-0.028	0.0002	0.113*	0.0029	-0.063	0.00015	0.117**	-0.0015	
	-0.26	0.77	1.78	0.68	-0.71	1.49	2.2	-0.56	
Tenure	-0.0075	8.52E-06	0.0056	-0.0001	-0.011*	9.36E-06	0.0057	0.0011	
	-1.05	0.44	0.99	-0.14	-1.81	1.5	1.23	1.27	
Org	-0.0013	-0.00002	-0.0014	-0.0006	-0.0029	-6.74E-06*	-0.0012	0.00054	
	-0.43	-1.44	-0.7	-1.09	-1.01	-1.88	-0.64	1.42	
Board	0.0049	0.000041**	0.0036	0.0006	0.0049	9.38E-06	0.0013	-0.0008*	
	0.71	2.02	0.64	0.66	0.8	1.54	0.25	-1.66	
logEMP	-0.029*	-0.00007	-0.0104	0.0032	-0.029**	-0.00004**	-0.005	-0.0013	
	-1.77	-1.18	-0.96	1.1	-2.17	-2.35	-0.5	-1.12	
USSA	0.032	0.00018	0.0317	-0.0043	0.042	-0.00005	0.063	0.0041	
	0.43	0.77	0.67	-0.82	0.56	-0.65	1.26	1.01	
MENA	0.086	-0.00037	-0.092	-0.0066	0.049	0.00006	-0.083	0.0033	
	0.53	-0.6	-0.91	-0.84	0.35	0.35	-1.1	0.82	
ASIA	0.385	0.0045***	0.037	0.0101	0.382	-0.0006***	-0.003	-0.0054	
	0.7	3.36	0.14	1.36	0.87	-3.49	-0.02	-1.23	
UKAU	-0.009	0.000039	0.099	-0.0062	-0.036	0.00005	0.162	0.0022	
	-0.05	0.09	0.69	-1	-0.2	0.37	0.97	0.51	
Industrials	0.069	0.00041	0.015	-0.0081	0.058	0.0001	-0.073	-0.0013	
	0.47	0.96	0.16	-1.09	0.42	0.73	-0.77	-0.39	
Health Care	0.139	-0.00029	-0.068	-0.0045	0.106	0.0002	-0.082	-0.00012	
	1.2	-0.75	-0.96	-1.38	0.82	1.1	-0.89	-0.04	
Information Technology	-0.186	-0.00079**	-0.0031	-0.001	-0.132	-0.0002*	-0.036	0.0027	
	-1.63	-3.18	-0.05	-0.39	-1.09	-1.91	-0.49	1.28	
Utilities	-0.062	-0.00017	-0.045	-0.0017	-0.094	-0.00002	-0.043	0.0033	

	-0.44	-0.31	-0.59	-0.55	-0.64	-0.12	-0.47	0.98
Materials	-0.296	-0.00029	0.242	0.0095	-0.187	-0.0002	0.089	0.0012
	-0.98	-0.71	1.05	1.01	-1.07	-1.24	0.72	0.47
Consumer Staples	0.127	-0.000096	-0.138	-0.0031	0.068	0.0002*	-0.12	-0.0006
	0.91	-0.27	-1.53	-1.01	0.57	1.87	-1.4	-0.2
Energy	-0.259	-0.00072**	0.0501	0.00096	-0.313*	-2.16E-06	0.0332	0.0022
	-1.58	-2.06	0.52	0.27	-1.66	-0.02	0.26	0.79
Telecommunication								
Services	-0.046	0.00014	0.05071097	0.0113	0.078	-0.0006***	-0.114*	-0.0087
	-0.53	0.5	0.95	1.07	0.92	-6.07	-1.94	-1.25
$L. \log\left(\left \frac{MV_{i,t} - MV_{i,t-1}}{MV_{i,t-1}}\right \right)$	0.122***				0.074***			
	15.8				14.37			
$\log(MTBV_{i,t} - MTBV_{i,t-1})$	0.544***				0.473***			
	15.12				15.75			
$L. \log(MTBV_{i,t} - MTBV_{i,t-1})$			0.456***				0.522***	
			16.63				20.59	
$\frac{MV_{i,t} - MV_{i,t-1}}{MV_{i,t-1}}$		-0.00016*				-0.0004		
		-1.74				-0.24		
$MTBV_{i,t} - MTBV_{i,t-1}$		0.0012				0.00022		
		1.61				0.4		
$L. (MTBV_{i,t} - MTBV_{i,t-1})$				-0.0067				0.0098*
				-0.89				1.8
_cons	-1.636***	0.0034***	-1.787***	-0.0366	-2.07***	0.0017***	-1.778***	0.0402
	-6.32	3.97	-10.34	-0.82	-8.66	4.44	-10.34	1.18
Time fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Individual fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R-Square	0.399	0.003	0.224	0.0001	0.342	0.003	0.291	0.0001

6.3 The moderation effects of CEO characteristics

As it is witnessed in previous analysis that the input of control variables, which are largely consisted of CEO characteristics, should not be ignored. Since these characteristics have been discussed and specifically researched in previous literature, this study would only look at

1) if there is a moderation effect of CEOs characteristics affecting the impacts that social media activism has on the firm value, no matter short-medium term or long-term;

and

2) how it would affect the direction and/ or the strength of the relationships between Panel B and explained variable.

Table 8 below demonstrates the extended estimation of this assumption. Explanatory variables participating in the generation of cross terms were centered before multiplication. Variables in Panel B are cross multiplied with Panel C, and the estimation results are called Cross Terms. The second and the third column depict the regression outputs on the market value, while the last two columns are those on the market-to-book ratio. Panel D, named Cross Terms, was added to aggregately present the assumed moderation effects.

As shown in **Table 8**, variable L.TWS was dropped after taking cross terms and ACC appears to show significant impacts on all indicators regressed. This, could be interpreted as CEOs having Twitter account result a positive influence on both market value and market-to-book ratio. And in combination with the output in Panel B, Panel D illustrates that CEO Age increasing the strength of ACC's impact on market value, implying that older CEOs will receive more positive changes in their firm market value after having Twitter account than younger CEOs do. But, the strength of relationships with market-to-book ratio decreases slightly. Moreover, the CEO Nationality group USSA, consisted of American, Canadian, Brazilian, Venezuelan and Cuban CEO changes the direction of the influence of social media activities in a negative way, the significance is getting lower as well. As for the firm sector, Industrial, Health Care and Information Technology demonstrate their adverse impacts on the relationships respectively, Information Technology, for instance, displays obviously. One probably reasonable explanation for the unequal influences generated from Sector is that, certain sectors always receive higher concentration that others does; however, limited sample may also be the constraint. Health Care sector for example, there are only one CEO, out of 56 companies, having Twitter account.

Table 8 The moderation effects of CEO characteristics on firm value

The table contains the regression results on hypotheses H_{1B} and H_{2B}. The dependent variables are short-medium term firm value and long-term firm value respectively, the degree of changes and the nature of changes are separately tested. Variable definitions are in **Table 1** above. t-statistics are denoted under coefficients. ***, ** and * stand for statistical significance based on two-sided tests at the 1%, 5%, and 10% level, respectively. Individual effects and time effects are controlled.

Variable	$\log\left(\left \frac{MV_{i,t} - MV_{i,t-1}}{MV_{i,t-1}}\right \right)$	$\frac{MV_{i,t} - MV_{i,t-1}}{MV_{i,t-1}}$	$\log(MTBV_{i,t} - MTBV_{i,t-1})$	$MTBV_{i,t} - MTBV_{i,t-1}$
Panel B CEO Social Media Activities				
ACC	-0.0703***	0.0028***	0.259***	0.0133***
	-4.94	74.22	24.35	8.79
Panel C Control Variables				
Gender	-0.051	0.0002	0.123**	-0.0006
	-0.56	1.22	2.24	-0.38
USSA	0.026	0.00001	0.067	0.002
	0.35	0.13	1.39	0.75
MENA	0.039	-0.00002	-0.069	0.0013
	0.29	-0.09	-0.85	0.52
ASIA	0.353	0.0007**	0.032	-0.0013
	0.77	2.4	0.16	-0.53
UKAU	0.023	-0.00003	0.082	0.0013
	0.11	-0.13	0.46	0.33
Industrials	0.066	0.00019	-0.049	-0.003
	0.47	1.12	-0.52	-0.69
Health Care	0.159	0.00002	-0.114	-0.0006
	1.25	0.11	-1.38	-0.32
Information Technology	-0.129	-0.0003***	-0.027	0.0018
	-1.07	-3.12	-0.37	1.08
Utilities	-0.0386	-0.00004	-0.065	0.0017
	-0.27	-0.18	-0.73	0.69
Materials	-0.222	-0.0002	0.136	0.0032
	-1.11	-1.24	0.93	1.41
Industrials	0.128	0.0001	-0.168**	-0.00096
	1.01	0.7	-1.97	-0.46
Energy	-0.287	-0.0002	0.027	0.0019
	-1.58	-1.57	0.23	0.93
Telecommunication Services	0.0619	-0.0004***	-0.086	-0.005
	0.74	-3.68	-1.54	-1.03
L. log $\left(\left \frac{MV_{i,t} - MV_{i,t-1}}{MV_{i,t-1}}\right \right)$	0.086***			

	16.29							
$\log(MTBV_{i,t} - MTBV_{i,t-1})$	0.492***							
	17.24							
$\frac{MV_{i,t} - MV_{i,t-1}}{MV_{i,t-1}}$				-0.0002*				
				-1.75				
$MTBV_{i,t} - MTBV_{i,t-1}$				0.0003				
				0.52				
$L. \log(MTBV_{i,t} - MTBV_{i,t-1})$						0.504***		
						21.61		
$L. (MTBV_{i,t} - MTBV_{i,t-1})$								0.009
								1.55

Panel D Cross Terms								
	ACC	L.TWS	ACC	L.TWS	ACC	L.TWS	ACC	L.TWS
Age	-0.65***	0.0026	0.025***	0.00002	-0.193**	-0.001	0.118***	-0.00007
	-7.96	1.25	36.86	0.67	-2.32	-0.59	21.1	-0.53
Gender	-0.0099	-0.106	0.00019	-0.0006	-0.1114	0.0519	0.0028	-0.0004
	-0.04	-1.61	0.85	-1.33	-0.54	0.91	1.16	-0.19
Tenure	-0.004	-0.007*	0.00002	9.77E-06	0.0137	0.0046	-0.0007	0.0001
	-0.28	-1.87	1.34	0.26	1.04	1.39	-0.89	0.61
Org	-0.005	-0.003	-0.00001	-9.24E-07	0.006	0.0007	-0.0005*	-0.00002
	-0.4	-0.74	-0.85	-0.04	0.62	0.22	-1.7	-0.2
Board	0.007	0.006	3.39E-07	-0.0001	-0.0157	0.0065	0.0008*	-0.00036
	0.3	0.7	0.02	-1.36	-0.94	0.98	1.9	-0.91
logEMP	0.055	0.058***	5.55E-06	0.0001	-0.089	-0.0248	0.00004	0.0008
	0.75	2.91	0.07	0.9	-1.29	-1.35	0.04	1.05
USSA	0.432	0.087	-0.0006	-0.0002	-0.289*	0.093	-0.0069**	0.0022
	1.47	0.7	-1.58	-0.38	-1.69	1.42	-2.07	1.01
ASIA	-0.428	0.0503	0.0002	7.08E-06	0.350	-0.0159	-0.0047	-0.0004
	-1.59	1.52	0.67	0.02	1.51	-0.52	-1.18	-0.19
Industrials	-0.0703	-0.35**	-0.0001	0.00027	-0.136	0.0429	-0.00015***	-0.0014
	-0.12	-2.57	-0.18	0.4	-0.27	0.54	-0.02	-0.52
Health Care	-0.684*	0.022	0.00078	-0.0008	0.389	-0.238**	0.0041	-0.0106
	-1.84	0.13	1.31	-0.65	1.28	-2.06	0.1277	-1.26
Information Technology	-0.784**	-0.204	0.0009**	-0.0012*	0.403*	0.0925	0.0042	-0.0137***
	-2.28	-1.46	2.09	-1.71	1.89	1.13	1.5	-5.54
Utilities	-0.824**	-0.142	0.0003	0.0013*	0.474**	-0.0294	0.0043	-0.0019
	-2.23	-1.08	0.61	1.82	2.45	-0.33	1.5	-0.59
Materials	0.278	-0.0745	0.00025	0.0009	-0.382	-0.074	-0.0007	0.0002

	0.75	-0.52	0.49	1.28	-1.49	-0.83	-0.25	0.07
_cons		-1.719***		0.0035***		-1.85***		0.0324
		-7		9.62		-10.72		1.27
Time fixed effect		Yes		Yes		Yes		Yes
Individual fixed effect		Yes		Yes		Yes		Yes
Adj. R-Square		0.0018		0.0001		0.278		0.0001

6.4 Firm values with the changes in CEO social media activities

Table 9 and **Table 10** below, correspondingly to Hypothesis H_{1C}, H_{1D} and H_{2C}, H_{2D} indicate:

- 1) the influences originated from the changes in CEO Twitter accounts on the Market Value and Market-to-Book ratio;
- 2) the influences originated from the changes in CEO tweet frequencies on the Market Value and Market-to-Book ratio and
- 3) the performance of these impacts in full time period, in recession as well as stable periods.

Compared to variables in Panel B discussed above, namely ACC and L.TWS, L.chgACC and L.chgTWS are seemingly confusing in implication. However, the study considers them critical in order to detect the instant market move after CEO registering the Twitter account and/ or raise the frequency of posting. Firstly, both holding an account that has already registered and/ or staying away from Twitter are denoted as 0 for variable L.chgACC. As there is no circumstance that CEO closed his/her account, deregistration is not considered in the study. Thereafter, there is only one day in every CEO's life to register the Twitter account. Secondly, CEOs who post nothing in time t-1 and time t share the same frequency with whom tweets 100 in time t-1 and time t. In this regard, the results are more meaningful in time series level than in cross-sectional level.

Taking the narrative above into account, the study summarized the estimation on market value and market-to-book ratio separately in **Table 9** and **Table 10**

Variable representing changes in account status displays a significant negative influence in an eight-year study period and being extremely significant in recession period, and not surprisingly, the negativity climbed up in unstable time. Moreover, the coefficient of control variables in Panel C changes to a large extent, together with the significances. Asia-nationality CEOs, firms in IT, Telecommunication Service perform negatively on the short-medium term firm value during the stable period. Which are similar if taking a look at how changes in posting frequency affecting the market value. However, in the contrast, the fluctuation in tweeting frequencies states no influences on the moves of short-medium firm value.

Table 9 The effects of changes in twitter activities on market value

The table contains the regression results on hypotheses H_{1C} and H_{1D}. The dependent variable is short-medium term firm value, the degree of changes and the nature of changes are separately tested for entire, recession and stable period. Variable definitions are in **Table 1** above. t-statistics are denoted under coefficients. ***, ** and * stand for statistical significance based on two-sided tests at the 1%, 5%, and 10% level, respectively. Individual effects and time effects are controlled.

Changes	Changes in Account						Changes in Frequency						
	Time Periods	Entire	Recession	Stable	Entire	Recession	Stable	Entire	Recession	Stable	Entire	Recession	Stable
Variable	$\log\left(\frac{MV_{it} - MV_{i,t-1}}{MV_{i,t-1}}\right)$			$\frac{MV_{it} - MV_{i,t-1}}{MV_{i,t-1}}$			$\log\left(\frac{MV_{it} - MV_{i,t-1}}{MV_{i,t-1}}\right)$			$\frac{MV_{it} - MV_{i,t-1}}{MV_{i,t-1}}$			
Panel B CEO Social Media Activities													
L. (ACC _{it} - ACC _{i,t-1})	-0.221*	-0.389***	-0.032	-0.005**	-0.005	-0.0046							
	-1.9	-6.71	-0.19	-2.06	-1.45	-1.3							
L. TWS _{it} - TWS _{i,t-1}							0.0249	0.069	0.023				
							1.36	1.37	1.27				
L. (TWS _{it} - TWS _{i,t-1})										0.00005	-0.0006	0.00007	
										0.81	-0.95	0.98	
Panel C Control Variables													
Age	0.0005	0.004	-0.0007	-1.03E-06	0.00001	-5.53E-06	0.0005	0.0041	-0.0007	-9.86E-07	0.00001	-5.53E-06	
	0.13	1.09	-0.2	-0.18	1.07	-0.82	0.14	1.11	-0.19	-0.17	1.08	-0.82	
Gender	-0.051	-0.033	-0.057	0.00016	0.0002	0.00014	-0.0499	-0.031	-0.057	0.00016	0.0002	0.00014	
	-0.54	-0.3	-0.63	1.37	0.83	1.39	-0.54	-0.28	-0.63	1.38	0.83	1.4	
Tenure	-0.0113*	-0.009	-0.0114*	8.72E-06	6.67E-06	0.00001	-0.0113*	-0.009	-0.0115*	8.71E-06	6.60E-06	0.00001	
	-1.84	-1.24	-1.92	1.35	0.34	1.58	-1.85	-1.24	-1.92	1.35	0.33	1.58	
Org	-0.002	-0.0011	-0.003	-9.02E-06**	-0.000017	-7.10E-06**	-0.0023	-0.001	-0.0027	-9.02E-06**	-0.00002	-7.09E-06**	
	-0.83	-0.35	-0.95	-2.35	-1.41	-2.04	-0.82	-0.34	-0.94	-2.35	-1.42	-2.03	

Board	0.0047	0.0047	0.0048	0.000015**	0.00004	9.71E-06	0.0047	0.0047	0.0048	0.000015**	0.00004**	9.70E-06
	0.75	0.67	0.78	2.55	1.99	1.6	0.75	0.67	0.78	2.55	1.99	1.6
logEMP	-0.032**	-0.0301	-0.031**	-0.000044**	-0.000075	-0.00003**	-0.031**	-0.0301*	-0.0314**	-0.00004**	-0.00008	-0.000035**
	-2.23	-1.87	-2.28	-2.21	-1.21	-2.22	-2.24	-1.87	-2.29	-2.22	-1.22	-2.23
USSA	0.039	0.0375	0.0428	-4.12E-06	0.00019	-0.00006	0.0398	0.0378	0.0432	-3.93E-06	0.00019	-0.000056
	0.55	0.51	0.58	-0.04	0.81	-0.68	0.55	0.52	0.58	-0.04	0.82	-0.68
MENA	0.0642	0.0978	0.055	-0.00006	-0.00036	0.00004	0.069	0.0984	0.05599	-0.000055	-0.0004	0.000044
	0.45	0.6	0.4	-0.24	-0.58	0.27	0.46	0.6	0.41	-0.24	-0.58	0.27
ASIA	0.388	0.395	0.386	0.0006**	0.0045***	-0.00063***	0.388	0.395	0.387	0.00065**	0.0045***	-0.000629***
	0.83	0.72	0.88	2.36	3.36	-3.56	0.83	0.72	0.88	2.37	3.36	-3.56
UKAU	-0.0435	-0.042	-0.041	0.00005	0.00001	0.00006423	-0.0434	-0.0419	-0.041	0.000045	9.24E-06	0.00006
	-0.23	-0.2	-0.23	0.24	0.02	0.42	-0.23	-0.2	-0.23	0.24	0.02	0.42
Industrials	0.067	0.0725	0.0595	0.00018	0.0004	0.000097	0.0672	0.0724	0.0596	0.00018	0.0004	0.000097
	0.49	0.49	0.43	1.09	0.96	0.71	0.49	0.49	0.43	1.09	0.96	0.71
Health Care	0.108	0.127	0.0996	0.00006	-0.00031	0.00018	0.107	0.12652906	0.099	0.000064	-0.00031	0.00018
	0.87	1.02	0.77	0.43	-0.77	1.12	0.87	1.02	0.77	0.43	-0.77	1.12
Information Technology	-0.144	-0.183	-0.132	-0.0003***	-0.00079**	-0.00016189*	-0.144	-0.183	-0.132	-0.00032***	-0.00079**	-0.00016*
	-1.23	-1.59	-1.09	-3.17	-3.17	-1.93	-1.22	-1.59	-1.09	-3.17	-3.18	-1.93
Utilities	-0.089	-0.0571	-0.1002	-0.00004	-0.00016	-6.90E-06	-0.0899	-0.057	-0.1015	-0.000038	-0.00016	-7.07E-06
	-0.62	-0.41	-0.67	-0.18	-0.31	-0.04	-0.63	-0.41	-0.68	-0.18	-0.31	-0.05
Materials	-0.207	-0.289	-0.186	-0.0002	-0.00029	-0.00022	-0.207	-0.2898	-0.186	-0.0002	-0.00029	-0.00022
	-1.04	-0.96	-1.06	-1.27	-0.7	-1.25	-1.05	-0.96	-1.07	-1.27	-0.7	-1.25
Consumer Staples	0.080	0.114	0.068	0.00014	-0.0001	0.00021*	0.0802	0.114	0.068	0.00014	-0.0001	0.00022*
	0.65	0.8	0.56	1.03	-0.31	1.86	0.65	0.79	0.56	1.03	-0.31	1.86
Energy	-0.298	-0.262	-0.311*	-0.0002	-0.0007**	-5.95E-06*	-0.298	-0.262	-0.311*	-0.00018	-0.00072**	-5.78E-06
	-1.64	-1.58	-1.65	-1.48	-2.06	-0.05	-1.63	-1.58	-1.65	-1.47	-2.06	-0.05
Telecommunication Services	0.0513	-0.0497	0.077	-0.0004***	0.00014	-0.00056***	0.0509	-0.0499	0.0768	-0.00039***	0.00014	-0.00056***
	0.62	-0.57	0.91	-3.63	0.47	-6.07	0.62	-0.58	0.91	-3.63	0.47	-6.07
$L \log \left(\frac{MV_{it} - MV_{it-1}}{MV_{it-1}} \right)$	0.086***	0.122***	0.0739***				0.0863***	0.122***	0.0738***			
	16.19	15.76	14.3				16.19	15.75	14.3			
$\log(MTBV_{it} - MTBV_{it-1})$	0.488***	0.541***	0.473***				0.488***	0.5412***	0.473***			
	17.31	15.18	15.82				17.31	15.18	15.82			
$\frac{MV_{it} - MV_{it-1}}{MV_{it-1}}$				-0.00016*	-0.00017*	-0.0004				-0.00016*	-0.00016*	-0.00043
				-1.75	-1.74	-0.24				-1.75	-1.74	-0.24
$MTBV_{it} - MTBV_{it-1}$				0.00028	0.0012	0.00022				0.00028	0.0012	0.00022
				0.52	1.61	0.4				0.52	1.61	0.4
_cons	-1.797***	-1.678***	-2.091***	0.0037***	0.0033***	0.0017***	-1.799***	-1.682***	-2.092***	0.0037***	0.0033***	0.0017***
	-7.69	-6.43	-8.79	10.42	3.86	4.52	-7.71	-6.43	-8.8	10.41	3.85	4.52
Time fixed	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

effect												
Individual	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
fixed effect												
Adj. R-Square	0.375	0.3973	0.3419	0.0018	0.003	0.0012	0.375	0.3973	0.342	0.0018	0.003	0.0012

Obviously the short-medium term firm value involves little with the changes in posting frequency. However, likewise the estimations for Lagged Twitter in sections above, it is necessary to think about long-term firm value's response in **Table 10**. Which indicating the changes in posting frequencies have influence in a long run perspective, especially in the recession period. However, effect that changes in Account brings turns out to be insignificant on the changes in market-to-book ratios fluctuations except the unstable environment, namely, year 2009 and 2011.

Above all, the study spotted that, though social media information was updated every second, it could impact the firm value in a relatively longer period, beyond prediction. However, the nature of their influences is more or less unobservable, as well as the degrees.

Table 10 The effects of changes in twitter activities on market-to-book value

The table contains the regression results on hypotheses H_{2B} and H_{2C}. The dependent variable is long-term firm value, the degree of changes and the nature of changes are separately tested for entire, recession and stable period. Variable definitions are presented in **Table 1** above. t-statistics are denoted under coefficients. ***, ** and * stand for statistical significance based on two-sided tests at the 1%, 5%, and 10% level, respectively. Individual effects and time effects are controlled.

Estimation	Changes in Account						Changes in Frequency					
	Entire	Recession	Stable	Entire	Recession	Stable	Entire	Recession	Stable	Entire	Recession	Stable
Variable	$\log(MTBV_{i,t} - MTBV_{i,t-1})$			$MTBV_{i,t} - MTBV_{i,t-1}$			$\log(MTBV_{i,t} - MTBV_{i,t-1})$			$MTBV_{i,t} - MTBV_{i,t-1}$		
Panel B CEO Social Media Activities												
L. (ACC _{i,t} - ACC _{i,t-1})	-0.079	-0.159**	0.017	-0.0088	-0.0095	-0.0058						
	-0.9	-2.28	0.11	-1.23	-1.54	-0.43						
L. TWS _{i,t} - TWS _{i,t-1}							-0.0187*	-0.071***	-0.0174*			
							-1.79	-2.76	-1.69			
L. (TWS _{i,t} - TWS _{i,t-1})										-0.00027	-0.0043	-0.00019
										-0.7	-1.28	-0.5

Panel C Control Variables

Age	-0.00051	-0.0025	0.00158	-0.0004	0.00042	-0.00069	-0.00054	-0.0025	-0.000034	-0.00043	0.00042	-0.00069
	-0.18	-0.94	0.55	-0.95	0.91	-1.14	-0.2	-0.96	-0.01	-0.95	0.91	-1.14
Gender	0.1112**	0.118*	0.104**	-0.0007	0.0029	-0.0019	0.111**	0.117*	0.109**	-0.00067	0.0029	-0.0019
	2.01	1.87	1.99	-0.37	0.67	-0.69	2	1.83	2.02	-0.37	0.67	-0.69
Tenure	0.0067	0.00755	0.0079*	0.00087	-0.000191	0.0011	0.00674	0.0076	0.0065	0.000867	-0.0002	0.0011
	1.41	1.24	1.68	1.27	-0.23	1.3	1.41	1.24	1.39	1.27	-0.23	1.3
Org	-0.0015	-0.00165	-0.00074	0.00031	-0.00057	0.00053	-0.00149	-0.0017	-0.0015	0.00031	-0.0006	0.00053
	-0.81	-0.84	-0.4	1.14	-1.08	1.41	-0.82	-0.85	-0.77	1.14	-1.08	1.41
Board	0.00188	0.00387	0.00075	-0.00059*	0.00054	-0.00083*	0.00189	0.0039	0.00149	-0.00059*	0.0005	-0.00083*
	0.36	0.7	0.15	-1.9	0.64	-1.64	0.37	0.7	0.29	-1.9	0.64	-1.64
logEMP	-0.0045	-0.0089	-0.00449	-0.00017	0.0031	-0.0012	-0.0044	-0.0089	-0.0031	-0.00017	0.0031	-0.0012
	-0.46	-0.81	-0.46	-0.34	1.09	-1.06	-0.45	-0.81	-0.32	-0.34	1.09	-1.06
USSA	0.0539	0.0256	0.0606	0.00203	-0.0041	0.0039	0.0537	0.025	0.0608	0.002	-0.0041	0.00398
	1.14	0.54	1.25	0.73	-0.79	0.99	1.14	0.53	1.23	0.73	-0.79	0.99
MENA	-0.0934	-0.105	-0.078	0.00102	-0.006	0.00272	-0.0939	-0.105	-0.092	0.001	-0.006	0.0027
	-1.15	-0.99	-1.07	0.45	-0.8	0.73	-1.16	-0.99	-1.2	0.45	-0.8	0.73
ASIA	0.0009	0.0267	-0.0014	-0.00144	0.0106	-0.00575	0.000578	0.026	-0.00859	-0.00144	0.0106	-0.0057
	0	0.1	-0.01	-0.62	1.45	-1.28	0	0.1	-0.04	-0.62	1.45	-1.28
UKAU	0.162	0.134	0.168	0.0002	-0.0076	0.0026	0.162	0.134	0.169	0.0002	-0.008	0.0026
	0.98	0.84	1	0.06	-1.2	0.61	0.98	0.84	0.99	0.06	-1.2	0.61
Industrials	-0.057	0.013	-0.0822	-0.003	-0.00790	-0.00145	-0.057	0.0125	-0.075	-0.0029	-0.0079	-0.00145
	-0.62	0.13	-0.87	-0.74	-1.08	-0.42	-0.62	0.13	-0.8	-0.74	-1.08	-0.42
Health Care	-0.070	-0.054	-0.079	-0.001	-0.005	0.00031	-0.070	-0.054	-0.0738	-0.0008	-0.0051	0.0003
	-0.8	-0.67	-0.85	-0.43	-1.33	0.1	-0.79	-0.67	-0.78	-0.43	-1.33	0.1
Information Technology	-0.029	-0.0068	-0.038	0.0018	-0.0009	0.0027	-0.030	-0.006	-0.0355	0.0018	-0.00087	0.0027
	-0.43	-0.1	-0.53	1.18	-0.34	1.26	-0.43	-0.1	-0.49	1.18	-0.34	1.26
Utilities	-0.039	-0.0497	-0.034	0.0026	-0.0015	0.0038	-0.038	-0.049	-0.03	0.0026	-0.0015	0.00376
	-0.44	-0.64	-0.36	1.12	-0.48	1.11	-0.43	-0.64	-0.37	1.12	-0.48	1.11
Materials	0.119	0.236	0.089	0.00303	0.00971	0.00113	0.1196	0.236	0.088	0.003	0.0097	0.00113
	0.82	1.03	0.72	1.43	1.04	0.48	0.83	1.03	0.71	1.43	1.04	0.48
Consumer Staples	-0.12	-0.124	-0.128	-0.0012	-0.0036	-0.00057	-0.121	-0.123	-0.120	-0.00121	-0.004	-0.00057
	-1.39	-1.28	-1.5	-0.57	-1.24	-0.19	-1.39	-1.28	-1.38	-0.57	-1.24	-0.19
Energy	0.0348	0.0526	0.026	0.0019	0.00088	0.0021	0.035	0.052	0.0305	0.0019	0.00088	0.0021
	0.29	0.55	0.21	0.87	0.24	0.74	0.29	0.55	0.24	0.87	0.24	0.74
Telecommunication Services	-0.077	0.055	-0.118**	-0.0049	0.0111	-0.0086	-0.0767	0.0552	-0.113*	-0.0049	0.01109	-0.0086
	-1.39	1.02	-2.03	-1.01	1.06	-1.25	-1.39	1.03	-1.91	-1.01	1.06	-1.24
$\log(MTBV_{i,t} - MTBV_{i,t-1})$	0.509***	0.459***	0.528***				0.509***	0.459***	0.5229***			
	22.21	16.92	21.34				22.21	16.92	20.78			

$MTBV_{it}$												
$-MTBV_{it-1}$				0.0089	-0.0067	0.0098*				0.0089	-0.0067	0.0098*
				1.55	-0.89	1.8				1.55	-0.89	1.8
_cons	-1.708***	-1.744***	-1.777***	0.0325	-0.038	0.0415	-1.7069***	-1.740***	-1.752***	0.0325	-0.038	0.0415
	-10.37	-9.94	-10.34	1.36	-0.84	1.2	-10.37	-9.9	-10.19	1.36	-0.84	1.2
Time fixed effect	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Individual fixed effect	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Adj. R-Square	0.276	0.222	0.288	0.0001	0.0001	0.0001	0.27	0.222	0.291	0.0001	0.0001	0.0001

6.5 CEO social media activism and the firm performance

In the following section I shall present and analyze the regression results of the changes in firm's performance. Comparing with the market value discussed above, the sample under analysis in this session is substantially reduced, to 2973 observations (537 for recession period and 2436 for stable period) owing to static Return on Assets in the same firm year. Therefore, only two hypotheses were tested. Estimations of Hypothesis H_{3A} and Hypothesis H_{3B} are separately explained in section 5.1.1 and explained 5.1.2, while different time periods are jointly analyzed as well as explained in each subsection. Dissimilar with the estimations on market value or market-to-book ratio, this study would utilize three indicators, which are absolute changes in ROA, changes in ROA as well as ROA itself. Comparing to using ROA in assessing the contribution of social media activism to the firm's profitability, changes in ROA give an intuitive observation on to what extent the social activities would affect the firm performance. What's more, as it is believed that recession period and stable period have distinctive performances, using diverse indicators shall provide robustness basis to the conclusion.

6.5.1 CEO social media activities and the firm performance

Table 11 displays the coefficients regressed by three indicators during three diverse time periods. Instead Lagged tweet, this section would use sumTWS instead, which mean the total number of tweets & retweets in corresponding firm year. Similar to previous practices, this session performed regressions on ACC and sumTWS

individually before joint regression that displaying in the table below. However, none of three indicators are found to be significantly affected by CEO's yearly number of posts. Neither does the registration of account.

However, situation differs in Panel C comparing to previous regression results. CEO Age displays significant negative influence on the firm profitability, especially in stable period; CEO who ages higher demonstrating a worse ROA than who ages lower. But the significant, positive coefficient in Tenure contrasts, as longer tenured CEO wins more profits. What's more, firms with more employees are indicated to have a better result, and CEOs from ASIA and MENA group shows significant results on recession and stable period respectively.

Table 11 CEO twitter activities and firm's return on assets

The table contains the regression results on hypotheses H_{3A}. The dependent variable is Return on Assets, the degree of changes and the nature of changes are separately tested for entire, recession and stable period. Variable definitions are in **Table 1** above. t-statistics are denoted under coefficients. ***, ** and * stand for statistical significance based on two-sided tests at the 1%, 5%, and 10% level, respectively. Individual effects and time effects are controlled.

Variable	log(ROA _{it} - ROA _{it-1})			ROA _{it} - ROA _{it-1}			ROA _{it}		
	Entire	Recession	Stable	Entire	Recession	Stable	Entire	Recession	Stable
Panel B CEO Social Media Activities									
ACC	0.086	-0.042	0.097	-0.0037	-0.0098	-0.0031	-0.0024	0.0038	-0.0027
	0.75	-0.13	0.8	-0.75	-0.89	-0.6	-0.47	0.33	-0.55
sumTWS	-0.00073	-0.0030	-0.00072	4.28E-05	5.93E-05	4.02E-05	2.38E-05	8.81E-05	2.8E-05
	-0.39	-0.7	-0.37	0.9	0.68	0.81	0.46	0.54	0.51
Panel C Control Variables									
Age	-0.0157***	-0.0298***	-0.0127**	-0.00018	0.0005	-0.00028*	-0.00036**	0.00025	-0.00044**
	-2.95	-2.9	-2.27	-1.19	1.14	-1.73	-2.17	0.63	-2.48
Gender	0.1459	0.326	0.112	0.0012	-0.005	0.0019	0.0028	0.0014	0.0027
	1.12	1.22	0.79	0.47	-1.06	0.72	0.77	0.22	0.83
Tenure	-0.0094	-0.0155	-0.0081	0.00036**	-0.0006	0.00048**	0.00032	-0.0011*	0.00047*
	-1.15	-0.71	-1.01	2.04	-1.08	2.52	1.34	-1.87	1.96
Org	-0.0008	-0.0152*	0.002	-5E-05	0.0001	-6.4E-05	0.00015	0.00028	0.00011
	-0.18	-1.86	0.42	-0.52	0.45	-0.59	1.03	1.19	0.73
Board	0.0049	0.042***	-0.0024	0.00023	-0.0004	0.00032	0.00016	-0.00058	0.00026
	0.63	2.94	-0.28	1.28	-0.85	1.53	0.6	-1.17	0.98
logEMP	-0.056**	-0.0442	-0.058**	0.00066	-0.0021	0.00112*	0.0024***	0.0014	0.00248***

	-2.41	-0.95	-2.35	1.17	-1.44	1.66	3.1	1.1	2.81
USSA	0.209*	0.21	0.2053*	-0.0023	0.0030	-0.004	-0.0017	0.0076	-0.0038
	1.88	0.95	1.68	-0.89	0.28	-1.17	-0.45	0.7	-0.94
MENA	-0.436**	0.066	-0.524***	0.0021	0.0044	-0.0001	-0.0012	0.0045	-0.0032
	-2.42	0.07	-2.99	0.43	0.16	-0.02	-0.25	0.34	-0.43
ASIA	-0.256	-2.76***	-0.036	0.003	0.054***	-0.0032	0.0085	0.0801***	0.0001
	-1.48	-7.8	-0.18	0.53	3.17	-0.55	0.51	5.39	0.01
UKAU	0.157	0.615	0.054	0.0056	0.063	-0.005	-0.012*	0.017	-0.0180
	0.53	1.18	0.2	0.64	1.06	-1.02	-1.78	0.66	-1.6
Industrials	-0.2399	-0.826**	-0.1148	0.00066	0.0093	0.00158	-0.0006	-0.0032	0.00146
	-1.23	-2.11	-0.53	0.18	0.67	0.32	-0.12	-0.18	0.31
Health Care	-0.185	0.00480	-0.229	0.00224	-0.0152	0.00656	-0.0037	-0.0241*	0.0016
	-0.93	0.01	-1.11	0.49	-0.91	1.53	-0.65	-1.77	0.31
Information Technology	0.00749	-0.264	0.0773	-0.007	-0.039**	-0.0003	-0.0012	-0.020	0.0033
	0.05	-0.82	0.49	-1.26	-2.24	-0.05	-0.18	-1.61	0.44
Utilities	-0.0376	-0.518	0.0798	-0.003	0.0061	-0.0029	0.0061	0.011	0.0057
	-0.18	-1.58	0.35	-0.54	0.37	-0.39	0.68	0.64	0.63
Materials	0.209	-0.327	0.313*	0.0048	0.0017	0.0055	-0.0034	-0.015	-0.0008
	1.34	-0.61	1.73	1.29	0.11	1.08	-0.83	-1.09	-0.14
Consumer Staples	-0.427*	-0.396	-0.443*	0.0003	-0.019	0.0054	-0.0039	-0.0311*	0.0026
	-1.66	-0.94	-1.7	0.08	-1.21	1	-0.67	-1.86	0.39
Energy	-0.114	-1.041	0.0518	-0.0019	-0.0026	-0.001	0.00139	0.0016	0.0017
	-0.53	-1.97	0.21	-0.3	-0.19	-0.12	0.13	0.11	0.16
Telecommuni cation Services	-0.01096	0.475*	-0.163	-0.0025	-0.006	5.06E-05	0.0158**	0.0085	0.017**
	-0.08	1.74	-1.11	-0.83	-0.52	0.01	3.13	0.74	3.2
L. log(ROA_{it} - ROA_{it-1})	0.4131***	0.4016***	0.419***						
	17.89	8.16	16.72						
L. ROA_{it} - ROA_{it-1}				-0.357***	-0.595***	-0.277***			
				-11.71	-6.84	-6.38			
L. ROA_{it}							0.660***	0.46***	0.727***
							17.54	6.27	18.88
_cons	-1.539***	-1.083	-1.959***	0.072***	0.089***	0.029***	0.059***	0.052**	0.0248**
	-4.03	-1.49	-5.17	5.72	3.83	2.8	4.37	2.17	2.19
Time fixed effect	YES	YES	YES	YES	YES	YES	YES	YES	YES
Individual fixed effect	YES	YES	YES	YES	YES	YES	YES	YES	YES
Adj. R-Square	0.198	0.237	0.197	0.18	0.504	0.108	0.475	0.456	0.496

6.5.2 Firm performance with the moderation effects of CEO social media activism

Although CEO twitter activities appear to have no effect on firm performance as illustrated above, certain control variables obviously do not. And, since it is doubt that if social media network activities could indirectly affect the profitability, further regression are performed as a check. Similar as previously, cross terms are generated on the centered variables to avoid collinearity and the final results are displayed in **Table 12**

The coefficients are generated basing on full period, recession and stable situation would not be discussed. First of first, the active Twitter account shows a less heavier moderation effects than the number of tweets sent by CEO does. Variable Account reduced the negative effects by age and changed the influential direction of CEO tenure to a negative outcome, yearly posts amount altered the effects that Gender has. Regression results of CEO nationality and sectors were largely impacted by yearly tweets amount. With such a help, it is obvious that sector Health Care and sector Information' negative influences on the changes in firm performance are exaggerated as the number of tweets increased. Sector Utilities and sector Materials, which indicated having no effect individually, execute significant, negative effects as well, yet positive on the overall return on assets with the help of variable ACC.

The study find it hard to interpret the output to specific variable as mentioned in previous sessions. Limited sample in certain variable results in the shortage of observations are observed. That is also the reason why I firstly estimated if there is certain influence before assessing its propertied in depth.

Table 12 The moderation effects of Twitter activities

The table contains the regression results on hypotheses H_{3B}. The dependent variable is Return on Assets, the degree of changes and the nature of changes are separately tested. Variable definitions are in **Table 1** above. t-statistics are denoted under coefficients. ***, ** and * stand for statistical significance based on two-sided tests at the 1%, 5%, and 10% level, respectively. Individual effects and time effects are controlled.

Time Periods	Entire period						
	Variable	log(ROA _{i,t} - ROA _{i,t-1})		ROA _{i,t} - ROA _{i,t-1}		ROA _{i,t}	
Panel D Cross Terms							
		ACC	sumTWS	ACC	sumTWS	ACC	sumTWS
Age		-0.039**		0.00096		0.00096	
		-3.25		1.51		1.49	
Gender		-0.555	0.0191**	0.0412	5.07E-05	0.0291	4.71E-05
		-1.49	2.27	1.2	0.11	0.76	0.1
Tenure		-0.0075	0.00056	-0.002***	-3.3E-05	-0.0021***	-2.4E-05
		-0.34	0.7	-2.66	-0.85	-3.36	-0.64
Org		0.0121	-0.0005*	-0.0007	1.35E-06	0.00044	1.73E-05
		0.83	-1.76	-1	0.08	0.62	-0.29
Board		0.0111	0.00148	-0.0019	6.58E-05	-0.0025	8E-05
		0.32	1.1	-1.04	0.92	-1.43	1.24
logEMP		0.212*	-0.002	0.0036	-0.00012*	-0.0032	-6.8E-05
		1.69	-1.09	0.9	-1.72	-0.67	-0.93
USSA		-0.046	-1.029***	-0.044***	0.0181***	-0.028***	0.0049
		-0.08	-3.92	-3	2.96	-2.89	0.82
ASIA		0.849*		-0.022**		-0.0167*	
		1.93		-2.2		-1.77	
Industrials		0.683	1.290***	0.063**	-0.0167*	0.0723**	-0.0038
		0.82	3.48	2.55	-1.82	3.19	-0.44
Health Care		0.947	1.0336***	0.0296*	-0.0175***	0.026**	-0.0047
		1.17	3.9	1.68	-2.79	1.82	-0.76
Information Technology		-0.6218	1.047***	0.0308	-0.0186***	0.0254	-0.0058
		-1.07	3.97	1.36	-3.11	1.2	-0.96
Utilities		-0.417	1.047***	0.0309*	-0.01796***	0.043**	-0.0048
		-0.73	3.99	1.75	-3	2.22	-0.8
Materials		1.007	1.018***	0.138***	-0.0185***	0.109***	-0.0054
		1.49	3.86	6.84	-3.05	6.43	-0.9
L. log(ROA _{i,t} - ROA _{i,t-1})			0.410***				
			17.57				
L. ROA _{i,t} - ROA _{i,t-1}					-0.357***		
					-11.6		
L. ROA _{i,t}							0.659***

			17.21
_cons	-1.721***	0.0746***	0.0589***
	-4.43	5.55	4.1
Time fixed effect	YES	YES	YES
Individual fixed effect	YES	YES	YES
Adj. R-Square	0.2098	0.1933	0.4831

7 Conclusion

7.1 Conclusion

There are three main hypotheses that the study came up with at the beginning of the paper.

- H1:** The social media network activities of Chief Executive Officers have certain impacts on their short-medium term firm value
- H2:** The social media activities of Chief Executive Officers have certain impacts on their long-term firm value.
- H3:** The social media activities of Chief Executive Officers have certain impacts on their firm performance.

Empirical analysis above suggests that:

Firstly, whether registering an account or not does not show significant impacts on the changes in the market value, nor in the market-to-book ratio. However, the tweets & retweets before the estimated intraday are found to have significant influences. Controlling for CEO characteristics, the number of tweets in recession period affect the firm value more significantly than in stable period, in other words, the more unstable the time is, the more sensitive the firm value is. Additionally, the nature of the impact is unknown and it is predicted to be determined by the specific contents of tweets, instead of the volume. What's more, CEO activism in social media network is examined to have no effects on firm performance, nether in recession nor in stable period, but generated a relatively different moderation effects on CEO characteristics.

Secondly, though the registration of Twitter account does not affect the firm value significantly, it has the significant moderation effect on CEO characteristics to the firm value.

Last but not the least, in exploring the impacts of opening an account in Twitter and changing the frequency of posting, the study found that opening Twitter account affects the firm value, both in short-medium term and long-term, significantly in recession

period, and changes in posting frequency is slightly different, which solely denotes significant influences on the long-term firm value in recession period.

Compared to stable period under this study, recession period contains much less observations but displays more influences. One possible reason, taking into previous researches into considerations, might be the heavier sentiments of the financial markets in less stable period. Every move of the man in power stands in our concentrations and is largely exaggerated.

7.2 Limitation and further considerations

The study innovated and tried to touch the associations between CEO activism and the firm value/performance, and accordingly found out some limitations as well as possibilities worth studying in a further step.

To the beginning, though over 500 CEOs from S&P 500 companies are taken as samples, the percentage of Twitter users among which is less than 10% after removing observations from financial sector. The persuasion of conclusion is more or less undermined by a merely 47 CEO Twitter users observed. Moreover, three CEOs out of 47 groups have seemingly terminated their usages, i.e. CEO Mark Zuckerberg.

Secondly, diversifications of CEO, such as CEO nationalities are not fully explored and detected owing to the characteristics of S&P 500 Index, skewness in the distribution of observations would not produce a required result.

Furthermore, there are several prospective might worth further considering and estimating:

- 1) The followers of CEO user could be regarded as another indicator of twitter activism to denote the popularity and influence power. However, the followers shown in twitter are updated on time and it would be more meaningful to have the time-series data.
- 2) Instead of “tweet” and “retweet” given by CEOs themselves, the number of “likes”, “comments” and “retweets” CEO received for each of their post are also worth

considering as indicators. And it is interesting to find out the distinctions of these activities, which would be of help in differentiating the implication and corresponding consequences of specific activity.

3) Not only Twitter, more social media channels, such as YouTube, Instagram and LinkedIn could also be the part in studying CEO social media activism. Different sites are constructed distinctively and targeted at different user groups, sub-dividing the platforms in the study are meaningful to this area.

Appendix

A. CEOs in S&P 500 having twitter accounts

S&P 500 COMPANY	CURRENT CEO	DATE OF TWITTER REGISTRATION (YYYYMMDD)
AUTODESK INC	Andrew Anagnost	20111110
AUTODESK INC	Amarpreet (Amar) Hanspal	20090408
NASDAQ INC (NASDAQ OMX GROUP INC PRIOR TO 09/2015)	Adena T Friedman	20141006
TYSON FOODS INC	Thomas (Tom) P Hayes	20141002
ALLERGAN PLC (ACTAVIS PLC PRIOR TO 06/2015)	Brenton (Brent) L Saunders	20150203
SOUTHWEST AIRLINES CO	Gary C Kelly	20150401
JOHNSON CONTROLS INTERNATIONAL PLC (TYCO INTERNATIONAL PLC PRIOR TO 09/2016)	Alex Adrian Molinaroli	20110828
ILLUMINA INC	Francis Aurelio DeSouza	20090317
TERADATA CORP	Victor Lynn Lund	20160524
CITRIX SYSTEMS INC	Kirill Tatarinov	20121025
GENERAL MOTORS CO	Mary Teresa Barra	20140115
INTUIT INC	Brad D Smith	20120526
WILLIS TOWERS WATSON PLC	John J Haley	20150501
NRG ENERGY INC	Mauricio Gutierrez	20160401
HEWLETT PACKARD ENTERPRISE CO	Margaret (Meg) Cushing Whitman	20090212

COCA-COLA CO	Muhtar A Kent	20111115
TWENTY-FIRST	James Rupert Murdoch	
CENTURY FOX INC		20111231
(NEWS CORP PRIOR TO		
07/2013)		
AETNA INC	Mark T Bertolini	20090902
FIDELITY NATIONAL	Gary A Norcross	
INFORMATION SERVICES		20141118
INC		
JUNIPER NETWORKS	Rami Rahim	
INC		20090320
ORACLE CORP	Mark Vincent Hurd	20111116
SYNCHRONY	Margaret M Keane	
FINANCIAL		20150710
SPECTRA ENERGY	Gregory (Greg) L Ebel	
CORP		20100707
(FORMERLY KNOWN AS		
GAS SPINCO INC)		
QUALCOMM INC	Steven (Steve) M	
	Mollenkopf	20140219
XYLEM INC	Patrick K Decker	20140731
MICROSOFT CORP	Satya Narayana Nadella	
	(20090210)	20090210
NIELSEN HOLDINGS	Mitchell (Mitch) Dwight	
PLC	Barns	20090807
(NIELSEN NV PRIOR TO		
08/2015)		
INTEL CORP	Brian Matthew Krzanich	20110211
LEUCADIA NATIONAL	Richard (Rich) B Handler	
CORP		20130926
SEALED AIR CORP	Jerome A Peribere	20131115
ACCENTURE PLC	Pierre Nanterme	
(ACCENTURE LTD		20180627
PRIOR TO 09/2009)		
AKAMAI	Doctor F (Tom) Thomson	
TECHNOLOGIES INC	Leighton	20130821
HUMANA INC	Bruce D Broussard	20131108

INTERNATIONAL BUSINESS MACHINES (IBM) CORP	Virginia (Ginni) Marie Rometty	20121211
YAHOO INC	Marissa Ann Mayer 19112008	20081119
FACEBOOK INC	Mark Elliot Zuckerberg	20090212
CISCO SYSTEMS INC	Charles (Chuck) H Robbins	20081016
TRIPADVISOR INC	Stephen (Steve) Kaufer	20090225
APPLE INC (APPLE COMPUTER INC PRIOR TO 01/2007)	Timothy (Tim) D Cook	20130731
MEDTRONIC PLC (MEDTRONIC INC PRIOR TO 01/2015)	Omar S Ishrak	20110613
MOTOROLA SOLUTIONS INC (MOTOROLA INC PRIOR TO 01/2011)	Gregory (Greg) Q Brown	20110218
SOUTHERN CO	Thomas (Tom) A Fanning	20160401
WESTERN UNION CO	Hikmet Ersek	20120710
CHARLES SCHWAB CORP	Walter (Walt) W Bettinger II	20100628
ACTIVISION BLIZZARD INC (ACTIVISION INC PRIOR TO 07/2008)	Robert (Bobby) A Kotick	20120427
RED HAT INC	James (Jim) M Whitehurst	20090127
PEPSICO INC	Indra Krishnamurthy Nooyi	20140716
EXPEDIA INC	Dara Khosrowshahi	20090521
AUTONATION INC	Michael (Mike) J Jackson	20100826
DAVITA INC	Kent J Thiry	20121004

(DAVITA HEALTHCARE
PARTNERS INC PRIOR TO
09/2016)

SALESFORCE.COM INC

Marc R Benioff

20090228

GENERAL ELECTRIC CO

Jeffrey (Jeff) Robert Immel

20120821

NETFLIX INC

Wilmot Reed Hastings Jr

20080626

AMAZON.COM INC

Jeffrey (Jeff) Preston

20080720

Bezos

BERKSHIRE

Warren Edward Buffett

20130419

HATHAWAY INC

EBAY INC

John Donahoe

20100220

Devin Norse Wenig

2008-2015.7

2015.7-NOW

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C. Pearson Correlation for the estimation on Firm Value

	<i>log.deltaMV</i>	<i>L.log.deltaMV</i>	<i>log.chgMTBV</i>	<i>L.log.chgMTBV</i>	<i>ACC</i>	<i>L.TWS</i>	<i>AGE</i>	<i>GENDER</i>	<i>TEN</i>	<i>ORG</i>	<i>BOARD</i>	<i>logEMP</i>	<i>USSA</i>	<i>MENA</i>	<i>ASIA</i>	<i>UKAU</i>	<i>IND</i>	<i>HEALTH</i>	<i>IT</i>	<i>UTILITY</i>	<i>MAT</i>	<i>STAP</i>	<i>ENERGY</i>	<i>TELE</i>
<i>log.deltaMV</i>	1																							
<i>L.log.deltaMV</i>	0.1762*	1																						
<i>log.chgMTBV</i>	0.5572*	0.0579*	1																					
<i>L.log.chgMTBV</i>	-0.0080*	0.5624*	0.5177*	1																				
<i>ACC</i>	-0.0172*	-0.0049*	0.0518*	0.0506*	1																			
<i>L.TWS</i>	-0.0050*	-0.0008	0	0.001	0.2493*	1																		
<i>AGE</i>	-0.0571*	-0.0493*	0.0285*	0.0360*	-0.0514*	-0.0121*	1																	
<i>GENDER</i>	0.0193*	0.0208*	0.0473*	0.0458*	-0.0448*	-0.0092*	0.0369*	1																
<i>TEN</i>	-0.0343*	-0.0227*	0.0622*	0.0680*	0.1384*	0.0179*	0.3967*	0.0635*	1															
<i>ORG</i>	-0.0579*	-0.0491*	-0.0186*	-0.0243*	-0.0776*	-0.0217*	0.2105*	-0.0251*	-0.0959*	1														
<i>BOARD</i>	-0.0060*	-0.0058*	0.0150*	0.0154*	-0.0351*	-0.0128*	0.3889*	0.0653*	0.1062*	0.5162*	1													
<i>logEMP</i>	-0.0669*	-0.0557*	-0.0209*	-0.0241*	0.0642*	0.0098*	0.0962*	-0.0316*	-0.0203*	0.1836*	0.0356*	1												
<i>USSA</i>	0.0229*	0.0229*	0.0230*	0.0234*	-0.0149*	-0.0123*	0.0645*	-0.0290*	0.0926*	-0.0351*	-0.0345*	-0.0109*	1											
<i>MENA</i>	-0.0106*	-0.0117*	-0.0217*	-0.0233*	-0.0195*	-0.0050*	-0.0520*	0.0180*	-0.0074*	-0.0227*	-0.0004	0.0155*	-0.0486*	1										
<i>ASIA</i>	0.0234*	0.0157*	-0.0064*	-0.0008	-0.0148*	-0.0038*	-0.0470*	0.0137*	0.0005	-0.0162*	-0.0241*	-0.0874*	-0.0370*	-0.0050*	1									
<i>UKAU</i>	0.0049*	0.0090*	0.0346*	0.0346*	0.0562*	0.0077*	-0.0148*	0.0285*	-0.0005	-0.0217*	-0.0283*	-0.0070*	-0.0768*	-0.0104*	-0.0079*	1								
<i>IND</i>	0.0217*	0.0186*	0.0028	0.0056*	-0.0212*	-0.0073*	0.0961*	-0.0397*	0.1498*	-0.0884*	-0.0274*	0.0272*	0.3770*	-0.0183*	-0.0139*	-0.0289*	1							
<i>HEALTH</i>	0.0271*	0.0211*	-0.0043*	-0.0026	0.0609*	0.0013	0.0008	0.0449*	0.0819*	-0.0148*	-0.0420*	-0.0259*	0.3102*	-0.0163*	-0.0124*	-0.0258*	-0.0456*	1						
<i>IT</i>	-0.0184*	-0.0115*	0.0042*	0.001	-0.0159*	-0.0106*	0.0025	-0.0013	-0.0087*	-0.0191*	-0.0197*	-0.0195*	0.1830*	0.1316*	0.1863*	0.1578*	-0.0464*	-0.0414*	1					
<i>UTILITY</i>	-0.0054*	-0.0026	0.0046*	0.0027	0.0360*	0.0116*	-0.0367*	0.0337*	-0.0327*	0.0460*	0.0608*	-0.0011	0.2205*	-0.0123*	-0.0093*	0.0931*	-0.0343*	-0.0306*	-0.0311*	1				
<i>MAT</i>	0.0024	0.0087*	0.0469*	0.0453*	-0.0170*	0.0075*	-0.0263*	0.0324*	-0.0427*	0.0069*	0.0327*	-0.0174*	0.1708*	-0.0118*	-0.0090*	0.1064*	-0.0329*	-0.0294*	-0.0299*	-0.0221*	1			
<i>STAP</i>	0.0076*	0.0015	-0.0163*	-0.0122*	0.0188*	0	0.0381*	0.0403*	0.1526*	-0.0546*	-0.0282*	0.0102*	0.2251*	0.1319*	0.1170*	0.0898*	-0.0410*	-0.0365*	-0.0372*	-0.0275*	-0.0264*	1		
<i>ENERGY</i>	-0.0311*	-0.0238*	0.0164*	0.0168*	-0.0344*	-0.0089*	0.0049*	-0.0398*	-0.0243*	0.0397*	-0.0287*	-0.0359*	0.2110*	-0.0116*	-0.0088*	-0.0183*	-0.0324*	-0.0288*	-0.0293*	-0.0217*	-0.0208*	-0.0259*	1	
<i>TELE</i>	0.0029	0.0014	-0.0052*	-0.0074*	-0.0114*	-0.0029	-0.0224*	0.0106*	-0.0253*	0.0870*	0.0231*	-0.0250*	0.0792*	-0.0038*	-0.0029	-0.0061*	-0.0108*	-0.0096*	-0.0098*	-0.0072*	-0.0069*	-0.0086*	-0.0068*	1

D. Pearson Correlation for the estimation on Firm Performance

	<i>log.chgROA</i>	<i>L.log.chgROA</i>	<i>ACC</i>	<i>SUMTWS</i>	<i>AGE</i>	<i>GENDER</i>	<i>TEN</i>	<i>ORG</i>	<i>BOARD</i>	<i>logEMP</i>	<i>USSA</i>	<i>MENA</i>	<i>ASIA</i>	<i>UKAU</i>	<i>IND</i>	<i>HEALTH</i>	<i>IT</i>	<i>UTILITY</i>	<i>MAT</i>	<i>STAP</i>	<i>ENERGY</i>	<i>TELE</i>	
<i>log.chgROA</i>	1																						
<i>L.log.chgROA</i>	0.4147*	1																					
<i>ACC</i>	0.0273	0.0188	1																				
<i>SUMTWS</i>	0.0063	-0.0042	0.4358*	1																			
<i>AGE</i>	-0.1336*	-0.1923*	-0.0621*	-0.0105	1																		
<i>GENDER</i>	0.0152	0.0016	-0.0335	-0.0467	0.0521*	1																	
<i>TEN</i>	-0.0884*	-0.1187*	0.1219*	0.0248	0.3823*	0.0670*	1																
<i>ORG</i>	-0.0278	-0.0622*	-0.0658*	-0.036	0.1982*	-0.0098	-0.0980*	1															
<i>BOARD</i>	-0.0226	-0.0404	-0.0375	-0.0239	0.3813*	0.0635*	0.1049*	0.5172*	1														
<i>logEMP</i>	-0.0842*	-0.0482*	0.0665*	0.024	0.1155*	-0.0273	-0.0068	0.1756*	0.0288	1													
<i>USSA</i>	0.032	0.0235	-0.0173	-0.0241	0.0540*	0.0004	0.1008*	-0.0437	-0.0335	0.0048	1												
<i>MENA</i>	-0.0402	-0.0235	-0.0192	-0.0089	-0.0536*	0.0184	-0.0061	-0.0222	0.0024	0.0164	-0.0490*	1											
<i>ASIA</i>	-0.0204	-0.0192	-0.0154	-0.0071	-0.0403	0.0148	0.0079	-0.0212	-0.0258	-0.0986*	-0.0394	-0.0055	1										
<i>UKAU</i>	0.0218	0.0243	0.0335	-0.0133	-0.0074	0.0278	-0.0142	-0.0121	-0.0291	-0.0077	-0.0737*	-0.0102	-0.0082	1									
<i>IND</i>	-0.0374	-0.0365	-0.0313	-0.0238	0.1009*	0.0138	0.1693*	-0.1052*	-0.0228	0.0464	0.3793*	-0.0186	-0.015	-0.028	1								
<i>HEALTH</i>	-0.0025	-0.002	0.0631*	0.0065	0.008	0.0451	0.0835*	-0.0038	-0.038	-0.0138	0.3150*	-0.0166	-0.0134	-0.025	-0.0455	1							
<i>IT</i>	0.0278	0.0297	-0.0072	-0.0175	-0.0102	-0.0123	-0.0434	-0.0064	-0.0204	-0.0033	0.1745*	0.1329*	0.1718*	0.1609*	-0.0453	-0.0404	1						
<i>UTILITY</i>	0.0288	0.0214	0.0389	0.0188	-0.0497*	0.0332	-0.0405	0.0448	0.0615*	-0.0101	0.2177*	-0.0122	-0.0098	0.0955*	-0.0335	-0.0299	-0.0298	1					
<i>MAT</i>	0.0533*	0.0316	-0.0118	0.028	-0.0202	0.0321	-0.0406	0.0214	0.0419	-0.0134	0.1651*	-0.0118	-0.0095	0.1193*	-0.0324	-0.0289	-0.0288	-0.0213	1				
<i>STAP</i>	-0.0695*	-0.0545*	0.0005	-0.0197	0.0437	0.0409	0.1515*	-0.0573*	-0.0309	0.0041	0.2291*	0.1479*	0.1609*	0.0553*	-0.0412	-0.0368	-0.0366	-0.0271	-0.0262	1			
<i>ENERGY</i>	0.0067	0.0057	-0.0331	-0.0153	0.0165	-0.0473*	-0.0142	0.0366	-0.0212	-0.04	0.2008*	-0.0117	-0.0094	-0.0176	-0.0321	-0.0287	-0.0285	-0.0211	-0.0204	-0.026	1		
<i>TELE</i>	0.0154	0.0158	-0.0113	-0.0052	-0.0261	0.0109	-0.0256	0.0874*	0.0198	-0.0261	0.0817*	-0.004	-0.0032	-0.006	-0.011	-0.0098	-0.0097	-0.0072	-0.007	-0.0089	-0.0069	1	