

Applying Digital Analysis to Corporate Governance and Financial Reporting Quality During Global Financial Upheavals

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ABSTRACT

In implementing financial reforms, government authorities in Taiwan have set a primary goal to encourage firms to enhance corporate governance efficacy and to improve financial reporting quality. This study examines the impact of changes in the global financial environment on corporate governance effectiveness and financial reporting quality in Taiwan. The authors follow the model of the financial statement deviation (FSD) score, using the digit of holistic data to identify whether the distribution of the whole firm-year financial statement numbers deviates from Benford's Law. The FSD score overcomes the insufficient explanatory power for detecting financial reporting quality in accrual models. The results show that the quality of corporate governance has improved significantly for sound firms, but has not improved – and may even have worsened – for poor firms. These findings suggest that legislative authorities and investors in Taiwan may wish to re-examine whether a suitable environment has been created to enhance financial reporting quality.

Keywords: Corporate governance, financial reporting quality, digit analysis

1. INTRODUCTION

As a result of modern financial technology, the global economic environment and the global financial market have developed into a highly interdependent worldwide system. As a result, any financial upheaval will inevitably affect related markets and may even spread around the world. One example is the U.S. subprime mortgage crisis which began in late 2007 and quickly spread worldwide, creating a global financial crisis (GFC, hereafter). In 2008, Iceland's Prime Minister Geir Haarde stated that his country may have been the first to suffer nationwide bankruptcy because of the disaster. In Japan, the Yamato Life Insurance Company became the first bankrupt financial institution in that country (Xu & Wang, 2009). The subsequent economic downturn, which lasted until 2009, led to the deepest economic recession since the Great Depression of the 1930s (Kuo et al., 2013; Sikka, 2009).

As one of the world's top 22 economies in 2016, Taiwan is closely intertwined with the global economic environment and relies strongly on global trade for economic growth. It was overwhelmingly affected, therefore, by the U.S. mortgage crisis. Kirkpatrick (2009) and Aebi et al. (2012) have indicated that the GFC stemmed primarily from poor corporate governance. Shieh (2009) argued that a large number of Taiwan firms lacked efficacy in their corporate governance in the long run, which led to weak business performance. Low performance induced high-level executives to exert earnings management, which, in turn, impaired the quality of financial statements.

The impact of corporate governance on business performance has been a major concern since the 1970s. Recently, it has been extensively explored in the literature. Studies have found that a sound governance structure allows firms to improve their business performance and further enhance the quality of their earnings information. Boivie et al. (2016) found that financial statements are a primary source of information for decision-making by investors. Truong and Nguyen (2017) found that full and good disclosure of financial statements is a major indicator of excellent corporate governance. Bowen et al. (2008) confirmed that the larger the scale of a firm, the better its business performance, and the greater the relevance of its performance and executive compensation, both of which require the full disclosure of financial information. Beaver (2002) found that a financial report of excellent quality can provide useful information about investment decisions and reduce the information asymmetry for investors so that they are better able to cope with the uncertain risks.

After the GFC, numerous national authorities undertook financial reforms and actively promoted enterprises to enhance corporate governance effectiveness and to improve financial information disclosure. The primary purpose of this study is to examine whether corporate governance efficacy has actually been improved since the GFC and, if so, whether the improvement of corporate governance effectiveness has enhanced financial reporting quality.

The literature has provided various definitions and measures of financial reporting quality. The majority of scholars define the term to mean that the quality of earnings information is identical to the quality of financial reports (McNichols & Stubben, 2015). In studies of financial reporting quality, abnormal accrual is widely used as a proxy variable to measure the quality of earnings information (Francis et al., 2005). Numerous studies have used the accrual model, the Jones model, or the modified Jones model (Islam et al., 2011) to explore the quality of earnings information. Other studies, however, have shown that the accrual model does not generate adequate explanatory power to investigate the quality of earnings information (Bowen et al., 2008; Islam et al., 2011). Despite major amelioration in the methodology for probing the quality of earnings information, there are some inadequacies that limit their practicality.

This paper applies the natural law of digital distribution to assess the quality of financial information. We have used the financial statement deviation (FSD) score proposed by Amiram et al. (2015) for this purpose. The FSD score, which is based on Benford's Law, constructs a measure of the quality of financial reporting that includes the advantages of the law. Benford's Law prescribes expected frequencies for leading digits in naturally emerging collections of numbers (Fewster, 2009). The tendency of the unaltered financial statement numbers complies with Benford's Law, whereas nonconformity is diagnosed with a fraud risk factor (Amiram et al., 2015; Durtschi et al., 2004; Nigrini, 2012). The law evaluates whether the distribution of entire numbers deviates from the theoretical distribution by probing the digit of holistic data (Aono & Guan, 2008), and has been extensively applied to investigate the quality of earnings information (Amiram et al., 2015; Hsieh & Lin, 2013; Lin et al., 2014).

The current paper makes two important contributions. First, we use the FSD measure to detect the first digit of all the accounting items in the financial statements and to investigate whether the actual distribution of the first digit deviates from Benford's Law. In contrast, prior studies examined the impact of corporate governance on the quality of earnings information mostly by focusing on the item of accruals. Bowen et al. (2008), for instance, revealed that the sound

corporate governance mechanism led to a lessening of the manipulation of earnings management and thereby improved financial reporting quality.

Second, this study looks at the situation before and after major events in Taiwan's capital markets in recent years in order to detect whether improvements in corporate governance have had a positive effect on the quality of financial reports. Our empirical results indicate that firms with poor corporate governance have had more FSD deviation from Benford's Law after the GFC than before. Furthermore, by examining individual industries in Taiwan, we found that, after the GFC, the financial reporting quality of firms with good corporate governance improved significantly, whereas the financial reporting quality of firms with poor corporate governance did not improve and may, in fact, have worsened. Our empirical results reaffirm that firms with a weak corporate governance mechanism are unable to significantly improve their financial reporting quality.

The remainder of this paper is organized as follows. Section 2 is a review of the literature. Section 3 describes our hypotheses and research methodology. Section 4 presents the descriptive statistics and empirical results. Section 5 offers concluding remarks.

2. LITERATURE

This review of the literature focuses on agency problems and corporate governance, financial reporting quality, corporate governance reforms, and Benford's Law.

2.1. Agency Problem and Corporate Governance

In terms of information asymmetry between management and shareholders in the business process, Hart and Moore (1994) found that, when managers have self-interested intentions, the moral hazard problem will occur (i.e., earnings manipulation). Williamson (1985) found that, because high-level management has an advantage over the company's operating information, shareholders cannot reliably assess or effectively supervise the behavior of management; thus, the possibility of speculation could occur. Bosse and Phillips (2016) found that inefficiency and high costs in enterprises caused by the agency problem will ultimately be borne by society.

Yeh et al. (2002) indicated that high-efficacy corporate governance provides a complete monitoring mechanism to improve the quality of corporate financial information and prevent management speculation. Good corporate governance can reduce agency cost (Fama & Jensen, 1983; Hsu & Young, 2012).

Claessens and Fan (2002) investigated Asian corporate governance issues and found that most Asian companies have low information transparency and a weak corporate governance system and that these traditional mechanisms are not strong enough to alleviate the agency problem. The Asian Corporate Governance Association (ACGA) also confirmed that, although Asian countries have improved the effectiveness of their corporate governance year after year, there is still a gap from international standards.

2.2. Financial Reporting Quality

Most scholars have asserted that earnings quality is the quality of financial reporting (McNichols, 2002). Degeorge et al. (1999) showed that earnings data is important for investors when making investment decisions. Agency problems, however, have led management to induce earnings manipulations in order to reach the desired earnings target, thus distorting earnings information. Ayres (1994) found that investors are concerned about whether earnings are manipulated by management. Manipulating earnings will reduce the quality of the financial report, thereby misleading investors in their decision-making.

Hsu and Liou (2005) confirmed that speculative earnings management often leads to deterioration of financial reporting quality. They found, furthermore, that poor financial reporting quality is the primary cause of abnormal volatilities in the capital market. Abbadi et al. (2016) contended that accounting information with less earnings manipulation has higher earnings quality. Leuz and Wysocki (2016) found that earnings quality is higher when the earnings information provided by a company accurately reflects the economic substance, when the information is consistent, and when it is highly predictable.

Based on the fact that its usefulness for decision-making is the highest quality of financial reporting, numerous studies have examined how to measure the quality of financial statements (Beneish, 1999; Dechow & Dichev, 2002; Hribar et al., 2014; Jones, 1991). In general, there are two ways. The first is persistence of earnings. When the account for reporting net profit is sustainable (for example, the earnings of the industry is more sustainable than the interest of the disposal of land), then the earnings information displays superior quality. The second approach is the correlation of earnings level with stock price. Based on the efficient-market hypothesis, a high stock price is associated with a high level of earnings. Lang et al. (2003) and Barth (2007) demonstrated that enterprises frequently use managerial discretion in accruals to stabilize their earnings level; that is,

management exerts earnings manipulation to avoid earnings fluctuations in order to maintain the stability of stock prices.

The most prevalent accrual models for assessing the quality of financial statements are the Jones model and the modified Jones model (Islam et al., 2011). Bhattacharya et al. (2003) revealed, however, that these models have certain limitations in terms of examining the quality of financial information. Amiram et al. (2015) asserted that the current models used in the measurement of earnings quality suffer from three shortcomings:

1. Since the settings of accrual models have no solid basis in theory, Thomas and Zhang (2001) found that these models investigate the quality of earnings information with low efficiency. Furthermore, it has been found that adopting the model residuals as abnormal accruals could cause serious biases that lead to results that deviate from basic economic realities (Dechow et al., 1995; Guay et al., 1996).
2. If it is necessary to explore more comprehensive analyses of the firm's characteristics or business model, the effectiveness of the accrual models is limited.
3. Indeed, when forward-looking information such as future realizations of cash flows or the information about returns and price are required in the accrual models, this may lead to biases in selection that reduce the usefulness of the model (Dechow & Dichev, 2002).

Although the methodology of accrual models has been continually improved, subject to its basic preconditions, the practicality of current models for detecting earnings quality is still challenged (Bowen et al., 2008; Islam et al., 2011).

2.3. Corporate Governance Reforms

Doyle et al. (2007a) found that strong corporate governance mechanisms will lead to the good quality of earnings information. Firms with major corporate governance problems will have poor earnings quality (e.g., the board of directors abuses power or there is an inefficient internal control environment).

According to the empirical results of Kam et al. (2008), firms with poor corporate governance efficacy will have a higher level of abnormal accruals than firms with strong corporate governance efficacy. This finding implies that firms with weak corporate governance will implement more earnings management. Klein (2002) indicated that, if the competent authority's norms on earnings

manipulation are more stringent, the quality of financial reports will be more excellent. Beneish et al. (2008) found that companies with major corporate governance problems cause higher accounting information uncertainty; thus, their financial reporting quality is relatively lower. Hence, various countries have stipulated relevant norms to reinforce the efficacy of corporate governance, such as the Sarbanes-Oxley Act (SOX) passed by the U.S. Congress in 2002 to decrease agency costs and preserve the interests of investors. Similarly, in Taiwan, authorities promulgated "Regulations Governing Information to be Published in Annual Reports of Public Companies" to improve the effectiveness of corporate governance.

Leuz et al. (2003) offered strong evidence to show that, if the legal norms of a corporate governance mechanism are stronger in a country, then the level of company earnings manipulation is lower and the quality of financial reporting is improved. The literature reveals that, since SOX was implemented in the U.S., governance mechanisms have ensured the decrease of earnings manipulations. Chen et al. (2015) verified that earnings manipulation has been dramatically reduced because SOX promotes the independence of board members. Even so, some scholars have different views on the issue.

After investigating the efficacy of regulatory amendments and corporate governance improvements on the earnings management practices of firms in Australia and New Zealand, Sun and Farooque (2017) found that, even with the adoption of new regulations to reform corporate governance, the degree of earnings manipulation is still not lessened. Lin et al. (2015) stated that, because of discrepancy in legal settings and contents between the United States and Taiwan, regulatory impacts on earnings manipulation of Taiwan's companies appear to need further detection. The efficacy of improvements in corporate governance is still a contentious issue.

2.4. Benford's Law

Newcomb (1881), an American scientist in astronomy, was the first to discover the phenomenon that the numbers used most often usually begin with smaller digits rather than with larger ones. Newcomb noticed that pages in logarithm tables adopted by people are more blurred at the start and then become increasingly clearer closer to the end. He proposed an inductive conclusion that numbers more constantly start with the digit 1 than with any other digit; moreover, that the occurrence frequency of each subsequent number (up to 9) at the most important position in the number is gradually reduced.

The situation observed by Newcomb (1881) has been examined through an investigation of 20 types of data in the real world (e.g., river basin area, specific heat of chemical substances, molecular weight, pressure, house numbers). Benford (1938) verified that, contrary to human intuition, the expected distribution of naturally emerging numbers is oblique to 1 for the first digit. This distribution of digits is called Benford's Law, or "the digit law". Hill (1995b) proposed an understandable explanation of the origins of Benford's Law and presented the first strict interpretation of the law with a measure-theoretical proof in which data comprising a random consolidation of various distributions will ultimately converge to Benford's Law. Furthermore, in Benford's distribution, the probability of each digit, from 1 to 9, has been calculated.

First, the numerical value of the first digit in a set of numbers has a correspondence with the logarithmic function. For example, take the number 7823.22 into the value of \log (base 10), which is 3.893. Round off the integer, leaving the decimal value 0.893, and then that value of 10 to the power of 0.893 is 7.81. In this example, the integer 7 of 7.81 is the first digit of the number 7823.22; that is, for any number set, if its mantissa of $\log(10)$ is between $\log(d+1)$ and $\log(d)$ (where d can be 1, 2, ..., 9), then the first digit of the number set must be d .

Second, numerous distributions in nature conform to the theoretical properties of Hill (1995b). After the logarithm is taken, the numbers all display a smooth and symmetric distribution (extension of the central limit theorem); and the probability values of these distributions are between $n+\log(d+1)$ and $n+\log(d)$ (n is the first digit in the logarithmic value). Then, the probability value of the first digit d is given exactly by Benford's Law by the difference of $[\log(d + 1) - \log(d)]$.

Figure 1 presents the leading digit probability distribution of Benford's Law. The figure shows that the distribution has a downhill slope. When the digit number is smaller, the theoretical probability of Benford's Law is greater. Solid evidence demonstrates that Benford's distribution can be extensively applied to identify various types of data sets. Essentially, even if the first digit of the data set is naturally produced randomly, it could comply with Benford's Law.

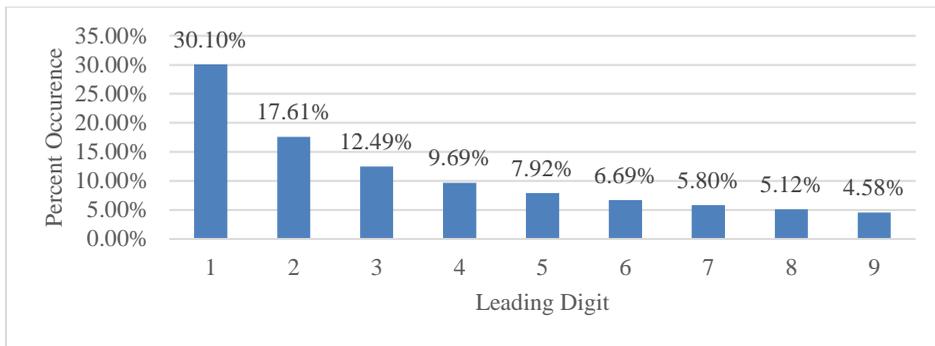


Figure 1. The First Digit Probability Distribution of Benford's Law

Studies in the literature have verified that Benford's Law is able to detect effectively the digital distribution of data sets (Villas-Boas et al., 2017). Numerous scholars are committed to enhancing the completeness of Benford's theoretical foundation and reinforcing its detection validity (Amiram et al., 2015; Hill, 1995a; Hill & Schurger, 2004; Nigrini & Mittermaier, 1997; Pinkham, 1961). Amiram et al. (2015) constructed a new model for assessing financial information quality, based on the theory of Benford's Law and the characteristics of digit numbers naturally emerging in financial statements. Their model used numerical analysis and simulation analysis to detect the data set of financial reports. They found that certain errors in the financial statements would amplify the deviation of the digital distribution from the theoretical distribution. Actually, this deviation provides evidence to detect the quality of financial reports.

Using mean absolute deviation (MAD), Amiram et al. (2015) built a model of financial statement deviation (FSD) and have demonstrated that the FSD model can remedy the fundamental defects of the accrual model (DA) in the detection of financial reporting quality. With the FSD model, it is not necessary to use time series or cross-sectional data for estimation, nor is it necessary to use error terms to predict the level of model residuals. The theoretical presupposition of FSD is not involved in the underlying characteristics of the business or its business model. FSD measurement does not require the use of prior ($t-1$) information and future realizations of cash flows (Dechow & Dichev, 2002). Also, there is no need to use returns or price information and no need to identify incentives of earnings management for management (Beneish, 1999; Dechow & Skinner, 2000). Furthermore, its use has nothing to do with the size of a business. The FSD model can therefore be applied to detect financial reporting quality for various businesses.

3. HYPOTHESES AND RESEARCH METHODOLOGY

This section posits the two hypotheses of this study, discusses our test of the hypotheses, and presents the relevant data.

3.1. Hypotheses

When the objectives of business executives are not in conformity with their company's expectations, a conflict of interest can arise between the executives and the shareholders. This conflict not only produces agency problems (Jensen & Meckling, 1976), but also lessens the corporate governance efficacy of the firm. The corporate governance of weak firms leads to poor business performance and induces managers to implement earnings management (Core et al., 1999), thereby impairing financial reporting quality.

Numerous studies have explored the impact of corporate governance mechanisms on the quality of earnings information. Klein (2002) and Cornett et al. (2009), for example, examined the impact of the independence of the audit committee and the board of directors. Xie et al. (2003) looked at the expertise of members of the board of directors. Leuz et al. (2003) considered investor-protection mechanisms. Peasnel et al. (2005) explored external directors. Cornett et al. (2008) looked at ownership and outside directors for institutional investors. Carey and Simnett (2006) and Frankel et al. (2002) considered characteristics for the appointment of accountants. All of these studies concluded that high corporate governance efficacy resulted in low earnings management, thereby enhancing financial reporting quality.

Kirkpatrick (2009) and Aebi et al. (2012) confirmed that the primary cause of the GFC stemmed from poor corporate governance. Claessens and Yurtoaglu (2013) found that the majority of Taiwan companies had suffered from corporate governance inefficiencies in the long term. Consequently, the Taiwan government accelerated efforts to implement a series of reforms in corporate governance, particularly after the GFC, in order to improve the efficiency of capital markets and to enhance corporate governance efficacy among firms. For instance, in 2010, regulations stipulated that a public-listed company should establish a payroll remuneration committee. In 2013, important policies proposed by the Taiwan authorities called for improvement of a company's internal control system, establishment of an independent director system, reinforcement of the information disclosure system, and promotion of corporate governance concepts and their importance.

A key purpose of the current study is to verify whether implementation of the relevant regulations has indeed motivated enterprises in Taiwan to improve their financial information quality. As a result of the efforts of Taiwan authorities after the GFC, we expect that Taiwan-listed companies have enhanced their financial reporting quality. We therefore posit this hypothesis:

H1: *The majority of the firms in Taiwan have a financial reporting quality that is better after the GFC than before the GFC.*

Klein (2002) found that, as management exerts less earnings manipulation, the quality of the financial statements becomes higher. Doyle et al. (2007b) found that, if there are significant faults in a firm's corporate governance (e.g., the board's abuse of power or an inefficient internal control mechanism), the quality of earnings information for the firm would be damaged. They argued that a firm's sound corporate governance mechanism would result in a higher quality of earnings information for the firm. Chan and Li (2008) revealed that companies with corporate governance deficiencies have higher discretionary accruals than those with corporate governance soundness. This finding suggests that firms with poor corporate governance efficacy are more likely to implement earnings management. Beneish et al. (2008) also confirmed that companies that lack corporate governance efficacy cause the earnings information to be unstable, thus leading to lower quality in their financial statements.

These studies concluded that a firm's weak governance mechanism leads to poor financial statements quality. In the current study, we expect that those firms with low corporate governance efficacy would be less likely to improve their financial information quality after the GFC. We therefore posit this hypothesis:

H2: *The financial reporting quality of those firms with weak corporate governance efficacy shows no difference between before and after the GFC.*

3.2. Test of the Hypotheses

In this study, we used a method of digital analysis proposed by Amiram et al. (2015) to measure the quality of accounting information. The measure detects the distribution of a firm's financial statement numbers, and then identifies the deviation of the first digit distribution and Benford's distribution. This distribution states that the expected probability and/or the frequency of the first digit in a number set can be evaluated by the following expression:

$$prob(a \text{ is the first digit}) = \log_{10}(a + 1) - \log_{10}(a) \quad (1)$$

Equation (1) presents the theoretical distribution of what is now commonly referred to as Benford's Law, or the expected frequency of the first digits 1 through 9. The distribution resulting from the equation is shown in Table 1.

Table 1
Expected Frequency Occurrences for Digit in the First Places

1	2	3	4	5	6	7	8	9
0.301	0.1761	0.1249	0.0969	0.0792	0.0669	0.058	0.0512	0.0458

Amiram et al. (2015) constructed the FSD score based on the mean absolute deviation (named FSD_MAD):

$$FSD_MAD = \frac{\sum_{d=1}^9 ABS[(\sum_{n=-\infty}^{\infty} \int_{n+\log(d)}^{n+\log(d+1)} PDF(\log(N))dN - (\log(d+1) - \log(d))]}{9} \quad (2)$$

In Equation (2), the integration, the area under the curve of a probability density function (PDF), represents the possibility that FSD numbers drawn from this distribution will be in the range from the first digit 1 to the first digit 9. If the FSD_MAD measure is in the uniform and the log-normal distribution's PDF, the FSD score above is equal to 0. This arises because these distributions are smooth and symmetric. The probability that a number extracted from any of these distributions starts off digit d is $\log(d+1) - \log(d)$, based on Benford's distribution. Hence, for each first digit d, the probability captured by the FSD score does not deviate from Benford's Law and makes the mean of the absolute deviation equal to 0.

In terms of no determined critical values in the MAD to test the distribution, Nigrini (2012) contended that, when using the MAD statistic in very large samples, a value of 0.006 or lower can be considered in compliance with Benford's Law. Moreover, in order to examine the individual firm-year conformity to Benford's Law, the measuring method of the FSD score is constructed on the Kolmogorov-Smirnov (KS) statistic (called FSD_KS). FSD_KS is generated by the estimation of maximum deviation, which is an accumulative difference between the sample

distribution and Benford's distribution from numbers 1 to 9. The KS statistic can be calculated as follows:

$$\begin{aligned}
 \text{FSD_KS} &= \text{Max} \left| \sum_{i=1}^k AD_i - ED_i \right| \\
 &= \text{Max} \left\{ |AD_1 - ED_1|, |(AD_1 + AD_2) - (ED_1 + ED_2)|, \dots, \right. \\
 &\quad \left. |(AD_1 + AD_2 + \dots + AD_9) - (ED_1 + ED_2 + \dots + ED_9)| \right\} \\
 \text{R.R.} &= \left\{ KS \geq KS_{\alpha/2, N} \right\}
 \end{aligned}
 \tag{3}$$

where AD (actual distribution) is the empirical frequency of the number; ED (expected distribution) is the theoretical frequency expected by Benford's distribution; and K is the number of leading digits being analyzed (K=9).

To test the conformity to Benford's distribution at the 5% level based on the KS statistic, the test value is calculated as $1.36/\sqrt{P}$, where P is the total number of first digits used. Nigrini (2011) argued that the KS statistic can be implemented to examine the conformity of the empirical distribution to Benford's distribution. Amiram et al. (2015) contended that Benford's Law is a leading indicator of assessing the quality of financial statements and confirmed that the law does have a sound theoretical basis in detecting financial reporting quality.

The prime property of Benford's Law is to probe the datasets that emerge in a natural situation and to recognize fraudulent earnings by searching for outliers by means of the entire sample data. This characteristic is a primary difference between Benford's Law and econometric models. The existence of outliers would impact the investigating consequences of econometric models, particularly for normal distribution-based tests. Regularly, in econometric exams, the outliers have to be removed from the fitted data. In contrast, the information regarding these outliers can supply Benford's Law with a further detection of the justifiability of the sample data and thus reinforce the effectiveness of the law in the evaluation of deviations.

3.3. Data Analysis

In this study, the sample data set originates from the *Taiwan Economic Journal* (TEJ) database for the years 2001 to 2015 and includes the financial statements of firms publicly listed on the Taiwan Stock Exchange (TWSE), excluding financial industry companies. To determine whether financial information quality does change between before and after the GFC during the period 2007-2008, we divided all sample firms into two groups: sound corporate

governance firms (SCGFs) and weak corporate governance firms (WCGFs),

Huang et al. (2015) argued that, in Taiwan, the top executive's unreasonably high compensation suggests that the firm's directors would be more likely to collaborate with top managers to exert earnings management. This finding implies that weak corporate governance efficacy leads to poor financial reporting quality. Thus, sample firms with poor corporate governance were selected from those companies that had been warned by Taiwan's authorities at the Public Information Observatory, since those companies suffered from substantial losses while their directors' and supervisors' compensation was still increasing. Table 2 shows that 2,279 (32%) of the companies had poor corporate governance before the GFC (2002-2006), whereas 2,866 (27%) had poor corporate governance after the GFC (2009-2015).

Table 2
Sample Selection of Firms in Taiwan with Poor Corporate Governance

	Overall	SCGFs	WCGFs
Firm-Year Observations 2001–2006	7,220 (100%)	4,941 (68%)	2,279 (32%)
Firm-Year Observations 2009–2015	10,383 (100%)	7,517 (73%)	2,866 (27%)

4. EMPIRICAL RESULTS

This section presents the empirical results of the current study with regard to conformity to Benford's Law and the results of the hypotheses tests.

4.1. Conformity to Benford's Law

Table 3 – which includes four panels, A through D – presents information on individual firm-year consistency with Benford's Law. Nigrini (2011) argued that the KS statistic can be applied to investigate the conformity of the sample distribution to Benford's distribution. Here, we used the statistics of the FSD_KS to identify whether the financial reports for a specific firm-year comply with the law. Our results (Panel A) show that 85.27% of the 20,298 firm-years in the sample comply with the law at the 5% level.

As indicated in Panel B, 89.43% of firm-year balance sheets, 77.75% of income statements, and 87.69% of cash flow statements were in line with the law. These data suggest that, when compared with balance sheets and cash flow statements, the consolidated income statements in the accounting information

could be subject to more manipulation. In Panel C, the data show that the conformity figures for all the years were between 82.88 and 87.89%. In Panel D, the data indicate a minimum conformity of 72.92% for all firms in a specific industry and a maximum conformity of 94.07%. These findings indicate that heterogeneous financial reporting quality may be caused by the different characteristics of the industries.

Table 3
Firm-Year Conformity to Benford's Law

Panel A: Conformity Test by Aggregate			
Analysis Year	Firm-Year Observations	FSD_KS Conformed (%)	
2001~2015	20,298	85.27%	

Panel B: Conformity Test by Financial Statement			
Financial Statement	Number of Accounts	Number of Firm-Year Observations	FSD_KS Conformed (%)
Balance Sheet	63	20,298	89.43%
Income Statement	48	20,298	77.75%
Cash Flow Statement	49	20,298	87.69%

Panel C: Conformity Test by Fiscal Year		
Fiscal Year	Number of Firm-Year Observations	FSD_KS Conformed (%)
2001	1115	83.29%
2002	1167	83.12%
2003	1198	83.41%
2004	1229	84.83%
2005	1246	82.88%
2006	1274	84.97%
2009	1402	87.89%
2010	1445	86.89%
2011	1469	85.99%
2012	1496	87.77%
2013	1512	85.37%
2014	1512	84.77%
2015	1534	86.22%

Panel D: Conformity Test by Industry			
Industry	Number of Firm-Year Observations	FSD_KS(5%) Conformed (N)	FSD_KS (5%) Conformed (%)
Cement	112	100	89.29%
Food	405	354	87.41%
Plastic	417	370	88.73%
Textile	873	771	88.32%
Electrical Machinery	1259	1120	88.96%
Electrical Cable	253	238	94.07%
Glass and Ceramic	72	67	93.06%
Paper	112	99	88.39%
Iron	659	589	89.38%
Rubber	182	162	89.01%
Automotive	103	93	90.29%
Construction	1026	886	86.35%
Shipping	380	311	81.84%
Tourism	356	298	83.71%
Trade Department Store	393	348	88.55%
Others	1231	1083	87.98%
Chemical	617	547	88.65%
Biotechnology Medical	1064	917	86.18%
Oil and Gas	192	140	72.92%
Semiconductor	1861	1626	87.37%
Computer Peripheral	1537	1335	86.86%
Optoelectronics	1558	1345	86.33%
Communication Network	1190	1020	85.71%
Electronic Components	3040	2665	87.66%
Electronic Access	555	497	89.55%
Information Services	464	396	85.34%
Other Electronics	1087	946	87.03%

4.2. Results of Hypotheses Test

For Hypothesis 1, we divided the samples into two groups (before the GFC and after the GFC) and then calculated their FSD_MAD. The larger the value of the FSD_MAD, the worse the quality of the financial statements, because the company's financial data provided a greater deviation from Benford's distribution. Panel A in Table 4 indicates that, before the GFC, the FSD_MAD of the financial statements provided by the whole listed companies in Taiwan was 0.00057, and that, after the GFC, it was 0.00047 – for a difference of -0.0001. The t-Stat ($t = -4.652$, $pr = 0.000$) showed that the financial reporting quality between before and

after the GFC had a negative effect at a significance level of 1%. This empirical result was in line with our expectations that, after the reforms in Taiwan's financial markets, the financial reporting quality of firms was significantly improved so as to decrease the FSD_MAD score. Therefore, Hypothesis 1 of this study is supported.

Table 4
Comparison of the Financial Reporting Quality

Panel A: Comparison Before and After the GFC				
	Before the GFC (2001~2006)	After the GFC (2009~2015)	Difference	T-Stat.
FSD_MAD	(N=7,220) 0.00057	(N=10,383) 0.00047	-0.0001	-4.652(pr=0.000)***
Panel B: Comparison of Corporate Governance Efficacy Before and After the GFC				
	Before the GFC (2001~2006)	After the GFC (2009~2015)	Difference	T-Stat.
SCGFs	(N=4,941) 0.00079	(N=7,517) 0.00046	- 0.00033	-3.4707(pr=0.000)***
WCGFs	(N=2,279) 0.00071	(N=2,866) 0.00099	0.00028	2.8098(pr=0.00028)***

Note: ***, ** and * mean significance at 1%, 5% and 10% levels, respectively.

To test Hypothesis 2, we detected the time-breakpoint and also categorized all sample firms into either the SCGFs or the WCGFs group in order to examine the impact of corporate governance on the quality of financial statements. The empirical results shown as Panel B in Table 4 above indicate that, for firms with sound corporate governance, the FSD score was 0.00079 before the GFC and 0.00046 after the GFC. The difference was -0.00033. The t-Stat ($t=-3.4707$, $pr=0.000$) indicates that financial reporting quality before and after the GFC had a negative effect at a significance level of 1%. This suggests that a sound corporate governance mechanism will enable those firms to enhance their financial statements quality.

In contrast, for firms with poor corporate governance, the FSD score was 0.00071 before the GFC and 0.00099 after the GFC. The difference was 0.00028. The t-Stat ($t=2.8098$, $pr=0.002$) demonstrates that financial reporting quality before and after the GFC had a positive effect at a significance level of 1%. This finding implies that a weak corporate governance mechanism considerably

lessened financial reporting quality after the GFC. This empirical result supports Hypothesis 2 of this study and indicates that the regulations and laws alone were unable to enhance the financial statements quality of those firms with weak corporate governance.

Although the quality of individual industries in Taiwan conforms to Benford's Law, the extent of the conformity is distinctive. The data indicate that the GFC indeed had a significant impact on industries in the industrial, financial, and insurance sectors in Taiwan, as well as industries specializing in plastics, steel, cement, shipping, and export-oriented information electronic products.

We analyzed the group with weak corporate governance, by industry, to determine whether financial reporting quality in various industries has been changed relative to before and after the GFC. Table 5 shows that, after the GFC, the majority of Taiwan's industries have not improved their financial reporting quality. Five industries, however, had significant improvements in financial reporting quality; namely, paper ($t=-2.2074$), trade department store ($t=-1.6799$), biotechnology medical ($t=-2.2074$), optoelectronics ($t=-2.3747$), and the communication network industry ($t=-2.3853$). The empirical results verify that firms with a weak corporate governance mechanism were unable to significantly reinforce their financial reporting quality.

5. SUMMARY AND CONCLUSIONS

The issue of poor corporate governance by firms, which leads to impaired financial reporting quality, has been of major concern for governments, investors, and researchers. Numerous scholars have found that the major cause of the GFC in 2007-2008 stemmed from poor corporate governance. The current study used the GFC as a breakpoint to examine the impact of changes in the global financial environment on corporate governance efficacy and the quality of financial reports.

This study followed the FSD model constructed by Amiram et al. (2015) to measure the financial reporting quality of companies in Taiwan and to verify the impact of the firms' corporate governance efficacy on improvement in financial reporting quality in terms of before and after the GFC. The empirical results show that the financial reporting quality of companies in Taiwan has, overall, had a significant improvement, thus supporting Hypothesis 1.

Table 5
Analysis of Financial Reporting Quality, by Industry

Industry	2001~2006 FSD_MAD	2009~2015 FSD_MAD	Difference	T-Stat.
Cement	0.01944	0.01733	- 0.00211	- 0.2912
Food	0.00878	0.00688	- 0.00190	0.0286
Plastic	0.00762	0.00842	0.00080	0.4611
Textile	0.00270	0.00367	0.00097	0.7078
Electrical Machinery	0.00497	0.00409	- 0.00088	0.1034
Electrical Cable	0.00564	0.00348	- 0.00216	0.5318
Glass and Ceramic	0.01992	0.01364	- 0.00628	0.0381
Paper	0.01130	0.00797	- 0.00333	- 2.2074**
Iron	0.00414	0.00627	0.00213	1.8500**
Rubber	0.01176	0.01557	0.00381	- 0.4611
Automotive	0.01265	0.01268	0.00003	1.1165
Construction	0.00437	0.00387	- 0.00050	1.4483*
Shipping	0.00528	0.00827	0.00299	- 0.3997
Tourism	0.00556	0.00165	- 0.00391	0.3297
Trade Department Store	0.00500	0.00422	- 0.00078	- 1.6799**
Others	0.00248	0.00426	0.00178	0.1522
Chemical	0.00595	0.00702	0.00107	0.4131
Biotechnology Medical	0.00506	0.00335	- 0.00171	-2.3747***
Semiconductor	0.00198	0.00207	0.00009	0.1779
Computer Peripheral	0.00146	0.00331	0.00185	0.2781
Optoelectronics	0.00170	0.00150	- 0.00020	- 1.9361**
Communication Network	0.00328	0.00150	- 0.00178	- 2.3853***
Electronic Components	0.00202	0.00174	- 0.00028	- 0.9040
Electronic Access	0.00658	0.00378	- 0.00280	1.0097

Note: ***, ** and * mean significance at 1%, 5% and 10% levels, respectively.

In addition, to explore whether the degree of corporate governance efficacy would affect financial reporting quality relative to before and after the GFC, we divided the sample firms into two groups (those with sound corporate governance and those with poor corporate governance). The test results show that the financial reporting quality of firms with strong corporate governance has improved significantly, whereas the financial reporting quality of firms with weak corporate

governance has not improved, and may have even worsened. The results are consistent with our expectations; therefore, Hypothesis 2 is also supported.

Our results are similar to those of Doyle et al. (2007a). Their conclusion stated that firms with certain major corporate governance problems will have poor earnings quality. The empirical evidence of Kam et al. (2008) also demonstrated that, for companies with weak corporate governance, the degree of abnormal accruals is higher than that of firms with strong corporate governance.

We also confirm that the soundness or weakness of a firm's corporate governance indeed has an impact on its financial reporting quality. We found that, although firms suffered from the same GFC, the extent of impairment caused by the GFC was different for different firms, depending on their corporate governance mechanism. Although all firms face the same regulatory and financial environment, companies with a different extent of impairment would require a different recovery period. The extent of improvement needed would also be affected by varied industrial characteristics and the distinct strengths of corporate governance. This paper confirms that companies with poor corporate governance have not made significant progress in the improvement of corporate governance efficacy or in the improvement of financial reporting quality after the GFC.

In practice, the majority of financial frauds in enterprises is caused by the failure of their corporate governance mechanism. Weak corporate governance efficacy results in poor transparency of financial information and significant impairment of financial reporting quality.

Our findings may well provide evidence that will motivate legislative authorities and investors to re-examine whether the Taiwan authorities have created a suitable environment for corporate governance – one that would enhance financial reporting quality and reinforce inhibition against earnings manipulation.

This paper examined the impact of corporate governance efficacy on financial reporting quality and adopted a holistic corporate governance for firms. A future study could investigate the impact of corporate governance efficacy for an individual firm on its financial reporting quality.

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