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Benford's Law and Earnings Management Detection: The Case of REITs

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Introduction

A mathematical property, which has become known as Benford's Law, was discovered independently by Newcomb (1881) and Benford (1938). Benford's Law holds that, contrary to intuition, the digits in large sets of positive-valued, naturally occurring numbers that range over many orders of scale are not uniformly distributed. Instead, they often (but not always) follow a logarithmic distribution such that numbers beginning with smaller digits appear more frequently than those beginning with larger ones. Because manipulated, unrelated, or created numbers usually do not follow a Benford distribution, Benford's Law has been used to identify suspicious data in a variety of settings. Financial auditors, for example, routinely check individual firm data for compliance with Benford's Law (Kumar and Bhattacharya, 2007), and researchers have used Benford's Law to investigate whether financial data has been manipulated for a group of firms or an entire industry.

A growing body of empirical evidence suggests that data omissions, errors, biases, misstatements, or fraud may be a possibility when data deviates from the Benford distribution. Not everyone, however, is convinced of the power of Benford's Law to detect suspicious data. Diekmann and Jann (2010), for example, assert that it is doubtful that Benford tests are necessarily an appropriate tool to discriminate between manipulated and nonmanipulated data and may produce false positives (i.e., incorrectly indicate a data set contains manipulated data). Others suggest that Benford tests may result in false negatives (i.e., fail to indicate a problem when the data set contains manipulated data). Varian (1972), for example, opined that a data sets' conformity with Benford's Law does not necessarily imply authenticity.

Researchers have employed other statistical tests and concluded that earnings management has occurred routinely in American corporations in general and REITs in particular.[1] The purpose of this study is to determine whether or not recent REIT earnings data conforms to a Benford's distribution. Quarterly net income collected for the years 2009 through 2014 for equity and mortgage REITs listed on either the NYSE or NASDAQ is evaluated by calculating and analyzing the Mean Absolute Deviation of both the first and second digits of REIT net income. For the entire sample, the results indicate that the data conforms to Benford's Law. This result is consistent with one of the following possibilities: 1) REITs no longer systematically manage earnings; or 2) the Benford test provides a false negative for the industry. When the sample is bifurcated by REIT classification (equity vs. mortgage), or by the exchange on which the REITs' shares are traded, nonconformance with Benford's Law is detected. This finding is consistent with another issue critics of Benford's Law find troublesome.

The remainder of this article is organized as follows. In the next section, a brief explanation of Benford's Law is presented. The third section contains a literature review. The data and methodology are presented in the fourth section, and the results are presented in the fifth section. The last section contains a summary and our conclusions.

Benford's Law

According to Benford's Law the expected occurrence, or proportion, of a given number (a) as the first digit in a number set (P_{1a}) can be calculated using equation (1).

$$P_{1a} = \log_{10}(a + 1) - \log_{10}(a) \qquad (1)$$

Further, the expected proportion of a given number (a) as the first digit and the number (b) as the second digit (P_{1a2b}) can be calculated using equation (2).

$$P_{1a2b} = \log_{10}\left(a + \frac{b+1}{10}\right) - \log_{10}\left(a + \frac{b}{10}\right) \qquad (2)$$

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And equation (3), which sums equation (2) over all possible a values for a particular b value yields an overall expected proportion for b as the second digit.

$$P_{1a2b} = \sum_{a=1}^{9} \left(log_{10}\left(a + \frac{b+1}{10}\right) - log_{10}\left(a + \frac{b}{10}\right)\right) \qquad (3)$$

The expected proportion of each number in the third, and all subsequent, digits can be similarly derived. Table I shows the proportion of each number in the first through fourth digits as predicted by Bedford's Law. Note that the proportions shown in Table I are skewed towards one for the first digit (because zero cannot be a first digit) and towards zero for subsequent digits.

Table I: Expected Proportions Based on Benford's Law

Number	1st digit	2nd digit	3rd digit	4th digit
0	.11968	.10178	.10018	
1	.30103	.11389	.10138	.10014
2	.17609	.10882	.10097	.10010
3	.12494	.10433	.10057	.10006
4	.09691	.10031	.10018	.10002
5	.07918	.09668	.09979	.09998
6	.06695	.09337	.09940	.09994
7	.05799	.09035	.09902	.09990
8	.05115	.08757	.09864	.09986
9	.04576	.08500	.09827	.09982

Source: Nigrini (1996)

Literature Review

Benford's Law

A mathematical discovery made by Simon Newcomb (1881) was ignored for nearly six decades until Benford (1938) rediscovered it, and for another six decades after its rediscovery published empirical applications of Benford's Law were sparse. In recent years, however, empirical studies have mushroomed. A variety of data has been shown to follow a Benford distribution including, among others, aggregated data reported to American (Nigrini, 1996) and Italian (Mir, et al, 2014) taxing agencies, prices in various stock markets (Ley, 1996) and eBay auctions (Giles 2007).[2]

Financial auditors now routinely check data for compliance with Benford's Law.[3] For example, McGinty (2014) relates the results an audit of a national call center. Several hundred call center operators were authorized to issue refunds up to fifty dollars (anything larger required the permission of a supervisor), and each operator had processed more than 10,000 refunds over several years. Auditors decided to check whether the first digit of each operator's refunds was consistent with Benford's Law. For most operators, no discrepancy was discovered, but for a small group there was a large spike in the four categories indicating that many refunds just below the fifty-dollar threshold were being issued. Further investigation revealed that these operators had issued thousands of dollars in fraudulent refunds to themselves, family, and friends.

Deviations from a Benford distribution are not necessarily a result of fraud. McGinty (2014a) describes another case in which auditors ran a Benford test on three types of a client's expense accounts. Two ended up exactly as predicted by Benford's Law. For the third, auto and truck expenses, nine's were overrepresented, and one's were underrepresented. Further investigation, however, indicated the discrepancies were not fraudulent as many employees were simply following company policy, which allowed them to expense gas purchases and to combine expenses if the combined amount did not exceed $100. The price of a tank of gas had effectively eliminated one's from the equation, and combining expenses increased the frequency of nine's.

Because Benford's Law works best with large data sets, many researchers using Benford's Law to analyze the private sector use data from an entire industry or groups of companies rather than focusing on a particular company; a procedure followed in the present study. Some of these studies report small irregularities or data that conformed to the Bedford distribution. Alali and Romero (2013) conducted tests on a variety of accounts from financial statements of American banks that failed between October 2000 and February 2012. First, they compared the distribution of the first digit in the accounts to Benford's theoretical distribution. They also computed what Nigrini (1996) coined the distortion factor model which equals the difference in the mean of the observed first two digits compared to the expected mean according to Benford's Law. They report no significant anomalies.

Özer and Babacan (2013) examine the first digit in annual off-balance sheet disclosures of Turkish Banks over the period 1990–2010 and report significant deviations between the distribution of the reported numbers and a Benford distribution for only one year: 1999. Gava and Vitiello (2014) compared the distribution of the first digit of asset accounts for fourteen Brazilian companies over the time period 1986 through 2009 to the Benford distribution. Their study period contained periods of high and low inflation, and they found that the data from the low-inflation period fit better to Benford's Law than data from the high-inflation period, and suggest that high inflation increases the possibility of fraud.

Other researchers report suspicious data. Johnson (2009) used Benford's Law to analyze the first digit of quarterly net income and earnings per share data for twenty-four randomly selected publicly traded American companies for fiscal years 1999 through 2004 to identify firm characteristics that may be associated with earnings management. He identified several firm characteristics where earnings management appeared possible because the earnings distributions were inconsistent with Benford's Law, including companies with low capitalization (below forty-five billion dollars), companies with higher levels of inside trading (three percent and higher), and three companies that have been publicly traded for less than twenty-five years. Hsieh and Lin (2013) analyzed the second digit of quarterly net income reported by 8,817 firms in the U.S. marine industry between the first quarter of 1980 and the first quarter of 2009. Finding significantly more zeros in the second digit than would be expected in a Benford distribution, they conclude that managers in the industry engage in managing earnings through rounding earnings numbers to achieve key reference points.

Several researchers have used Benford's Law to scrutinize government entities. Michalski and Stoltz (2013) analyzed data from 1989 through 2007, and they concluded that some countries strategically provide manipulated financial data to economic agents. They observed non-Benford distributions for the first digits of data issued by groups of countries that are more vulnerable to high capital outflows, have fixed exchange rate regimes, have the highest levels of net indebtedness, and those that were running current account deficits. In addition, they report rejection of the Benford distribution for the first digits of the balance of payments statistics for euro-adopting countries after these countries joined the euro zone.

Johnson and Weggenmann (2013) subjected the first digits in a small set of American state government data to Benford's Law. The accounts for each of the fifty states examined were: 1) total general revenues of the primary government; 2) total fund balance of the general fund; and 3) total fund balance of governmental funds; all of which are often used as benchmarks in financial analysis. Most authorities (e.g., Durtschi, et al., [2004]) agree that Benford's Law is most effective when applied to large data sets, but in the Johnson and Weggenmann study, only three (unidentified) years of data were collected, yielding 150 data points for each state/balance. The authors report distributions in conformity with Benford's Law for the first two accounts, but nonconformity for the total fund balance of governmental funds.

de Freitas Costa, et al., (2012) analyzed 134,281 contracts issued by twenty management units in two Brazilian states and discovered significant deviations in the distribution of the first and second digits from the distribution predicted by Benford's Law. The first digit of the contract data contained an excess amount of the numbers seven and eight, while nine and six were rare occurrences, which the authors assert denoted a tendency to avoid conducting the bidding process. Analysis of the second digit revealed a significant excess of the numbers zero and five, which is indicative of rounding being used in determining the value of contracts.

Given recent events, it is interesting to note that Müller (2011) used Benford's Law to conclude that the macroeconomic data the Greek government reported to the European Union before entering the Eurozone was probably fraudulent, albeit years after the country joined.

REIT Earnings Management

REITs provide an interesting venue for the study of earnings management. Like firms in other industries, REITs can manage earnings through accruals earnings management and/or by real activities earnings management. Accruals earnings management is accomplished by choosing different accounting methods (e.g., depreciation), which do not alter the REITs' economic activities nor have any direct cash flow consequences, to disguise true profitability. Real activities earnings management occurs when REITs depart from normal operational practices with the intent to mislead at least some stakeholders into believing certain financial goals have been met in the normal course of operations. Manipulation of real activities normally has direct cash flow consequences (e.g., cutting discretionary expenditures such as maintenance or selling real properties).

After analyzing data for over 8,000 nonfinancial firms in the Compustat annual industrial and research files for the period 1987–2005, Cohen et al., (2008) observed that accruals earnings management increased from 1987 until the Sarbanes-Oxley (SOX) legislation was enacted in 2002. Since then, they note that a decline in accrual earnings management that appears to have been accompanied by an increase in (harder to detect) real activities manipulation. This finding is consistent with the results presented by Zang (2011) who concludes that when a firm is subject to more regulatory scrutiny and/or its' financial reporting policies are more transparent, managers tend to substitute real activities management for accruals management.

Previous studies report that REITs have engaged in earnings management. One possible motivation for manipulating earnings is the desire to reduce the cost of obtaining external financing. If security issuers can increase reported earnings, they can improve the terms on which securities are sold to the public. A higher security price benefits the firm because, for a given issue size, the issuer receives more money, or for a given amount of new equity funding there will be less ownership dilution. Zhu et al., (2010) used regression analysis to analyze quarterly data including discretionary accruals and Funds from Operations (FFO) from 140 REITs over the period 2001 through 2006. They found that manipulation of both accruals and FFO occurred in their sample, with FFO being manipulated more, and up to three quarters prior to the financing. The authors also concluded that REITs with deteriorating cash flow and frequent SEO have more FFO manipulation. In addition, they report that REITs with lower external auditor quality and institutional holdings are more likely to engage in earnings management. Interestingly, they found FFO manipulation decreased over the study period as both the regulatory environment and corporate governance inside REITs strengthened. In contrast, no clear trend was discovered for management of discretionary accruals, and the effect of the SOX Act on earnings management was not obvious when only equity-issuing REITs were considered.

Other recent studies report additional evidence of REIT earnings management. Ben-Shahar et al., (2011) analyzed financial data from ninety-six REITs for the years 2001–2008. They conclude that FFO has superior information content because, unlike net income, FFO excludes depreciation, which their analysis indicated was subject to manipulation. Anglin, et al., (2013) analyzed data from sixty-eight equity REITs over the years 2004 through 2008. They found that corporate governance quality is unrelated to accruals earnings management and manipulation of FFO, but report significant, less visible, real activities manipulation for earnings management purposes.

Inflated earnings management is the more common issue investigated by researchers, but some REITs may be motivated to manipulate taxable income downward. REITs face strong binding constraints regarding the use of internal funds as the tax code specifies that to avoid Federal income tax, a REIT must pay out at least ninety percent of (what would be) taxable income as dividends. This constraint forces REITs to access external sources to fund capital investments, but a REIT can increase its retained earnings and lower its need for external funds by lowering taxable income. Empirical evidence of this practice is presented by Ambrose and Bian (2010) who employed regression analysis to investigate both accruals and real activities management using data from 104 REITs for the years 1999 through 2006. They concluded that REITs employ both types of earning-reducing manipulations to lower taxable income and the amount of dividends that must be paid to meet the regulatory requirement. Another motivation for REITs to manage earnings would be to smooth income during burgeoning real estate markets; although this motivation is untested to date.

Despite the relatively transparent reporting requirements faced by REITs, the studies described above indicate that earnings management has occurred with some regularity in the REIT industry. And this practice has continued since passage of the 2002 SOX Act. Note that all but one of the REIT studies mentioned above examined data that straddled passage of the SOX and one was limited to post SOX data. However, it seems plausible that detecting REIT industrywide earnings management with a Benford test may be problematic if some REITs are managing earnings downward while others are managing them upward.

Data and Methodology

REITs listed on either the New York Stock Exchange (NYSE) or NASDAQ were identified by examining the REIT Directory at NAREIT.com.[4] Data for each REIT was obtained from their unaudited quarterly Statements of Comprehensive Income contained in their 10-Q filings with the Securities and Exchange Commission for the years 2009 through 2014. The 183 REITs in our sample consist of 141 equity REITS and twenty-six mortgage REITs listed on the NYSE, as well as fourteen equity REITs and two mortgage REITs listed on NASDAQ.

Several measures of REIT operating performance might serve as the variable of interest in a Benford test. Because authorities (e.g., Phatarfod, 2013) have pointed out that goodness of fit tests tend to become insignificant with small samples, an important consideration in selecting a performance measure was that it would preserve observations. FFO is the industry standard in determining REIT profitability, but its value in this case is limited because it is not defined by generally accepted accounting principles (GAAP), and is not included in 10-Q filings.[5] Net operating income from continuing operations, and net income attributable to common shareholders are two other widely used REIT profitability measures.[6] Two problems with the former are: 1) that it is not defined by GAAP; and 2) its use here would preclude the inclusion of almost all mortgage REITs because they (and some equity REITs) do not report net operating income from continuing operations. Net income attributable to common shareholders is defined by GAAP, but its use would eliminate a substantial number of observations as many REITs do not report this measure in their quarterly reports. To overcome these difficulties, net income, which all REITs report, is used as our variable of interest.[7]

The 183 REITs in our sample present a potential 3,294 observations for study, but 360 observations were lost because some of the REITs were not in operation for the full study period. In addition, because accounting authorities (e.g., Nigrini, 2011) suggest that tests of Benford's Law should be conducted on either positive numbers or negative numbers, but not both in the same analysis, we elect to focus on positive valued observations, and, therefore, 686 observations with negative values were eliminated from the database. This reduced the number of observations in the final sample to 2,248. Following the precedent of previous researchers, we limit our investigation to the first and second digits of the variable of interest and strip the numbers in each of these places from each observation.

Using the entire sample, the proportion of all observations accounted for by each number in the first digit of net income was calculated and the distribution of these proportions was tested for goodness of fit to the Benford's distribution by calculating the sample distributions mean absolute deviation (MAD). The same methodology was then followed for the second digit. Drake and Nigrini (2000) assert that MAD provides for a more precise analysis than simply examining the individual differences in the sample distribution with Benford's distribution. MAD is defined by Equation (4) as:

$$MAD = \frac{1}{N} \sum_{i=1}^{N} |x_i - \bar{x}| \qquad (4)$$

where N is the total possible numbers that may occur as the digit of interest (i.e., nine for the first digit and ten for the second and all subsequent digits), x_i is the proportion of the sample accounted for by each number (*i*) in N, and $\bar{x}$ is proportion of the sample that *i* should represent according to Benford's Law. The critical values in Table II were developed by Drake and Nigrini (2000) to assess how well a sample distribution fits the Benford distribution for first and second digits using MAD.

Finally, to observe the effect of reduced sample size on the level of conformity with a Benford's distribution, the above described methodology is applied to subsamples of the data. For this purpose, the data was arbitrarily grouped based upon: 1) where the REIT shares are traded; and 2) whether the REIT is classified as an equity or mortgage REIT.

Table II: Mean Absolute Deviation Critical Values for First and Second Digits

Goodness of Fit	First Digit	Second Digit
Close Conformity	0.000 – 0.004	0.000 – 0.008
Acceptable Conformity	0.004 – 0.008	0.008 – 0.012
Marginally Acceptable Conformity	0.008 – 0.012	0.012 – 0.016
Nonconformity	> 0.012	> 0.016

Source: Drake and Nigrini (2000)

Results

Comparison of the Mean Absolute Deviations for the full sample, shown on the last line of Table III, with the critical MAD values presented in Table II indicates that the distribution of the first digit of REIT quarterly net income is in marginally acceptable conformity with Benford's Law, while the second digit is in close conformity.

Table III: Mean Absolute Deviation: Full Sample

	1st Digit				2nd Digit			
Number	# of Obs.	% of Obs.	Predicted Proportion	Absolute Difference	# of Obs.	% of Obs.	Predicted Proportion	Absolute Difference
0					270	0.12011	0.11968	0.00043
1	660	0.29359	0.30103	0.00744	266	0.11833	0.11389	0.00444
2	429	0.19084	0.17609	0.01475	235	0.10454	0.10882	0.00428
3	289	0.12856	0.12494	0.00362	248	0.11032	0.10433	0.00599
4	245	0.10899	0.09691	0.01208	229	0.10187	0.10031	0.00156
5	197	0.08763	0.07918	0.00845	224	0.09964	0.09668	0.00296
6	123	0.05472	0.06695	0.01223	212	0.09431	0.09337	0.00094
7	113	0.05027	0.05799	0.00772	205	0.09119	0.09035	0.00084
8	113	0.05027	0.05115	0.00088	174	0.0774	0.08757	0.01017
9	79	0.03514	0.04576	0.01062	185	0.0823	0.08500	0.00270
Total	2248	1.00000	1.00000	0.07779	2248	1.0000	1.0000	0.03431
MAD				0.00864				0.00343

Comparison of the MAD values shown in the upper panels of Table IV and V with the critical values shown in Table II will reveal similar results were discovered for REITS traded on the NYSE and those classified as an equity REIT (i.e., marginally acceptable conformity for the first digit and close conformity for the second digit). Comparison of the MAD values shown in the lower panel of Table IV with the critical values shown in Table II indicates that while the distribution of the second digit of net income for REITs traded on the NASDAQ system are in close conformity with Benford's Law, the first digit is in nonconformity. Finally, comparison of the MAD values shown in the lower panel of Table V with the critical values shown in Table II indicates that the distribution of the second digit of net income for mortgage REITs are in marginally acceptable conformity with Benford's Law, but the distribution of the first digit for these REITs is in nonconformity.

Table IV: Mean Absolute Deviation by Exchange Listing

NYSE REITs

	1st Digit				2nd Digit			
Number	# of Obs.	% of Obs.	Predicted Proportion	Absolute Difference	# of Obs.	% of Obs.	Predicted Proportion	Absolute Difference
0					249	0.11835	0.11968	0.00133
1	605	0.28755	0.30103	0.01348	254	0.12072	0.11389	0.00683
2	404	0.19202	0.17609	0.01593	215	0.10219	0.10882	0.00663
3	272	0.12928	0.12494	0.00434	234	0.11122	0.10433	0.00689
4	224	0.10646	0.09691	0.00955	215	0.10219	0.10031	0.00188
5	190	0.0903	0.07918	0.01112	208	0.09886	0.09668	0.00218

6	117	0.05561	0.06695	0.01134	202	0.09601	0.09337	0.00264
7	109	0.05181	0.05799	0.00618	190	0.09030	0.09035	0.00005
8	107	0.05086	0.05115	0.00029	162	0.07700	0.08757	0.01057
9	76	0.03612	0.04576	0.00964	175	0.08317	0.08500	0.00183
Total	2104	1.00000	1.00000	0.08188	2104	1.00000	1.00000	0.04082
MAD				0.00910				0.00408

NASDAQ REITs

		1st Digit				2nd Digit		
Number	# of Obs.	% of Obs.	Predicted Proportion	Absolute Difference	# of Obs.	% of Obs.	Predicted Proportion	Absolute Difference
0					21	0.14583	0.11968	0.02615
1	55	0.38194	0.30103	0.08091	12	0.08333	0.11389	0.03056
2	25	0.17361	0.17609	0.00248	20	0.13889	0.10882	0.03007
3	17	0.11806	0.12494	0.00688	14	0.09722	0.10433	0.00711
4	21	0.14583	0.09691	0.04892	14	0.09722	0.10031	0.00309
5	7	0.04861	0.07918	0.03057	16	0.11111	0.09668	0.01443
6	6	0.04167	0.06695	0.02528	10	0.06944	0.09337	0.02393
7	4	0.02778	0.05799	0.03021	15	0.10417	0.09035	0.01382
8	6	0.04167	0.05115	0.00948	12	0.08333	0.08757	0.00424
9	3	0.02083	0.04576	0.02493	10	0.06944	0.08500	0.01556
Total	144	1.00000	1.00000	0.25968	144	1.00000	1.00000	0.16894
MAD				0.02885				0.00169

Table V: Mean Absolute Deviation by REIT Classification

Equity REITs

		1st Digit				2nd Digit		
Number	# of Obs.	% of Obs.	Predicted Proportion	Absolute Difference	# of Obs.	% of Obs.	Predicted Proportion	Absolute Difference
0					229	0.11921	0.11968	0.00047
1	563	0.29308	0.30103	0.00795	238	0.12389	0.11389	0.01000
2	381	0.19833	0.17609	0.02224	191	0.09943	0.10882	0.00939
3	249	0.12962	0.12494	0.00468	206	0.10724	0.10433	0.00291
4	216	0.11244	0.09691	0.01553	190	0.09891	0.10031	0.00140
5	169	0.08798	0.07918	0.00880	201	0.10463	0.09668	0.00795
6	99	0.05154	0.06695	0.01541	186	0.09682	0.09337	0.00345
7	86	0.04477	0.05799	0.01322	176	0.09162	0.09035	-0.00127
8	88	0.04581	0.05115	0.00534	146	0.076	0.08757	0.01157

9	70	0.03644	0.04576	0.00932	158	0.08225	0.08500	0.00275
Total	1921	1.00000	1.00000	0.10250	1921	1.00000	1.00000	0.04863
MAD				0.01139				0.00486

Mortgage REITs

		1st Digit				2nd Digit		
Number	# of Obs.	% of Obs.	Predicted Proportion	Absolute Difference	# of Obs.	% of Obs.	Predicted Proportion	Absolute Difference
0					41	0.12538	0.11968	0.00570
1	97	0.29664	0.30103	0.00439	28	0.08563	0.11389	0.02826
2	48	0.14679	0.17609	0.02930	44	0.13456	0.10882	0.02574
3	40	0.12232	0.12494	0.00262	42	0.12844	0.10433	0.02411
4	29	0.08869	0.09691	0.00822	39	0.11927	0.10031	0.01896
5	28	0.08563	0.07918	0.00645	23	0.07034	0.09668	0.02634
6	24	0.07339	0.06695	0.00644	26	0.07951	0.09337	0.01386
7	27	0.08257	0.05799	0.02458	29	0.08869	0.09035	0.00166
8	25	0.07645	0.05115	0.02530	28	0.08563	0.08757	0.00194
9	9	0.02752	0.04576	0.01824	27	0.08257	0.08500	0.00243
Total	327	1.00000	1.00000	0.12555	327	1.00000	1.00000	0.14901
MAD				0.01395				0.01490

Summary and Conclusions

Benford’s Law holds that naturally occurring numbers tend to follow a logarithmic distribution such that numbers beginning with smaller digits appear more frequently than those beginning with larger ones. Manipulated data, on the other hand, does not usually conform to a Benford distribution. Thus, Benford’s Law has been used to identify suspicious data in a variety of settings. One researcher, for example, that analyzed the first digit of net income and earnings per share from a group of randomly selected American companies reported several characteristics that may be associated with earnings management. Another researcher analyzed the second digit of quarterly net income reported by firms in the U.S. marine industry and concluded that managers in the industry manage earnings through rounding earnings numbers to achieve key reference points. Neither of these issues is discovered for the full sample examined here even though previous studies indicate that earnings management has been commonplace within the REIT industry. Using a sample of 2,248 observations of unaudited quarterly net income collected from 183 REITs over the six-year period 2009 through 2014, it is discovered that the distribution of the first digit is in marginally acceptable conformity to the distribution predicted by Benford’s Law, while the distribution of the second digit closely conforms.

The above results are consistent with the possibility that REITs did not engage in earnings management during our study period, or that they reduced it to a level that was undetectable by a Benford test. The ability of REIT managers to practice earnings management may have been limited by additional scrutiny due to SOX, and a lack of balance sheet bloat as suggested by Copeland (1968). In addition, Strobl (2013) suggests that managers have lower incentives to engage in upward earnings manipulation during times when their performance cannot be explained by general market trends, which suggests that REITs may have limited earnings management during the sample period.

The above results are also consistent with the assertion of some critics that Benford’s Law lacks power as a diagnostic tool. Possibly, during the study period REITs employed a less detectable form of earnings management. This theory seems a real possibility if REITs continued the earlier trend noted by Cohen et al., (2008) of substituting real activities earnings management for accrual earnings management. Similarly, the observation of Zang (2011) that firms subject to more regulatory scrutiny tend to substitute real activities management for accruals management seems applicable in the post SOX era. Another factor that may cause the Benford test to result in a false negative is the possibility that the earnings management activities of some REITs offset the earnings management activities of others (i.e., while some REITS manage earnings upward to achieve certain financial objectives, others are managing earnings downward to conserve retained earnings or to smooth income.

Grouping the data based on the exchange on which the REIT's shares were traded provided results similar to those obtained for the full sample for the 2,104 observations from the NYSE, but for the 144 observations that occurred on the NASDAQ the distribution of the first digit did not conform to a Benford's distribution. Interestingly, the second digit was found to be in close conformity despite the fact that both zero's and five's were overrepresented (which previous studies have suggested is a sign that rounding may have occurred). When the data was grouped based upon REIT classification, the results for the 1,921 equity REITs were like those for the full sample, but for the 327 mortgage REITs, the distribution of the second digit conformed only marginally acceptable and the first digit did not conform to a Benford distribution. Whether the poor first-digit conformity for mortgage REITs and those traded on the NASDAQ is a true indication of suspicious data is debatable, however, because of the relatively small number of observations for both groups. Even supporters of Benford's Law acknowledge that the level of conformity to a Benford's distribution and sample size are positively related. Diekmann and Jann (2010), however, question this type of result and refer to it as a circularity problem; how can a sample that conforms to a Benford's distribution consist of subsamples that do not?

When employing Benford testing, financial auditors recommend focusing on an accounting measure that is subject to Generally Accepted Accounting Principles (GAAP) because they are concerned with discovering GAAP violations. Net income, which was the focus of our study, is subject to GAAP, but the industry standard of profitability in the REIT industry, FFO, is not. We believe that an interesting extension of this initial research would be to investigate whether tests of Benford's Law detect earnings management behavior by REIT managers on FFO.

Endnotes

1. Earnings management is the manipulation of accounting numbers within the scope of GAAP. Jackson and Pitman (2001) provide three definitions of earnings management: 1) the purposeful intervention in the external financial reporting process with the intent of obtaining some private gain; 2) an intentional structuring of reporting or production/investment decisions around the bottom line impact; and 3) the use of judgment in financial reporting and in structuring transactions to alter financial reports to either mislead some stakeholders about the underlying economic performance of the firm, or to influence contractual outcomes.

2. Nigrini (1996) results provide evidence that conformity with a Benford distribution does not guarantee problem-free data. He reported that aggregate data submitted on income tax returns to the United States Internal Revenue Service closely conformed to a Benford distribution, yet cases of tax evasion are a regular occurrence.

3. Financial auditors use computer aided audit techniques such as the Audit Command Language and CaseWare IDEA to assist in evaluating large data sets for unusual amounts, relationships, and frequencies. Embedded in these data extraction software is a profile of digit placement probabilities based on Benford's Law. Company data which falls outside the Benford profile can offer helpful information to auditors in their preliminary assessment of the financial statements.

4. https://www.reit.com/investing/investing-tools/reit-directory/searchable-directory

5. FFO equals net income plus depreciation and amortization of expenses less gains (or plus losses) on the disposition of property. Authorities on Benford's Law suggest that it is best to use an accounting measure that is subject GAAP when employing Benford testing, but we believe an interesting extension of this research thread could focus on FFO.

6. The following definitions are provided in the SECs interactive 10-Q. Net operating income from continuing operations is the amount of income (loss) from continuing operations attributable to the parent. Net operating income from continuing operations is also defined as revenue less expenses and taxes from ongoing operations before extraordinary items, but after deduction of those portions of income or loss from continuing operations that are allocable to noncontrolling interests. Net income attributable to common shareholders is the amount after tax of other comprehensive income (loss) attributable to the parent entity.

7. Net income is defined on the SECs interactive 10-Q as the portion of profit or loss for the period, net of income taxes, which is attributable to the parent. Some REITs refer to this as consolidated net income.

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