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Investigating earnings and revenue management in Jordanian companies through Benford's law

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Abstract

This study explores how financial figures—specifically revenue and net income—are reported by 164 companies listed on the Amman Stock Exchange in Jordan. By applying Benford's Law, the research analyzes the distribution of the first and second digits in these figures over a ten-year period (2010–2023) to identify any irregularities or rounding behavior. The companies were grouped based on whether they reported positive or negative net income. The analysis of the first digit reveals that revenue figures across Jordanian companies tend to deviate from expected patterns, regardless of whether the firms were profitable or not. Among firms with positive net income, there are minor signs of potential manipulation, while those with losses do not exhibit such behavior. On the other hand, the second digit analysis shows no statistically significant evidence of rounding in either revenue or net income data. These findings highlight the need for stronger oversight and preventive measures to reduce the risk of earnings management in Jordan's financial reporting practices.

Keywords: Benford's law, Earning management, Revenue management.

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1. Introduction

Many companies engage in managing their revenues and profits to present a more stable income stream to stakeholders—a practice often referred to as income smoothing [1]. However, such manipulation can distort financial statements, leading creditors, investors, and other stakeholders to make misinformed decisions. This challenges the core

principles of high-quality financial reporting, especially the principle of *faithful representation* as outlined in IAS 1, which emphasizes accuracy, neutrality, and integrity.

One subtle but significant form of manipulation is the intentional rounding up of earnings, known as cosmetic earnings management [2]. Detecting this practice is vital to identifying and correcting distortions introduced by managerial decisions. This study focuses on uncovering potential manipulative behavior in the financial reports of Jordanian companies, specifically looking at reported revenues and net income.

Previous research has extensively examined rounding and manipulation in financial figures, including the works of Nigrini [3]; Al-Darayseh and Jahmani [4]; Kinnunen and Koskela [5]; Jordan, et al. [1]; Darayseh and Waples [6] and Jordan and Clark [7].

In this context, the present study investigates anomalies in revenue and net income figures reported by companies listed on the Amman Stock Exchange. Identifying the absence or presence of rounding patterns helps assess the risk of financial misstatement and the degree to which companies adhere to faithful representation under IAS 1. This research is motivated by the need to understand and address earnings management practices in emerging markets like Jordan. By applying Benford's Law, the study seeks to detect manipulation and promote greater transparency in financial reporting—an essential step toward sustaining investor trust and enhancing market integrity.

2. Significance of the Research

This study plays a vital role in uncovering potential financial irregularities in Jordanian companies by applying Benford's Law. Through the analysis of deviations in the distribution of first and second digits in reported income figures, the research aims to detect signs of data manipulation. These insights contribute to the enhancement of financial reporting quality, support more effective auditing practices, and aid in fraud detection efforts.

By focusing on a developing market context, this study provides a deeper understanding of financial reporting behavior in Jordan and similar economies. It promotes transparency and accountability, aligning with global standards of financial integrity. The findings offer practical value to a wide range of stakeholders—investors, auditors, regulators, and policymakers—by equipping them with analytical tools to identify and respond to financial discrepancies more effectively.

3. Literature Review

Benford's Law, first introduced by Benford [8] describes the expected frequency distribution of digits in naturally occurring datasets. It suggests that lower digits, particularly the number 1, appear more frequently as the leading digit than higher digits like 8 or 9 [9, 10]. Specifically, the probability that a number begins with the digit *d* (where *d* ranges from 1 to 9) is given by the formula:

3.1. $P(d) = log10(1 + 1/d)$

Benford's Law has since been extended to include the analysis of second, third, and even fourth digits, making it a robust tool in forensic accounting and fraud detection. Table 1 as outlined by Nigrini [10] demonstrates the expected frequencies of digits according to Benford's distribution. Its application has proven effective in detecting anomalies in financial data, tax returns, and election results, among other datasets, making it a well-established method in empirical research related to data integrity and earnings management.

Table-1.
Law of Benford's: Anticipated frequencies of Digits [10]: Digits Position in figures:

Digit	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
First Digit		0.30103	0.17609	0.12494	0.09691	0.07918	0.06695	0.05799	0.05115	0.04576
Second Digit	0.11968	0.11389	0.10882	0.10433	0.10031	0.09668	0.09337	0.09035	0.08757	0.08500
Third Digit	0.10178	0.10138	0.10097	0.10057	0.10018	0.09979	0.09940	0.09902	0.09864	0.09827
Fourth Digit	0.10018	0.10014	0.10010	0.10006	0.10002	0.09998	0.09994	0.09990	0.09986	0.09982

Numerous studies have explored the application of Benford's Law in detecting earnings management and financial manipulation across various contexts. Kinnunen and Koskela [5] examined earnings management across 18 countries and found significant net income manipulation in half of them. Countries such as Spain, Hong Kong, and Singapore showed higher levels of manipulation, while Finland, Denmark, Sweden, and Norway demonstrated lower levels. The United Kingdom displayed only marginal manipulation.

Jordan, et al. [1] analyzed 1,002 publicly traded U.S. firms, discovering that income manipulation was more common in smaller firms, companies with low leverage, and those with higher returns on assets. In a regional context, Al-Darayseh and Jahmani [4] investigated the conformity of income digits to Benford's Law in 74 Jordanian firms from 1990 to 1994, revealing minimal deviations. Al-Darayseh, et al. [11] extended the analysis to Turkish firms and similarly found no substantial anomalies.

In Asia, Yang and Wang [12] examined Taiwanese firms between 2002 and 2006 and identified rounding in positive pre-tax earnings, particularly in firms with low insider ownership. Jordan, et al. [13] detected manipulation in U.S. sales revenue figures, while Darayseh and Waples [6] found inaccuracies in income figures among Gulf Cooperation Council (GCC) firms during 2002–2006.

Jordan and Clark [7] observed rounding behaviors around zero and nine prior to the enactment of the Sarbanes-Oxley Act (SOX) of 2002, with a noticeable decline in such practices after SOX was implemented. Thomas and Wilson [14] later confirmed SOX's effectiveness in reducing manipulation. Geyer and Drechsler [15] also identified rounding manipulation in revenue figures of U.S. firms.

Other notable studies include Cox, et al. [16] who found inappropriate rounding in 13 out of 6,593 U.S. companies analyzed from 1955 to 2010, and He and Guan [17] who reported that profitable firms tend to round earnings more than revenues, while loss-making firms round less frequently. Shette and Kuntluru [18] discovered rounding patterns in high-income Indian companies. Similarly, Jordan, et al. [19] noted a decline in manipulative practices following Ontario's Bill 198.

Ning, et al. [20] demonstrated that U.S. managers tend to round segment earnings figures. In Korea, Kang and Jin [21] found higher levels of rounding in highly leveraged firms. On the other hand, Özarı and Ocak [22] observed no significant deviations in Turkish corporate financials.

Geyer and Drechsler [15] identified anomalies in long-term debt accounts of U.S. firms. In Japan, He and Tian [23] found that manipulation patterns varied by industry. He and Guan [17] reported rounding in U.S. R&D expenses, particularly around the implementation of SFAS No. 2. Jordan, et al. [2] also documented a reduction in manipulation post-Ontario Bill 198. Lin and Wu [24] revealed continued rounding of earnings in Taiwanese firms, despite regulatory changes. Kienle [25] used Benford's Law to successfully detect fraud in the covered bond market. Most recently, Kienle [25] applied Benford's Law to ASEAN-5 countries, reporting general conformity to the expected distribution. They also observed a positive correlation between deviations from Benford's Law and abnormal accruals, especially after the adoption of International Financial Reporting Standards (IFRS).

In summary, the literature consistently highlights Benford's Law as a reliable tool for uncovering rounding behaviors and potential earnings manipulation across various industries and regions. Moreover, the effectiveness of regulatory interventions such as SOX and IFRS adoption is evident in reducing the prevalence of such manipulative practices.

4. Research Hypotheses

This study investigates irregularities in the first number and rounding behaviors in the second number for three financial accounts—revenue and net income—as reported in the annual reports of Jordanian firms. The research suggests the subsequent hypotheses:

Hypothesis 1: The first digit's frequency distribution of revenue and net income of Jordanian companies who reported positive net income aligns with the expected digit frequencies outlined by Benford's Law.

Hypothesis 2: The first digit's frequency distribution of revenue and net income of Jordanian companies who reported negative net income aligns with the anticipated digit frequencies according to Benford's Law.

Hypothesis 3: The frequency of zero (0) as the second digit in revenue and net income of Jordanian companies who reported positive net income is expected to be higher than anticipated, while the frequency of nine (9) is expected to be lower than anticipated.

Hypothesis 4: The frequency of zero (0) as the second digit in revenue and net income of Jordanian companies who reported a negative net income is expected to be lower than anticipated, with the occurrence of nine (9) expected to be higher than anticipated.

5. Methodology and Data Analysis

5.1. Methodology

The data for this study were gathered from the annual reports of Jordanian companies listed on the Amman Stock Exchange (ASE), covering revenue and net income from 2012 to 2022. The dataset included firms with positive net income (2360 observations) and firms with negative net income (942 observations). The initial analysis evaluated the applicability of Benford's Law by examining whether the mean of observed digits exceeded the median and if the skewness was positive, following the methodology of Özarı and Ocak [22].

Subsequently, the Chi-squared test was used to determine whether the observed frequencies of the first and second digits (ranging from 1 to 9) aligned with Benford's Law. Anomalies were indicated if the calculated Chi-squared value surpassed the tabulated value. The Chi-squared values were computed using the equation provided by Lin and Wu [24].

The first Chi-squared equation was applied to the first digit across all accounts for numbers from 1 to 9.

$$\chi^2 = \sum_{i=1}^{9} \frac{\left[nP_0 - nP_e\right]^2}{nP_0}$$

(2) Second Chi-squared equation used for second digit to all accounts for numbers from (0 – 9):

$$\chi^2 = \sum_{i=0}^{9} \frac{\left[nP_0 - nP_e\right]^2}{nP_0}$$

Where: (P0) represents the anticipated proportions, (Pe) stands for observed proportions, and (n) denotes the number of observations. Subsequently, the Mean Absolute Deviation (MAD) was employed to assess the first digit for all accounts, as per the methodology proposed by Nigrini [3]. This approach was chosen to address challenges arising from small datasets, as emphasized by Johnson and Weggenmann [26]. The rationale for using the MAD test lies in its capacity to draw conclusions about nonconformity when the data are unbiased, ensuring conformity. This test serves as a valuable tool to provide additional evidence regarding conformity and overcoming challenges previously outlined. The MAD was calculated using the following equation, as outlined by Johnson and Weggenmann [26]:

$$M.A.D. = \frac{1}{N}\sum_{1}^{N} f_i \, |x_i - \bar{x}|$$

Where (N) represents the sample size; (x_i) denotes the sample value; (mu) signifies the expected value, and (sum) represents the frequency.

The interpretation of the results obtained from the calculated Mean Absolute Deviation (MAD) aligns with the framework established by Nigrini. The outcomes are categorized into four types: Close Conformism, Acceptable Conformism, Marginally Acceptable Conformism, and Nonconformity. These classifications are detailed in Table 2 as follows:

Table 2.
MAD- the mean absolute deviation model : Nigrini [3].

MAD-Mean of Absolute Deviation	Conformism	Accepted conformism	Marginal Acceptance conformism	None-Conformism
First Digit	0.000-0.006	0.006 -0.012	0.012-0.015	More than 0.015

(4) The z-statistic test was utilized to gain deeper insights into the distribution of numbers (0, 1, 2, … 9) in both the first and second digits, evaluating their compliance with the expected occurrences based on the law of Benford. This test provides a more detailed analysis compared to the Chi-squared and Mean Absolute Deviation (MAD) tests. The z-value was computed using the formula outlined by He and Guan [17].

$$Z = \frac{|p - p_0| - (1/2n)}{\sqrt{p_0(1 - p_0)/n}}$$

Where: (P) represents observed proportions; (P0) signifies expected proportions, and (n) denotes the size of the sample .

The term (1/2n) is applied only when it is smaller than the absolute value of (P - P0).

The z-value is tested at a 95% confidence level. If the significance value is less than 5% for the z-value, it indicates that the deviation between observed and expected frequencies is significant, suggesting that the observed digit deviates from Benford's law.

5.2. Data Analysis

5.2.1. Descriptive Statistics

The descriptive measures for all accounts are detailed in Table 3.

Table 3.
Encompassing revenue and net income, (1,2).

1: companies Reported positive net income		
Statistic	Revenue	Net income
mean	70,869,066.00	10,334,373.00
median	10,263,829.00	1,296,707.00
skewness	11.26	7.06
minimum	2,798.00	261.00
maximum	4,855,334,092.00	378,182,700.00
Number of observations	2,360.	2,360.
2: Companies' Reported Negative net income (absolute)		
Statistic	Revenue	Net income
mean	18,406,622.00	2,292,057.00
median	3,436,647.00	546,192.00
skewness	9.22	7.06
minimum	3,417.00	1,780.00
maximum	807,720,342.00	72,298,079.00
Number of observations	1,300.	1,300.

Based on the results shown in the previous table, Benford's law is applicable to the entire dataset, as indicated by the means surpassing the median across all accounts. It's worth noting that when dealing with negative numbers, the calculations were adjusted using absolute values to negate the impact of the negative sign, following the methodology proposed by Özarı and Ocak [22].

Table 4.
Distribution of First Digit in revenues for companies with Positive net income.

Number	**Observed proportion (%)**	**Expected proportion (%)**	**Deviation rate (%)**	**Z-statistics**	**P-value**
1	30.67	32.10	(1.43)	1.14	0.26
2	16.27	19.61	(3.34)	3.24	0.001*
3	13.54	14.49	(0.95)	1.04	0.30
4	12.82	11.69	1.13	1.39	0.17
5	10.39	9.92	0.47	0.60	0.55
6	10.53	8.70	1.84	2.69	0.007*
7	9.03	7.80	1.23	1.90	0.06
8	7.74	7.12	0.62	0.99	0.32
9	7.02	6.58	0.44	0.73	0.47

Note:

- # of observation (N) = 3400
- Calculated Chi-square is (25.884), with Chi-square that is tabulated (15.857) at 8 degrees of freedom.
- The Mean Absolute Deviation (M.A.D) is 0.012982, indicating marginally acceptable conformity.
- indicates significance at the 5% level for the two-tailed test**.**

In Table 4 the Chi-square test indicates that companies with positive net income do not conform to Benford's Law, with a value of 25.884 exceeding the expected 15.857. The Mean Absolute Deviation (MAD) test shows marginal conformity, suggesting potential revenue inaccuracies due to rounding. Notably, digit 2 occurs less frequently, and digit 6 more frequently than expected, both significant at the 5% level (p-values of 0.001 and 0.007). These results imply inaccurate revenue reporting by companies with positive net income**.**

Table 5.
Distribution of First Digit in revenue for companies which have Negative net income.

Number	Observed proportion (%)	Expected proportion (%)	Deviation rate (%)	Z-statistics	P-value
1	34.212	30.405	3.807	1.885	0.060
2	14.156	17.785	(3.629)	2.168	0.030*
3	13.604	12.619	0.985	0.640	0.522
4	6.151	9.788	(3.637)	2.775	0.006*
5	6.151	8.006	(1.855)	1.519	0.129
6	8.576	6.762	1.814	1.610	0.107
7	7.454	5.855	1.599	1.502	0.133
8	5.404	5.167	0.237	0.152	0.879
9	5.590	4.622	0.968	0.971	0.331

Note:
- # of observations (N) is 1300.
- The Chi-square calculated for all digits is 22.40343882, exceeding the tabulated Chi-square value of 15.682 at 8 degrees of freedom.
- The Mean Absolute Deviation (M.A.D) is 0.02024206, indicating nonconformity.
- indicates significance at the 5% level for the two-tailed test.

The results for firms with negative net income in Table 5 are similar to those with positive net income, indicating non-alignment with Benford's Law. The Chi-square value exceeds the tabulated value, and the MAD test confirms nonconformity. Companies with positive results show less nonconformity, especially in revenue accounts. Digit 2 tends to be rounded down in both profitable and unprofitable firms, and digit 4 is often rounded down in loss-reporting companies, both statistically significant. Firms reporting losses exhibit higher numerical inaccuracies compared to profitable firms, as shown by the MAD test.

Table 6.
Distribution of Second Digit in revenue figures for companies that have Positive net income.

Number	Observed proportion (%)	Expected proportion (%)	Deviation rate (%)	Z-statistics	P-value
0	13.81	12.31	1.51	1.61	0.11
1	11.44	11.73	(0.29)	0.28	0.78
2	10.12	11.21	(1.09)	1.32	0.19
3	10.18	10.76	(0.58)	0.62	0.54
4	10.17	10.33	(0.16)	0.13	0.90
5	10.13	9.95	0.17	0.15	0.88
6	8.79	9.62	(0.83)	0.99	0.32
7	9.61	8.80	0.81	0.32	0.75
8	10.34	9.02	1.32	1.64	0.33
9	8.50	8.76	(0.26)	0.30	0.76

- The number of observations (N) is 2360.
- The Chi-square calculated for all digits is 8.66825113, exceeding the tabulated Chi-square value of 17.449 at 9 degrees of freedom.
- indicates significance at the 5% level for the two-tailed test.

In the analysis of the second digit for firms with positive net income, Table-6 shows that these companies conform to Benford's Law. Digit 0 occurs more frequently, and digit 9 less frequently than expected, suggesting possible rounding up of revenue figures. However, the z-value tests for these deviations are not statistically significant at the 5% level, indicating insufficient evidence to conclude that companies are actively rounding up their revenue figures.

Table 7.
Distribution of Second Digit in revenue figures – for companies which have Negative net income.

Number	Observed proportion (%)	Expected proportion (%)	Deviation rate (%)	Z-statistics	P-value
0	15.24	12.21	3.04	2.07	0.038*
1	10.35	11.61	(1.26)	0.84	0.40
2	12.40	11.10	1.30	0.90	0.37
3	10.74	10.55	0.19	0.06	0.95
4	9.98	10.23	(0.26)	0.12	0.90
5	9.42	9.85	(0.43)	0.28	0.78
6	7.00	9.56	(2.56)	1.94	0.05
7	9.44	9.22	0.22	0.08	0.94
8	8.09	8.95	(0.86)	0.60	0.55
9	9.44	8.67	0.77	0.53	0.60

Note:
- # of observations (N) is 1300.
- The Chi-square calculated for all digits is 10.368764, exceeding the tabulated Chi-square value of 17.265 at 9 degrees of freedom.
- indicates significance at the 5% level for the two-tailed test.

In analyzing the second digit for firms with negative net income, the Chi-square test results in Table 7 show a calculated value of 10.3687, which is lower than the tabulated value of 17.265. This indicates that these companies align with Benford's Law, suggesting a tendency to round down their numbers. Previous studies have shown a tendency to round down revenues and net income. In Table-7 firms reporting losses show a higher frequency of digit 0 and a more frequent occurrence of digit 9 than expected. However, these deviations are not statistically significant, indicating that firms reporting losses do not significantly round down their revenue numbers.

Table 8.
Distribution of First Digit for companies which have Positive net income.

Number	Observed proportion (%)	Expected proportion (%)	Deviation rate (%)	Z-statistics	P-value
1	29.78	30.40	(0.63)	0.76	0.45
2	18.90	17.77	1.13	1.09	0.28
3	12.96	12.62	0.34	0.35	0.73
4	10.64	9.79	0.86	1.04	0.30
5	9.77	8.01	1.77	2.54	0.011*
6	5.29	6.76	(1.48)	2.19	0.029*
7	5.21	5.85	(0.64)	0.97	0.34
8	4.20	5.17	(0.97)	1.57	0.12
9	5.35	4.62	0.73	1.25	0.21

Note: #of observations (N) = 2360
- CHI square calculated for all digits is 18.67185497, compared to the tabulated Chi-square value of 15.507 at 8 degrees of freedom.
- Mean Absolute Deviation (M.A.D) is 0.010717479 (Acceptable conformity).
- Significance at 5% (two-tailed test).

The analysis of the first digit for companies reporting positive net income, as shown in Table 8 reveals a calculated Chi-square value of 18.67185, exceeding the tabulated value of 15.507. This result indicates a lack of conformity to Benford's law. Additionally, the Mean Absolute Deviation (MAD) test yielded a result of 0.010717, falling within the acceptable range of 0.006 to 0.012, suggesting reasonable conformity in digit frequencies and warranting further investigation.

Further examination of individual frequencies shows that digit 5 occurs more frequently than expected, with a p-value of 1.767%, while digit 6 occurs less frequently than expected, with a p-value of 3.35%. Both deviations are statistically significant, suggesting that profitable Jordanian firms exhibit anomalies in their net income accounts for the first digit.

Table 9.
Distribution of first digit for companies which have negative net income.

Number	Observed proportion (%)	Expected proportion (%)	Deviation rate (%)	Z-statistics	P-value
1	30.54	30.57	(0.04)	0.02	0.99
2	16.87	17.88	(1.00)	0.56	0.58
3	15.15	12.73	2.42	1.64	0.10
4	8.44	9.83	(1.40)	1.03	0.30
5	8.81	8.04	0.77	0.58	0.56
6	7.11	6.79	0.32	0.21	0.83
7	5.24	5.88	(0.64)	0.54	0.59
8	3.75	5.19	(1.45)	1.42	0.16
9	5.62	4.65	0.97	0.98	0.33

Note:
- Number of observation (N) = 1300.
- CHI square calculated to all of digit 8.20304947, where Chi-square tabulated 15.507 at 8 degrees of freedom .
- Mean absolute deviation (M.A.D) is 0.010106441 (Acceptable conformity).
- significance at 5% (two-tailed test)* significance at 5% (two-tailed test).

In analyzing the first digit anomalies among companies reporting negative net income, Table-9 demonstrates adherence to Benford's law, as the calculated Chi-square value is lower than the tabulated one. The Mean Absolute Deviation (MAD) test results further confirm this, with digit frequencies falling within an acceptable conformity range. Additionally, z-value tests reveal no significant difference between observed and expected values. These findings suggest that companies reporting a loss do not exhibit anomalies in their first digit numbers, in contrast to companies reported a profit, which do show such anomalies.

Table 10.
Distribution of second digit for companies which have positive net income.

Number	Observed proportion (%)	Expected proportion (%)	Deviation rate (%)	Z-statistics	P-value
0	12.69	11.98	0.71	0.79	0.43
1	12.69	11.40	1.28	1.49	0.13
2	10.90	10.89	0.01	0.02	0.99
3	10.39	10.44	(0.04)	0.05	0.96
4	8.96	10.04	(1.08)	1.29	0.20
5	10.54	9.67	0.87	1.06	0.29
6	10.61	9.34	1.27	1.59	0.11
7	7.31	9.04	(1.73)	2.20	0.0265*
8	8.25	8.76	(0.52)	0.64	0.53
9	7.67	8.51	(0.84)	1.07	0.29

Note: *-#of observations (N) = 2360.*
- CHI square calculated for all digits = 13.977582, where the Chi-square tabulated value is 16.971 at 9 degrees of freedom.
*- *Significance at 5% (two-tailed test).*

In Table-10 the Chi-square test indicates adherence to the law of Benford, with a calculated value of 13.911 compared to the tabulated value of 16.919. Notably, the observed frequency of 0 is higher than expected, while the occurrence of number 9 is lower than anticipated. This pattern suggests that companies may be rounding up their net income, but the differences are not statistically significant. The digit 7 exhibits a negative deviation of -1.723% with a p-value of 2.793%, indicating a potential anomaly. However, overall, the evidence suggests that companies, in general, do not engage significantly in rounding phenomena.

Table 11.
Second Digit Distribution for companies which has Negative net income.

Number	Observed proportion (%)	Expected proportion (%)	Deviation rate (%)	Z-statistics	P-value
0	11.55	11.95	(0.41)	0.33	0.74
1	9.79	11.36	(1.57)	1.64	0.10
2	9.79	10.86	(1.07)	1.36	0.17
3	10.53	10.41	0.12	0.49	0.62
4	11.45	10.01	1.45	0.44	0.66
5	9.42	9.64	(0.22)	0.71	0.48
6	11.27	9.31	1.96	0.87	0.39
7	11.27	9.01	2.26	1.12	0.26
8	9.98	8.73	1.24	0.31	0.76
9	11.82	8.48	3.35	2.07	0.04

Note:
- Number of observations (N) =1300
- CHI square calculated for all digits = 12.024042, where the Chi-square tabulated value is 16.971 at 9 degrees of freedom
- *Significance at 5% (two-tailed test)

In Table 11 the Chi-square test results for the second digit in companies reporting a loss indicate conformity to Benford's Law. The calculated Chi-square value of 12.024 is lower than the tabulated value of 16.971 at 9 degrees of freedom. Companies reporting losses often show more instances of 9 and fewer instances of 0. While the reduction in zeros is not statistically significant, there is a significant increase in the frequency of 9, suggesting companies round down their net losses. This behavior aligns with the tendency in Jordanian firms to present their net losses in a way that minimizes the impact on stakeholders. Reporting a loss of 0.995 million is perceived more positively than 1 million. This practice is supported by previous studies, such as Kinnunen and Koskela [5].

6. Results and Recommendations

This study employed Benford's Law to investigate potential manipulations in the financial data of Jordanian firms, specifically focusing on revenue and net income. The analysis segmented companies into two categories: those reporting positive net income and those reporting negative net income.

For firms with positive net income, the first hypothesis examined whether the distribution of first digits in revenue and net income conformed to Benford's Law. The results revealed noticeable deviations in revenue figures, with an overrepresentation of the digits 2 and 6—findings that align with Jordan, et al. [13] and contrast with the results of Özarı and Ocak [22]. In terms of net income, the distribution also failed to conform to Benford's Law, showing an elevated frequency of the digit 5 and a reduced frequency of digit 6. These results challenge earlier findings by Al-Darayseh and Jahmani [4] and Özarı and Ocak [22] suggesting potential manipulation among profitable firms.

For firms with negative net income, the second hypothesis assessed conformity to Benford's Law. The analysis showed that revenue figures deviated from the expected distribution, particularly with a lower frequency of digits 2 and 4. This pattern is consistent with the findings of He, et al. [27] and contradicts [22]. Interestingly, net income figures for loss-making firms did conform to Benford's Law, indicating a more complex relationship between profitability status and income manipulation.

The third hypothesis focused on the frequency of the digits zero and nine in the second digit position of figures reported by profitable firms. Although an increase in the digit zero and a decrease in the digit nine were observed in both revenue and net income data, the differences were not statistically significant.

The fourth hypothesis proposed that firms reporting negative net income might engage in rounding down, which would manifest as a lower frequency of the digit zero and a higher frequency of the digit nine in the second digit position. The findings revealed elevated frequencies of both digits in revenue data, contradicting the hypothesis. However, net income data for unprofitable firms showed a decrease in the frequency of zero and an increase in the frequency of nine, offering partial support for the hypothesis.

Recommendations

- Strengthen regulatory oversight**:** Given the evidence of manipulation in revenue and net income, especially among profitable firms, regulatory bodies should enhance scrutiny over financial reporting practices in Jordan.
- Implement stricter audit standards**:** External auditors should be encouraged to use tools like Benford's Law in regular audit procedures to detect anomalies that may indicate manipulation.
- Raise awareness and training**:** Company management and accounting professionals should be educated about the ethical implications of earnings manipulation and trained in transparent reporting practices.
- Further research**:** Future studies should expand the dataset to include more recent years or sector-specific analyses to uncover industry trends and the effectiveness of reforms over time.

In conclusion, this study provides compelling evidence of irregularities in financial reporting among Jordanian firms, with differing patterns based on profitability. These findings reinforce the importance of analytical tools like Benford's Law in promoting transparency, reliability, and investor confidence in emerging markets.

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