Using the anomalous numbers model (Newcom-Benford model) to verify the accuracy of published data for the fire insurance branch of insurance companies in the Egyptian market

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Abstract

This study aims to use the anomalous numbers model (Newcom-Benford model) to verify the accuracy of premium and claims data for the fire branch of property and liability insurance companies operating in the Egyptian market during the period from 2012/2013 to 2021/2022 by relying on data for both direct underwriting and reinsurance, local and foreign incoming reinsurance, local and foreign outgoing reinsurance for premiums and claims, total underwriting premiums, net operations from premiums, total claims, and net operations from claims, and by operating the data and comparing it with the results of the probabilities of the Benford model for all variables related to premiums and claims,the study reached a number of results, including the absence of significant statistical differences between the actual data and the results of the Benford model, which means the validity of the first and second study hypotheses,the study recommended the necessity of using the Benford model to verify the accuracy of the data by applying it to other branches of insurance companies and relying on the Benford model by the Financial

Regulatory Authority to verify the accuracy of the data of insurance companies.

Keywords

Premiums - Claims - Fire Insurance - Property and Liability Insurance - Anomalous Numbers Model (Newcom-Benford Model).

1- Introduction and research problem

Insurance companies are exposed to many cases of fraudulent practices, deception and fraud, and thus they incur unreal claims payments, which increases their loss rates and thus they are forced to raise the insurance price on their customers in general, and not only on fraudsters in many cases, it can be said that fraudulent practices and cases of fraud have accompanied insurance since its inception, but with the rapid technological and electronic development, the methods by which these practices are carried out have developed, and insurance companies must face many of the challenges they face internally and externally, these challenges are based on the inadequacy of insurance companies' mechanisms to confront the threats of fraudulent practices and fraud, and from here the importance of trying to discover cases of fraudulent practices and fraud in the data of various companies appears.

Many studies and researches have been conducted to try to assess the losses resulting from fraudulent practices for insurance companies, For example, the European Federation of Insurance Companies (European Insurance Federation) estimated the cost of fraud in the European market in 2020 at 10% of the total amount of claims, this percentage is significantly higher in developing countries that suffer from weak insurance supervision and control systems.

As insurance is considered one of the most important pillars of the national economy, ensuring the accuracy of data related to this sector and that it does not contain fraudulent practices and deception is one of the most important challenges that must be faced, the New com-Benford distribution is one of the tools through which fraudulent

practices and deception can be detected, as well as verifying the accuracy of data related to different branches of insurance, therefore, the research problem is represented in the extent to which the anomalous numbers model (New com- Benford model) can be used as a mathematical tool that helps verify the accuracy of published data related to property and liability insurance, especially in fire insurance.

This research aims to identify the extent of the possibility of applying the anomalous numbers model (New com- Benford model) in verifying the accuracy of published data related to the fire insurance branch, and directing the attention of Egyptian insurance companies to the mechanisms through which the anomalous numbers model (New com- Benford model) can be used in discovering fraudulent practices in the data submitted to them.

The literature related to the research topic was reviewed and previous studies in the field of fraud and deception practices were presented, as well as the application of the statistical distribution of the anomalous numbers model (Newcom-Benford model) during a ten-year period from 2013 to 2022 on the published data for the fire insurance branch in property and liability insurance companies, in order to verify the accuracy and quality of this data and then trust and rely on it, the following is a table showing the data related to each of the premiums and claims for the fire branch in the Egyptian insurance market in the period from 2013 to 2022.

Table (1)

Fire branch premiums in the Egyptian insurance market during the period from 2012/2013 to 2021/2022

year	direct underwriting	local incoming reinsurance	Foreign incoming reinsurance	total underwriting	local outgoing reinsurance	foreign outgoing reinsurance	net operations from premiums
2012\2013	1047589	10298	73002	1130889	37426	875563	217901
2013\2014	1215697	11284	136603	1363583	37601	965270	360713
2014\2015	1353526	21937	175524	1550988	44471	984176	522341
2015\2016	1447700	85822	218942	1689500	65435	976137	647928
2016\2017	1933448	25740	425511	2384700	87328	1326192	971180
2017\2018	2394667	35449	472095	2902211	77853	1586321	1238037
2018\2019	2819675	33285	477167	3330132	53491	1762454	1514188

2019\2020	**3339841**	**23842**	**402874**	**3766557**	**63428**	**2759145**	**943984**
2020\2021	**3595144**	**29144**	**524982**	**4149270**	**67086**	**2682755**	**1399428**
2021\2022	**3985431**	**36957**	**546279**	**4568667**	**95931**	**3160585**	**1312152**

Source: General Authority for Financial Supervision, Annual Statistical Book, various issues.

Table (2)

Fire branch claims in the Egyptian insurance market during the period from 2012/2013 to 2021/2022

year	direct underwriting	local incoming reinsurance	Foreign incoming reinsurance	total underwriting	local outgoing reinsurance	foreign outgoing reinsurance	net operations from claims
2012\2013	529629	4234	21771	555634	20512	329845	205276
2013\2014	597541	5395	42470	645406	20985	372233	262188
2014\2015	656057	4381	55244	715681	24244	375865	315572
2015\2016	746626	4766	70234	821726	36843	390818	394065
2016\2017	1063337	7890	128415	1199642	48432	519323	631887
2017\2018	1278461	13019	151111	1442592	44765	584107	813720
2018\2019	1521858	14385	150827	1687071	38942	638257	1009872
2019\2020	1953088	9430	109121	2071639	37722	1002836	1031082
2020\2021	2183756	11427	181240	2376423	46520	970284	1359619
2021\2022	2474241	15205	180114	2669560	44524	1164698	1460339

Source: General Authority for Financial Supervision, Annual Statistical Book, various issues.

2- Literature reviews

The study "Murad, Engy Farouk Ahmed, 2023" addressed the role of Benford's law in verifying the quality of data contained in the financial statements of insurance companies operating in the Egyptian market, and the extent to which it can be used to verify the quality of matching data contained in the financial statements of insurance companies at the level of the total Egyptian market and according to the sector, and to identify differences, if any, as well as in the quality of matching data contained in the financial statements of insurance companies operating in the public business sector compared to the data contained in the financial statements of insurance companies as an attempt to

early detect fraud/financial fraud practices, profit management and accounting errors, the study "Al-Naghi, Mahmoud Al-Sayed and others, 2023" addressed clarifying the importance of sectorial specialization for the external auditor, and the possibility of discovering fraud committed by the company's management in the form of a material distortion or deliberate omission of a number of disclosures in the financial statements submitted by the management, and the extent to which this harms investors, creditors and other parties who use the financial statements.

The study of " Parnes, 2022", analyzed the recorded and expected data for the values of activities practiced outside the balance sheet of commercial banks with the aim of proving their validity and the extent of their conformity with Benford's law, the study concluded that the data under study partially or weakly conforms to Benford's law, in addition to their lack of symmetry to the normal distribution gradually, which means that some of this data has been manipulated or distorted in one way or another.

The study "Hamwi Khalil, et al. 2021" determined the role of using Benford's law by auditors in detecting fraud in financial statements, by testing the purchase account, and applying Benford's law to these invoices, the research concluded that Benford's law is one of the modern control techniques that enhance the performance of auditors in the auditing process as it is an effective way to detect fraud or errors in financial statements in addition to revealing illegal practices that can be used by employees and managers in companies, the study "Mustafa, Nasser Faraj 2019" examined whether there was manipulation of a set of basic data extracted from the balance sheet and income statement in the banking sector during the five years from 2013 to 2017, and to what extent there is a strong and statistically significant deviation from the Benford distribution for ten basic variables that are not distributed according to Benford's law, the study "Larsen, James E2017" examined whether the earnings data of one of the companies listed on the New York Stock Exchange, which is a REIT company - which operates in REITs and Mortgage Investment Trusts - Benford Compliant or Not?

The quarterly net income collected by 183 REITs over the six-year period from 2009 to 2014 was evaluated by calculating and analyzing the absolute deviation of both the first and second digits of the REITs' net income, the results of the entire sample indicated that the data conformed to Benford's law, this result is consistent with the idea that REITs no longer systematically manage earnings. "Chang, Juan C., 2017", applied Benford's law to data derived from the financial statements of three companies, the law was applied to the published financial statements of those companies, the study concluded that the published data did not follow Benford's law in the three companies, which is evidence of the possibility of manipulation in the financial statements of those three companies ,under study"Lakhdar Larous et al., 2016 ",the possibility of using Benford's law in early detection of errors and fraud in accounting and financial data and determining whether it can be used in detection or not," Salem, Sherine Ali Ibrahim, 2016, "Applied Benford's law in Detecting fraudulent practices in financial reports and development mechanisms through the use of spreadsheets and developed work logs to detect fraud and prevent crises from arising as a result of manipulating the company's accounting data and not using some accounting treatments and policies to show accounting data in a misleading manner, which affects the decisions of its users.

The study of "Sugiarto, Teguh 2016", discussed the possibility of using Benford's law to detect any deviations that indicate the possibility of an error or fraud in the proper processing of data, the study focused on accountants and auditors applying Benford's law to the data of a number of institutions in Indonesia to find data or numbers that may include distortion or misrepresentation, the application was practically applied to a case study of the financial statements of PTTimah (Persero) Tbk listed on the Indonesia Stock Exchange for five years from 2006 – 2010,the study concluded that it can be concluded that Benford's law method is capable of analyzing the possibility of fraud in financial statements, the study of "Grammatikosa, T. and Nikolaos I 2015" examined the detection of potential manipulation of accounting data in the banking sector in the United States of America by applying "Benford's

Law", the researchers in this study tested whether there was manipulation of a set of basic variables of the balance sheet in the years preceding the outbreak of the financial crisis in late 2000 and also during the crisis and the extent of the impact of this manipulation, the study found a strong and statistically significant deviation from the Benford distribution for three basic indicators and the study recommended the need to use modern techniques to detect any manipulation or fraud that may occur in accounting data, and among those proposed techniques is the Benford distribution as a tool that can be used in this regard, and the study "Al-Tamimi, Abbas Hamid, and others, 2013" dealt with the use of Benford's law to detect companies that practiced earnings management in a sample of companies listed on the Iraq Stock Exchange, and it was used to identify companies that may practice earnings management as this law is one of the control methods that were used to detect the risk of earnings management, and the study "Stambaugh, Clydet, and others 2012" dealt with identifying the main role of accountants, including internal audit functions, in helping their organizations detect fraud operations before they are implemented based on Benford's law, which is a mathematical technique for identifying irregular patterns in data,these irregular patterns may represent red flags indicating activity Fraud or material errors.

Benford's law was used to help identify potential fraudulent incidents or material errors by comparing the actual occurrence rates of numbers with their expected values under Benford's law, and the accountant has a mathematical basis to investigate the risks of material errors and to identify potentially fraudulent activities, by reviewing and analyzing previous studies to reach the research gap, it became clear that there are some studies that dealt with the applications of Benford's law in the field of banking, which helped in understanding this tool and the possibility of using it in detecting manipulation of financial statements and profit management in banks, there are also a number of studies that dealt with the applications of Benford's law in fields other than banks, such as real estate investment fields, and showed the existence of manipulation in the data of these companies. Finally, a number of studies dealt with the applications of Benford's law in the field of insurance,

but they dealt with its application in relation to financial position statements and did not address the study of the various branches of insurance, which is what was addressed in the current research.

3- Conceptual Framework of the Anomalous Numbers Model (Newcomb-Benford Model)

The Anomalous Numbers Model (Newcomb-Benford Model) is most accurately applied to data spanning several orders of magnitude, in general, the more orders of magnitude the data spans evenly, the more accurately the Anomalous Numbers Model (Newcomb-Benford Model) is applied, Benford's Law, also called the Newcomb-Benford Law, the Anomalous Numbers Law, or the First Number Law, is the observation that in many real-world numerical data sets, the first digit is likely to be small, in sets that adhere to the law, the digit 1 appears as the first significant digit about 30% of the time, while the digit 9 appears as the first digit less than 5% of the time, If the numbers are uniformly distributed, each will occur about 11.1% of the time. Benford's Law also makes predictions about the distribution of second digits, third digits, number combinations, etc.

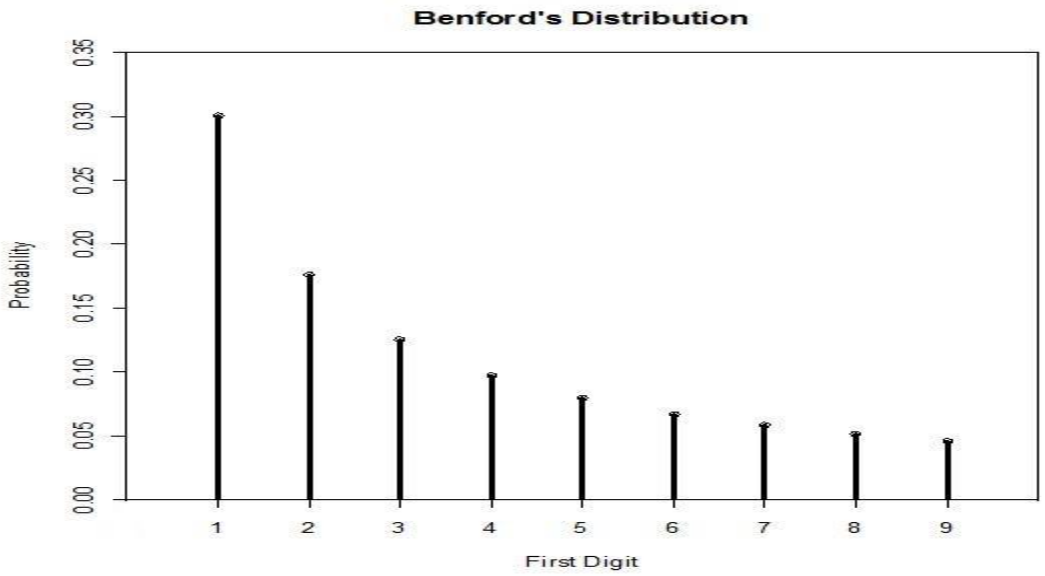
Benford discovered that the degree to which the digits 1 through 9 appear does not it is equal in terms of relative distribution and that some numbers appear more frequently than others. Mr. Binford formulated the probability of obtaining the numbers from 1-9 in each position of the number, meaning is this the first, second or third number? For example, in the number 3879, the following results can be obtained:

The first number is 3 in the first place, the second number is 8 in the second place, the third number is 7 in the third place, the fourth number is 9 in the fourth place, and he mentioned that the probability of the number (1) appearing in the first place is higher than the number (2) and that the number (2) is higher than the number (3) and so on, and he noticed the following:

The probability ratio that the first number is one is 0.301 while the probability ratio that the first number is 2 is 0.176 and so on until he was able to obtain the following probabilities:

irst Digit	1	2	3	4	5	6	7	8	9
robability	.301	.176	.125	.097	.079	.067	.058	.051	.046

Accordingly, the following graph can be obtained, which illustrates Benford's law:



$$p(D) = log_{10}(d+1) - log_{10}(d)$$

$$P(D) = log_{10}\left(1 + \frac{1}{d}\right)$$

Where:

P: The probability of the observation, D represents the rank of the number itself, and d represents the number.

In (1961), Roger Pinkham studied the phenomenon of number distribution in some natural phenomena, and he reached a mathematical proof of Benford's law, and finally (Hill, T. P., & Fox, R. F, 2016) proved the validity of

Benford's law, which helped in explaining and predicting the phenomenon of digital evidence in various data.

Based on the above, the extent of the possibility of applying the outlier numbers model (Newcomb-Benford model) as a measure of data credibility appears, as when the data does not agree with the model, this means that some of the data has been manipulated or distorted in one way or another (Krakar & Zgela, 2009)

3/2 Technique for applying the anomalous numbers model (Newcomb-Benford model)

Researchers were able, through the following website:
https://web.williams.edu/Mathematics/sjmiller/public_html/tas2011/benford/Miller Nigrini_Excel BenfordTester_Ver301.xls
Which is available on the Internet, to determine the technique for applying the anomalous numbers model (Newcomb-Benford model) through three axes, which are?

3/2/1 the first axis

This is the axis related to testing the data, through which the data under study were placed and determined, It is worth noting that when this step was carried out, the necessary determinants were followed to apply the anomalous numbers model, and it should be noted that the data published in the annual statistical book of insurance activity has all these determinants.

3/2/2 the second axis

Here, the data obtained and related to applying the anomalous numbers model (Newcom-Benford model) were converted to contain:

3/2/2/1 Tables for dividing the data into subgroups for analysis purposes, the researchers here divided the data into data related to premiums, and data related to published claims related to fire insurance in the Egyptian market during the study period from 2013 to 2022.

3/2/2/2 The expected percentage of occurrence for each number according to the application of the anomalous numbers model (Newcom-Benford model).

3/2/2/3 The actual data for each number. This was done by selecting the numbers related to the premiums and compensations of the property and liability insurance companies operating in the Egyptian market.

3/2/3 the third axis

It is the axis related to Benford maps, which contain the graphic forms for each number according to Benford's law compared to those actual numbers for each number in the form of a map or graphic form, due to the large number of graphic forms and their multiplicity, the researchers will suffice with presenting a graphic for the premiums and another for the claims.

4- Applied Study

4/1 determining the study population:

The study population consists of all property and liability insurance companies operating in the Egyptian market that practice fire insurance through the data available in the annual statistical book issued by the Financial Regulatory Authority.

4/1/1 Data entry and processing stage

After entering the data, the researchers conducted a study of the research variables related to the data published in the statistical book, which are as follows:

- Premiums, which are represented by direct underwriting, local incoming reinsurance, foreign incoming reinsurance, total underwriting, local outgoing reinsurance, foreign outgoing reinsurance, net operations from premiums.
- Claims, which are represented by: direct underwriting, local incoming reinsurance, foreign incoming reinsurance, total underwriting, local

outgoing reinsurance, foreign outgoing reinsurance, net operations from claims.

4/1/2 the Anomalous Numbers Model (Newcom-Benford Model)

In this part of the research, the Anomalous Numbers Model (Newcom-Benford Model) was applied to discover the accuracy of the published data for the fire insurance branch, through the research variables under study in the period from (2013-2022), and there are some assumptions related to the geometric pattern of the applied phenomena, and the expected patterns of numbers were formulated from the data tables for the different variables, to identify the expected frequencies arranged by the first number, then the second and third through the following equations:

$$\mathrm{P}(\mathrm{D}_1 = \mathrm{d}_1) = \log_{10}(1 + 1/\mathrm{d}_1); \mathrm{d}_1 = \{1,2,3, \dots ,9\}$$

$$P(D_2 = d_2) = \sum_{0}^{9} log_{10}\,(1 + 1/d_1 d_2); d_2 = \{0,1,2,..,9\}$$

$$P(D_1 D_2 = d_1 d_2) = log_{10}\left(1 + \frac{1}{d_1 d_2}\right); d_1 d_2 = \{10,11,12,..,99\}$$

Where:
P: Probability of occurrence of observations.
D: Represents the rank of the number.
D: Represents the number**.**

4/3 Study hypotheses

First hypothesis

There are no statistically significant differences between the actual data of fire branch premiums for the companies under study and the probabilities of the Benford distribution.

Second hypothesis

There are no statistically significant differences between the actual data of fire branch claims for the companies under study and the probabilities of the Benford distribution.

4/3 applying the model to fire insurance premium data

Table (3) and Figure (1) show the results of running the data to compare the actual results with the results of the Benford model, as follows

Table (3)

Results of running the data (premiums) using the Benford model

premiums	No. of data points	$\chi 2$ Tabulated at 95%	$\chi 2$ Tabulated at 99%	$\chi 2$ Calculated	r	Hypothesis 1
direct underwriting	10	15.0507	20.0902	14.63	0.8921	Accept HO
local incoming reinsurance	10	15.0507	20.0902	14.33	0.9251	Accept HO
Foreign incoming reinsurance	10	15.0507	20.0902	13.9	0.872	Accept HO
total underwriting	10	15.0507	20.0902	14.36	0.9432	Accept HO
local outgoing reinsurance	10	15.0507	20.0902	13.05	٠,٨٧١	Accept HO
foreign outgoing reinsurance	10	15.0507	20.0902	13.99	0.8632	Accept HO
net operations from premiums	10	15.0507	20.0902	14.353	0.847	Accept HO

Source: Results of running the data using the Benford model.

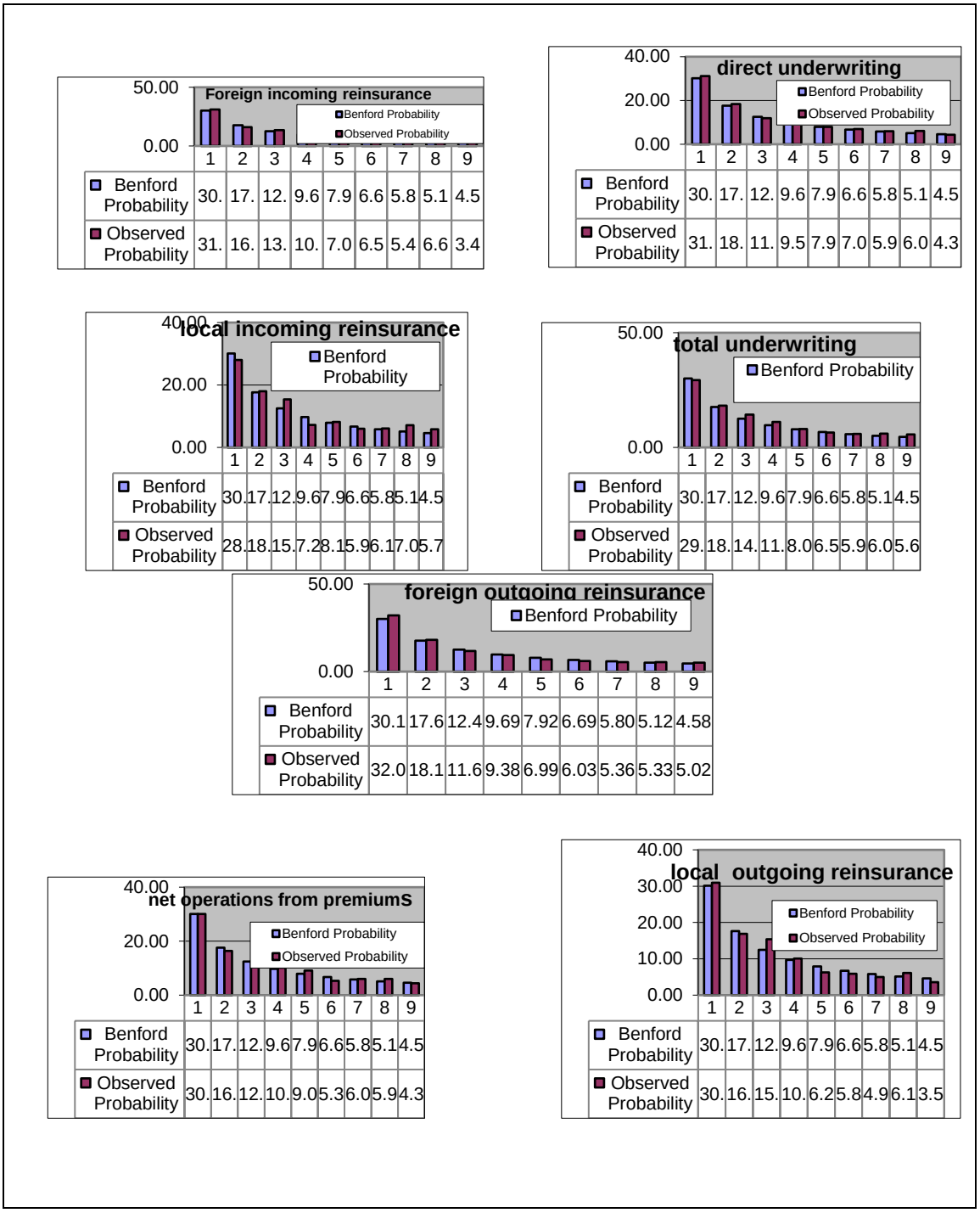


Figure (1)

Comparison between fire branch installment data and Benford model data

The data in the previous table and figure related to the premiums show the following:

1- The calculated value of Calculated $\chi 2$ is less than the table value at both confidence levels of 95% and 99% for each of (direct subscription, foreign reinsurance premiums, local reinsurance premiums, total subscription, foreign reinsurance premiums, local reinsurance premiums, net operations from premiums) as it reached 14.63, 14.33, 13.90, 14.36, 13.050, 13.990, and 14.353 respectively, and all of them are less than the table value(at95%,99%), and thus this data is distributed according to Benford's law, which gives an indication of its accuracy and there is no manipulation or fraud in it.

2- The correlation coefficients between the probabilities of the actual data and the probabilities of the Benford distribution were high, as the highest correlation coefficient was for the total subscription (0.943) and the lowest correlation coefficient was for the net operations of the premiums (0.847), which indicates the existence of a strong correlation between the actual data and the probabilities of the Benford distribution, which indicates the accuracy of the premium data for the fire branch of the property and liability insurance companies for the companies under study and during the study period.

٣-According to the above, the validity of the first hypothesis of the study is clear, and there are no statistically significant differences between the actual data of the fire branch premiums for the companies under study and the probabilities of the Benford distribution.

4/4 applying the model to fire insurance claims data

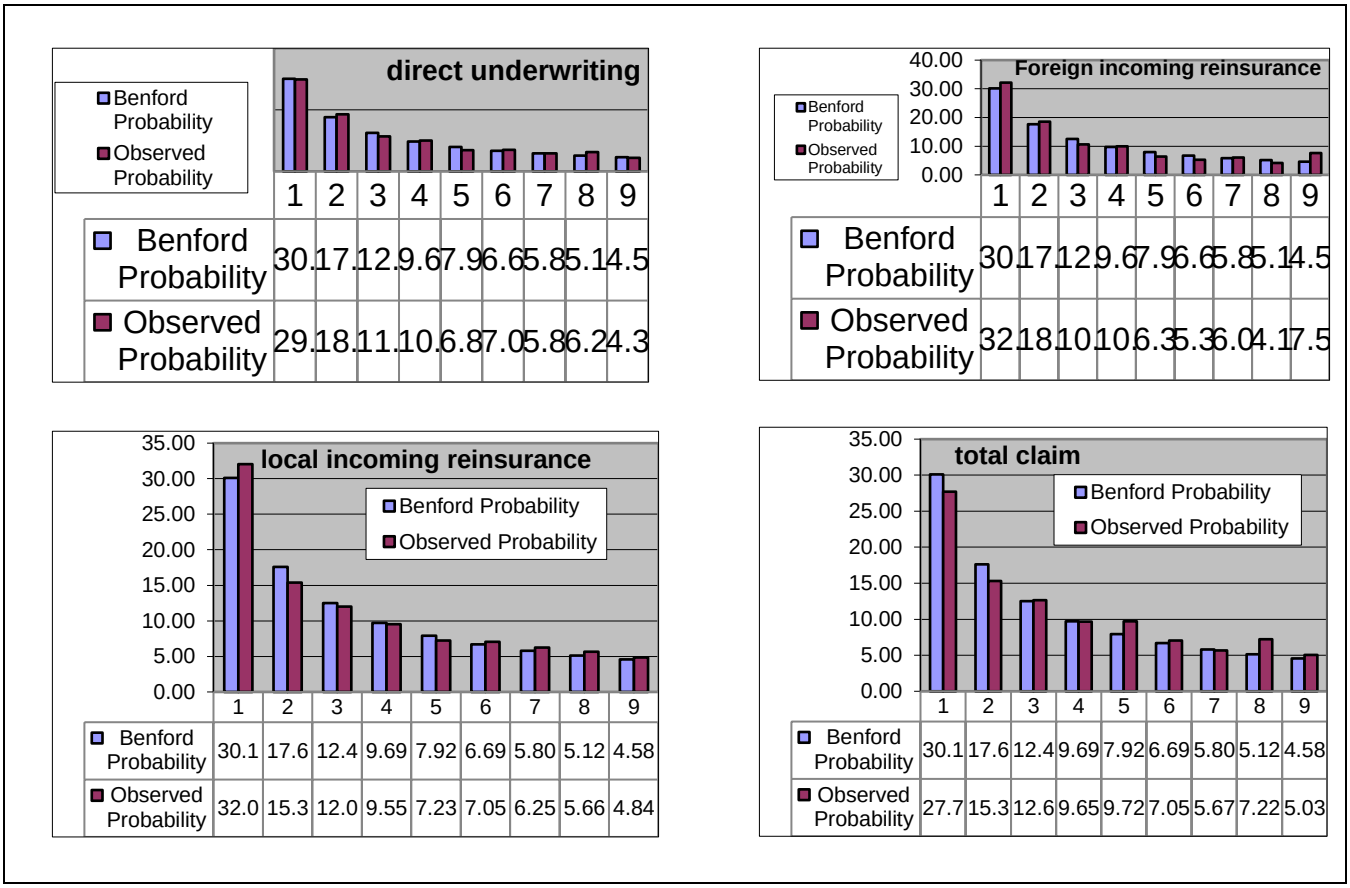
Table (4) and Figure (2) show the results of running the data to compare the actual results with the results of the Benford model, as follows

Table (4)
Results of running the data (claims) using the Benford model

claims	No. of data points	$\chi 2$ Tabulated at 95%	$\chi 2$ Tabulated at 99%	$\chi 2$ Calculated	r	Hypothesis 2

direct underwriting	**10**	**15.0507**	**20.0902**	**14.30**	**0.٩٣٢١0**	**Accept HO**
local incoming reinsurance	**10**	**15.0507**	**20.0902**	١٣,١٤	**0.٨٨١٤0**	**Accept HO**
Foreign incoming reinsurance	**10**	**15.0507**	**20.0902**	١٣,٢٥٠	٠,٨٨٧٢	**Accept HO**
total claims	**10**	**15.0507**	**20.0902**	١٤,٩١٠	٠,٨٤٧٢	**Accept HO**
local outgoing reinsurance	**10**	**15.0507**	**20.0902**	١٢,٦٦٠	٠,٩١٢٩	**Accept HO**
foreign outgoing reinsurance	**10**	**15.0507**	**20.0902**	١١,٤٧٠	٠,٨٩٦٣	**Accept HO**
net operations from claims	**10**	**15.0507**	**20.0902**	١٢,٥٧٠	٠,٨٤٤٧	**Accept HO**

Source: Results of running the data using the Benford model.



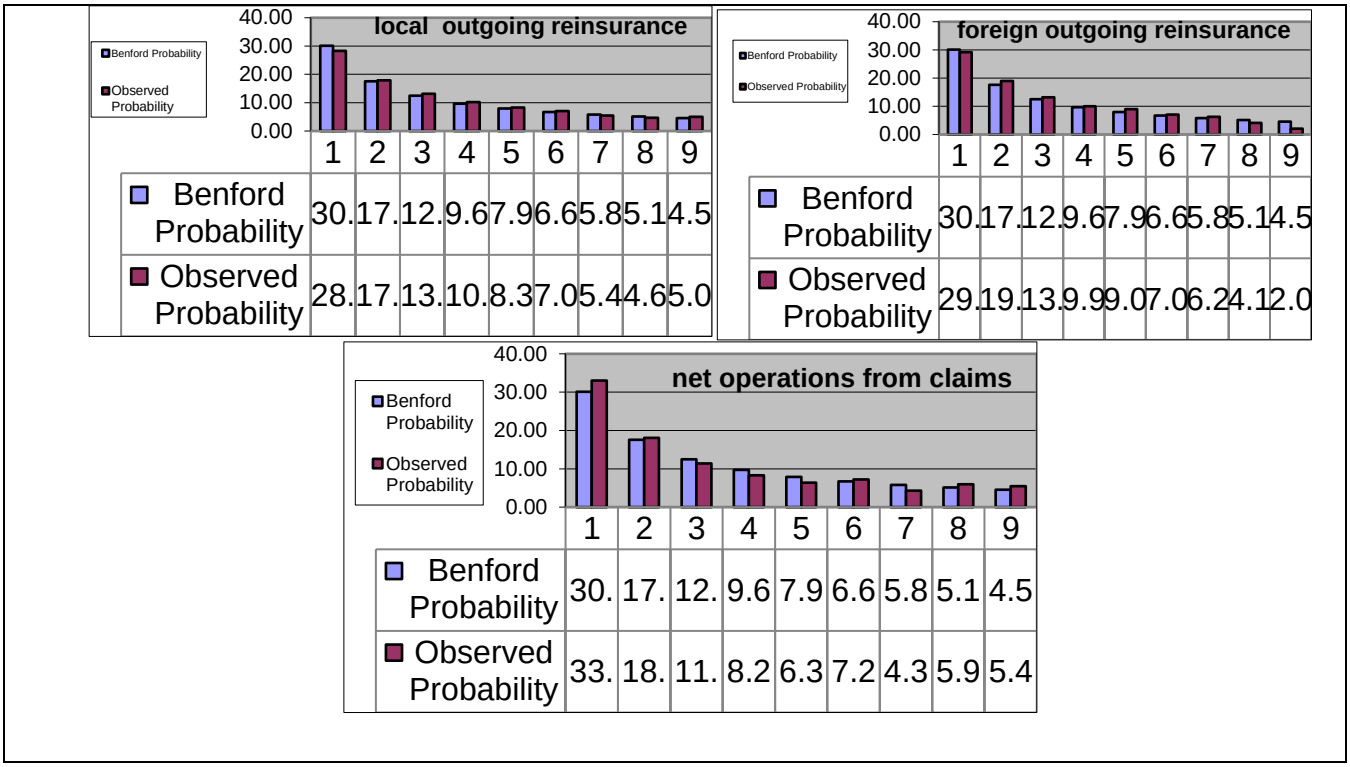


Figure (2)

Comparison between fire branch compensation data and Benford model data

The data in the previous table and figure related to claims show the following:

1- The calculated value of $\chi 2$ is less than the table value at both confidence levels of 95% and 99% for each of (direct underwriting compensations, foreign reinsurance claims, domestic reinsurance compensations, total compensations, foreign reinsurance compensations, domestic reinsurance compensations, net operations from claims) as it reached 14.30, 13.14, 13.250, 14.910, 12.660, 11.470, and12.570 respectively, and all of them are less than the table value(at95%,99%) , and thus this data is distributed according to Benford's law, which gives an indication of its accuracy and that there is no manipulation or fraud in it.

2- The correlation coefficients between the probabilities of the actual data and the probabilities of the Benford distribution were high, as the highest

correlation coefficient was for direct underwriting claims (0.9321) and the lowest correlation coefficient was for net operations from claims (0.8447), indicating the existence of a strong correlation between the actual data and the probabilities of the Benford distribution, which indicates the accuracy of the claims data for the fire branch of the property and liability insurance companies of the companies under study and during the study period.

3- According to the above, the validity of the second hypothesis of the study is clear, and there are no statistically significant differences between the actual data of the fire branch claims for the companies under study and the probabilities of the Benford distribution.

5-Results and Recommendations

5/1 Results

1- There are no statistically significant differences between the data of direct underwriting premiums for property and liability insurance companies of the companies under study and the data of the Benford model.

2- There are no statistically significant differences between the data of Foreign reinsurance premiums for property and liability insurance companies of the companies under study and the data of the Benford model.

3- There are no statistically significant differences between the data of local reinsurance premiums for property and liability insurance companies of the companies under study and the data of the Benford model.

4- There are no statistically significant differences between the data of total underwriting premiums for property and liability insurance companies of the companies under study and the data of the Benford model.

5- There are no statistically significant differences between the data of Foreign reinsurance premiums for property and liability insurance companies of the companies under study and the data of the Benford model.

6- There are no statistically significant differences between the data of local reinsurance premiums issued by the property and liability insurance companies of the study companies and the data of the Benford model.

7- There are no statistically significant differences between the data of net operations from premiums for the property and liability insurance companies of the study companies and the data of the Benford model.

8- There are no statistically significant differences between the data of direct underwriting claims for the property and liability insurance companies of the study companies and the data of the Benford model.

9- There are no statistically significant differences between the data of Foreign reinsurance claims for the property and liability insurance companies of the study companies and the data of the Benford model.

10- There are no statistically significant differences between the data of local reinsurance claims issued by the property and liability insurance companies of the study companies and the data of the Benford model.

11- There are no statistically significant differences between the total claims data of the property and liability insurance companies of the companies under study and the Benford model data.

12- There are no statistically significant differences between the Foreign reinsurance claims data of the property and liability insurance companies of the companies under study and the Benford model data.

13- There are no statistically significant differences between the local reinsurance claims data of the property and liability insurance companies of the companies under study and the Benford model data.

14- There are no statistically significant differences between the net operations data of claims for the property and liability insurance companies of the companies under study and the Benford model data.

15- The validity of the first hypothesis of the study was accepted and there are no statistically significant differences between the actual data of the fire branch premiums of the companies under study and the probabilities of the Benford distribution.

16- The validity of the second hypothesis of the study was accepted, and there are no statistically significant differences between the actual data of fire branch claims for the companies under study and the probabilities of the Benford distribution.

5/2 Recommendations

1- The necessity of using the Benford model to verify the accuracy of data by applying it to other insurance company branches.

2- The Financial Regulatory Authority should rely on the Benford model to verify the accuracy of insurance company data.

3- Rely on the Benford model to verify the validity of data at the level of the company's branches and regions.

4- Benefit from the results of the Benford model in reducing deviations between the company's actual results and the Binford model.
5- Rely on the results of the Benford model in reducing fraud and claims leakage in insurance companies.

6. references

First, Arabic references

1- Abdel-Samee, Muhammad, Standard and statistical analysis of economic relations: A modern introduction using SPSS, University House for Publishing and Distribution, 2011.

2- Hamwi, Khalil and others, the role of using Benford's law in detecting fraud in financial statements: An applied study, Al-Baath University Journal, Economic Sciences Series, Al-Baath University, Vol. 43, No. 19, 2021.

3- Mustafa, Nasser Faraj, Using Benford's law as a tool for auditors in early detection of fraudulent practices and earnings management - An applied study on the Egyptian banking sector, Accounting and Auditing Journal, Faculty of Commerce, Beni Suef University, 2019

4- Al-Tamimi, Abbas Hamid Yahya Hassan, and others, Using Benford's law in detecting earnings management - applied to a sample of companies listed on the Iraq Stock Exchange, Scientific Abstracts Database, Faculty of Administration and Economics, University of Baghdad, 2013.

5- Al-Naghi, Mahmoud Al-Sayed and others, The effect of the sectorial specialization of the external auditor in detecting fraud and improving the quality of auditing "A field study in the Central Auditing Organization, Scientific Journal of Financial and Commercial Studies and Research, Sadat City University, Faculty of Commerce, Issue No. 1, March 2023

6- Murad, Angie Farouk Ahmed, The extent of the possibility of using Benford's Law in verifying the quality of matching data contained in the financial statements of insurance companies operating in the Egyptian market, Journal of Financial and Commercial Studies, Faculty of Commerce, Beni Suef University, 2022

7- Lakhdar Larous, Yahya Saidi, The possibility of using Benford's Law in early detection of errors and fraud in accounting and financial data, a case study of the customer account for Algerian Water, Journal of Law and Human Sciences, University of Ziane Ashour, Algeria, 2016

8- Salem, Sherine Ali Ibrahim, Using Benford's analysis to detect fraudulent accounting practices in financial reports, Scientific Journal of Commercial and Environmental Studies, Faculty of Commerce, Suez Canal University, 2016.

Second: Foreign references

1. Asllani,Arben and Manjola Naco,Using Benford’s Law for Fraud Detection inAccounting Practices ,Journal of Social Science Studies 2014, Vol. 1, No. 2
   Available of: http://www.isicenter.org/fulltext/paper-31052015160558.pdf
2. Beneish, Messod D,,"Earnings Management: A Perspective "Working Paper, Indiana University,April 2001, Available at : http://papers.ssrn.com/sol3/papers.cfm?abstract_id=269625
3. Benford, Frank (1938), "The law of anomalous numbers", Proceedings of the American Philosophical Society. Vol 78, No (4). Balkaoui, Ahmed,

(2002), "Accounting Theory", 4th ed., Business Press-Thomson learning, USA.
4. Carslaw, Charles A.; “Anomalies in Income Numbers: Evidence of Goal Oriented Behavior”, The Accounting Review, Volume 63, No. 2, 1988.
5. Chang , Juan C. ,study of BENFORD'S LAW, with applications to the analysis of corporate financial statements, Submitted in Partial Fulfillment of the Requirements for the Degree of Master of Science, The Pennsylvania State University,2017
6. Dechow, Patricia M. & Schrand, Catherine M), "Earnings Quality" The Research Foundation of CFA Institute. , (2004)
7. Durtschi, Cindy, William Hillison, and Carl Pacini "The effective use of Benford’s law to assist in detecting fraud in accounting data". Journal of forensic accounting, Vol5, No 1,(2004).
8. Goldmann, Peter; " Fraud in the Markets: Why It Happens and How to Fight It"; John Wiley and Sons; First Edition, 2010.
9. Goldmann, Peter; Kaufman, Hilton; "Anti-Fraud Risk and Control Workbook"; John Wiley and Sons; First Edition, 2009.
10. Grabiński, K, & Paszek, Z"Examining Reliability of Large financial Datasets using Benford's Law", Economic Themes, Vol51, No3, (2013).
11. Graham, Lynford & D. R. Carmichhael & O. RAY Whittington, (2007), "Financial Accounting and General Topics", John Wiley & Sons.
12. Grammatikos,T. and Papanikolaou Nikolaos (2015) Applying Benford’s law to detect fraudulent practices in the banking industry.Working Paper. Luxembourg School of Finance, Luxembourg.
13. Hill, T. P., & Fox, R. F"Hubble’s Law Implies Benford’s Law for Distances to Galaxies". Journal of Astrophysics and Astronomy, Vol 37, (2016).
14. Hillison, William & Cindy Durtschi & Carl Pacini, (2004), "The Effective Use of Benford's Law to Assist in Detecting Fraud in Accounting Data", Journal of Forensic Accounting 1524-5586 Vol V (2004), pp. 17-34.
15. Hopwood, William. S, & Jay J. leiner & George R, Young, (2008),"forensic accounting", McGraw-Hill companies.
16. Johnson, Gary C"Using Benford’s Law to Determine if Selected Company Characteristics are Red Flags for Earnings Management", Journal of Forensic Studies in Accounting and Business, (2009).
17. Johnson, Peter; “Fraud Detection with Benford’s Law”, Accountancy Ireland, Institute of Chartered Accountants in Ireland, 2005.
18. Khosravani, A. & Rasinariu, R, (2016). "Characterization of Benford variables and their numerical simulations". 5th Annual international conference on computational Mathematics, Computational Geometry &statistic.
19. Krakar, Zdravko; Zgela, Mario; “Application of Benford’s Law in Payment Systems Auditing”, Journal of Information and Organizational Sciences, Volume 33, No. 1 , 2009.

20. Lambert, Jackie; “Detecting Fraud Using Benford’s Law”, July, 2006. www.data-mines.com
21. Larsen, James E., Benford’s Law and Earnings Management Detection: The Case of REITs, Journal of Forensic & Investigative Accounting, Volume 9: Issue 2, 2017
22. Lee, James J.W. Fraud Detection using Benford’s Law, ISACA- SG, 2015.
23. Mark G. Simkin, , "Using Spreadsheets and Benford's Law to Test Accounting Data", ISACA Journal, Vol 1,(2010)
24. Mcmillan, Edward J.; "Prevention Fraud in Nonprofit Organizations", John Wiley & Sons, Inc., First Edition, 2006.
25. Mulford, Charles W. & Comiskey, Eugene E, (2002), "The Financial Numbers Game Detecting Creative Accounting Practices", John Wiley&Sons.
26. Nadine Lybaert, Mieke Jans &Raf Orens (2005), Provisions: A tool for Earnings Management?" Available on: http://doclib.uhasselt.be/ bitstream/1942/7879/1/paperEAA_provisions.doc
27. Nigrini, M.J., 1994. Using digital frequencies to detect fraud. Fraud Magazine, the White Paper Index 8, 3-6.
28. Nigrini, M.J., 1996. A taxpayer compliance application of Benford’s Law. Journal of the American Taxation Association 18, 72-91.
29. Nigrini, M.J., 2005. An assessment of the change in the incidence of earnings management around the Enron-Andersen episode. Review of Accounting and Finance 4, 92-110.
30. Nigrini, M.J., Mittermaier, L.J., 1997. The Use of Benford’s Law as an aid in analytical procedures. Auditing: A Journal of Practice and Theory 16, 52-67.
31. Nigrini, Mark J.; Mittermaier, Linda J.; “The Use of Benford’s Law as an Aid in Analytical Procedures”, Auditing: A Journal of Practice & Theory, Volume 16, No. 2, 1997.
32. Nigrini, Mark; “I’ve Got Your Number – How a mathematical phenomenon can help CPAs uncover fraud and other irregulaities”, Journal of Accountancy, May 1999.
33. Peterson, Bonita; Zikmund, Paul; “10 Truths You Need to Know About Fraud”; Strategic Finance Magazine; Vol. 85 Issue 11, May,2004
34. Ronser, R, "Earnings Manipulation in failing firms contemporary" Accounting Research, Vol. 20, No 2.2003.
35. Saville A.,Using Benford’s Law to detect data error and fraud: An examination of companies listed on the Johannesburg Stock Exchange, South African Journal of Economic and Management Sciences (SAJEMS) • September 2006
36. Scholten ,Sander ,Earnings management and Big Bath Accounting during the financial crisis: a case study of European listed companies with a focus on the Netherlands,Amsterdam Business School,2013

37. Schroeder, Richard G & myrtle W. clark& jack M. cathey, (2009)"financial accounting theory and analysis: text and cases", John Wiley&Sons.
38. Stambaugh ,Clydet, and others "Using Benford analysis to detect fraud, internal auditing, May-June 2012
39. Sugiarto, T., Application of First Digits 'Benford' Law: A Case Study of an Indonesian Company, International Journal of Management & Organizational Studies Volume 5, Issue 2, June, 2016
40. Tilden, C., Janes,T.,2006. Empirical evidence of financial statement manipulation during economic recessions. Journal of Finance and Accountancy.
41. Vona, Leonard W. ; "Fraud Risk Assessment: Building a Fraud Audit Program" ; John Wiley and Sons; First Edition, 2008.
42. Wells, Joseph; "Corporate Fraud Handbook – Prevention and Detection", John Wiley & Sons, Inc., Second Edition, 2007.
43. Parnes, D "Banks' off–balance sheet manipulations". Quarterly Review of Economics and Finance, . (2022)..