Chapter 20.

APPLICATION OF BENFORD'S LAW TO DETECT FRAUD IN THE NON-LIFE INSURANCE INDUSTRY: SOME RESULTS FROM SERBIA

We consider data from financial statements for 2022 for four insurance companies that operate in the non-life insurance industry sector in Serbia, with the aim to detect possible irregularities and fraud. Financial reporting is a subject to manipulative reporting, in order to improve the image of the business. As the insurance sector faces with many types of risks, where the some of them are the risks of fraud and data manipulations, Benford's law may be applied over these data.[557] It has become increasingly possible to analyze large amounts of data to detect trends, with the improvements in technology over the last decade. Hence, the use of Benford's law has now become feasible. The purpose of this research is to determine whether the data in financial statements (balance sheets and income statements) of the four insurance companies conforms to Benford's law. The study will answer on one main question: through testing the first digit and the second digit by Benford's law, is there any manipulation (fraud) practiced by insurance companies?

1. THEORETICAL FRAMEWORK OF BENFORD'S LAW

Benford's law is known as "first digit phenomenon". It is in general a complex mathematical method which can be applied to detect irregularities in a large data set. The law claims that many numerical sets follow the trend that first digits 1-9 appears with decreasing logarithmic distribution, what is in the contradiction with our intuition, where we expect uniform distribution. The number 1 would appear about 30% of the time, while digit 9 would appear less then 5% of the time. Hill[558] in 1995 used this law for test of errors and fraud. Nigrini[559] confirmed in his paper application of the law for identification of

[557] Al-Rawashdeh, F., & Al Singlawi, O. (2016). The existence of fraud indicators in insurance industry: Case of Jordan. *International Journal of Economics and Financial Issues, 6*(S5), pp. 168-176.

[558] Hill, T. P. (1995). A statistical deviation of the significant digit law. *Statistical Scientist, 10*(4), pp. 354-363.

[559] Nigrini, M. J. (1999). I've got your number. *Journal of Accountancy, 187*(5), pp. 79-83.

manipulations in the financial statement and also in the field of accounting[560]. He suggested that there are two type of error risks: Type I or efficiency error is false positives error, when Benford shows nonconformance and data actually conforms, and Type II or effectiveness error is false negatives error, when Benford shows conformance and data actually does not conform. If the financial reports do not conform to Benford's law, that is the signal that these data may not be truly represented or they may have been manipulated, while nonconformance does not guarantee that problems exist in the underlying accounts or that fraud has occurred. Results of the Benford analysis should be used as an indicator that further investigation is needed.

Some authors confirmed that Benford's law is most effective in a situation with large data set, when data represents more than one distribution, with transactional data, when mean is greater than median and skewness is positive[561]. The data should have more small numbers than larger numbers, which implies that data should not be too clustered around its mean value. For instance, salary data does not conform to Benford's law because most people in the same organization are paid approximately the same amount[562]. There should be no built-in minimum or maximum values in the data, except for data that can only be positive numbers where minimum is zero, for instance, election results or population counts.

Also, limitations of Benford's law application are coded data, the numbers used as identification numbers or labels, such as social security numbers or bank account numbers, psychologically rounded numbers, perfectly uniform distributions and mathematical sequences like the square roots[563]. For further limitations of the Benford's law application see Durtschi et al. (2004)[564] and Nigrini (2012). Based on the research in probability theory Hill (1995)[565],

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560 Nigrini, M. J. (1996). A taxpayer compliance application of Benford's law. *The Journal of the American Taxation Association, 18*(1), p. 72.

561 Wallace, W. (2002). Assessing the quality of data used for benchmarking and decision-making, *Journal of Government Financial Management, 31*, pp. 16-22.

562 Nigrini M. J. (2012). *Benford's Law: Applications for forensic accounting, auditing, and fraud detection*. John Wiley & Sons.

563 Raimi, R. A. (1976). The first digit problem. *The American Mathematical Monthly, 83*(7), pp. 521-538.

564 Durtschi, C., Hillison W., Pacini C. (2004). The effective use of Benford's law to assist in detecting fraud in accounting data. *Journal of Forensic Accounting, 5*(1), pp. 17-34.

565 Hill, P.(1995). Base-invariance implies Benford's law. *Proceedings of the American Mathematical Society, 123*, pp. 887-895.

Pinkham (1961)[566] and Raimi (1969)[567] showed that Benford's distribution has the next characterisation: scale and base invariance[568] [569] and different data sources can be observed. As considered number of variables grow, the density function tends to a logarithm distribution. Also, data set collected from arbitrary samples provided from a variety of different distributions has the Benford distribution. As a powerful methodology in the audit field, the law were considered by Hill (1998)[570], Pinkham (1961), Raimi (1985)[571], Durtschi et al. (2004), Nigrini and Miler (2009)[572], Primbley (2014)[573], among others. There is a wide literature which contains a long list of refernces, for example see Alali and Romero (2013)[574] or Costa et al. (2013)[575].

The requirements for conformity with the Benford's law are that the data should represent the sizes of events, such as the populations of towns and cities, the flow rates of rivers, or the sizes of heavenly bodies, while financial examples include market values, companies' revenues, or daily trading volumes, suggested by Nigrini (2012). The first rigorous proof of Benford's law was

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[566] Pinkham, R. S. (1961). On the distribution of first significant digits. *The Annals of Mathematical Statistics, 32,* pp. 1223-1230.

[567] Raimi, H. A. (1969). The peculiar distribution of first digits. *Scientific American, 221,* pp. 109-121.

[568] Pietronero, L., Tosatti, E., Tosatti, V., & Vespignani, A. (2001). Explaining the uneven distribution of numbers in nature: The laws of Benford and Zipf. *Physica A, 293,* pp. 297-304.

[569] Whyman, G., Ohtori, N., Shulzinger, E., & Bormashenko, E. (2016). Revisiting the Benford law: When the Benford-like distribution of leading digits in sets of numerical data is expectable? *Physica A, 461,* pp. 595-601.

[570] Hill, T. P. (1998). The first digit phenomenon: A century-old observation about an unexpected pattern in many numerical tables applies to the stock market, census statistics and accounting data. *American Scientist, 86,* pp. 358-363.

[571] Raimi, R. A. (1985). The first digit phenomenon again. *Proceedings of the American Philosophical Society, 2,* pp. 211-219.

[572] Nigrini, S. J., & Miller, M. (2009). Data diagnostics using second-order tests of Benford's law. *Auditing: A Journal of Practice & Theory, 28*, pp. 305-324.

[573] Pimbley, J. M. (2014). Benford's law and the risk of financial fraud. *Risk Professional*, pp. 1-7.

[574] Alali, F. A., & Romero, S. (2013). Benford's law: Analyzing a decade of financial data. *Journal of Emerging Technologies in Accounting, 10,* pp. 1-39.

[575] De Costa, J. I., Travassos, S. K. de M., & Santos, J. (2013). Application of Newcomb-Benford law in accounting audit: a bibliometric analysis in the period from 1988 to 2011. *10th International Conference on Information Systems and Technology Management*, June 12-14, Sao Paulo, Brazil.

developed by Theodore Hill in 1995[576]. Based on the probability theory he proved that scale invariance implies base invariance and base invariance, in turn, implies the Benford's law. In the same paper Hill also expanded the law not only for the first digit but also to the others. For the first digit the law gives:

$$P(D_1(X) = d_1) = \log\ (1 + \frac{1}{d_1}), d_1 \in \{1, 2, \dots, 9\},$$

where $D_1(X)$ is a random variable representing the digit on the first position of the random variable X. The probabilities of occurrence for the higher-order digits up to the last digit are also derived, whereas higher-order digits appear with an equal probability of 0.1 which is identical to a uniform distribution:

$$P(D_k(X) = d_k) = \sum_{d_1=1}^{9} \sum_{d_2=0}^{9} \dots \sum_{d_{k-1}=0}^{9} \log\ (1 + \frac{1}{\sum_{i=1}^{k} 10^{k-i} d_i}).$$

In the above formula, $D_k(X)$ is a random variable representing the digit on the k-th position of the random variable X and d_k is the digit on that position, $d_k \in \{0, 1, \dots, 9\}$[577]. It is possible to extend Benford's law on the first k digits in the number. The appropriate formula is given in the paper Papić et al (2017)[578], and says that a random variable X follows Benford's law if and only if

$$P(D_1(X) = d_1, D_2(X) = d_2, \dots, D_k(X) = d_k) = \log\ (1 + \frac{1}{\sum_{i=1}^{k} 10^{k-i} d_i}),$$

for all $k \in N$, all $d_1 \in \{1, 2, \dots, 9\}$ and all $d_i \in \{0, 1, \dots, 9\}$, $i \geq 2$.

2. DATA AND RESEARCH METHOD

For examining reliability of the data in financial statements (balance sheet and income statement) in this chapter, we use Benford's law. By testing the first digit and the second digit of the observations that are extracted from the

[576] Hill, T. P. (1995). The significant digit phenomenon. *The American Mathematical Monthly, 102,* pp. 322-327.

[577] Jovšić, H., & Žmuk, B. (2021). Assessing the quality of Covid-19 data: evidence from Newcomb-Benford law. *Facta Universitatis, Series: Economics and Organization*, pp. 135-156.

[578] Papić, M., Vudrić, N., & Jerin, K. (2017). Benfordov zakon i njegova primjena u forenzičkom računovodstvu. *Zbornik sveučilišta Libertas, 1*(1-2), pp. 153-172.

financial statements for the four insurance companies in Serbia, the manipulations existence is evaluated. First, the numbers from the first digit will be tested with aim to show whether the frequencies are in accordance or not by Benford's law. There is an indication for management manipulation when the observations frequency is not compatible with the law. Second, manipulations through the rounding up or down will examine the numbers that fall within the second digit of tested numbers from the balance sheet and income statement. The rounding-up process means that companies are bringing the results closer to a higher number. For example, when a company achieves an income of 49,999 millions, the second digit will be rounded up to 50 millions. This means that there is a large frequency of 0 and a small frequency of the number 9. The rounding-down process is on the contrary, i.e. the companies are trying to reduce their negative result. Therefore, the number 9 frequency is greater and the number 0 is also less than Benford's law applications.

This study was conducted for the four insurance companies in Serbia. From the financial statements of companies we took balance sheets and income statements for 2022. Two conditions are important for the application of the law: 1) the mean value must be greater than the median of the observation; 2) the skewness must be positive[579].

2.1. Statistical tests

For examining the statistical significance to validate distribution according to Benford's law, our analysis uses three statistical tests proposed by Nigrini (2012)[580] and de Costa et al. (2013)[581]: z-test, Chi-square test and Mean Absolute Deviation test (shortly MAD test). Those tests are complete different. The null hypothesis is that the distribution is in accordance with the Benford's law, while the alternative is that the distribution is not in accordance with the law. The researcher determines the significance level before investigation. All calculations will be given with 5% significance level. This means that there is a 5% risk of concluding that a difference exists when there is no actual difference (probability of Type I error). If we get *p*-value less than 5%, the number does

[579] Özarı, Ç., & Ocak, M. (2013). Detection of earnings management by applying Benford's law in selected accounts: Evidence from quarterly financial statements of Turkish public companies. *European Journal of Economics Finance and Administrative Sciences, 59*(4), pp. 37-52.

[580] Nigrini (2012), op. cit.

[581] De Costa et al. (2013), op. cit.

not correspond to the Benford's law frequency and if the p-value is greater than or equal to 5%, this indicates that it is consistent with the law.

Z-statistic checks whether the "individual distribution" significantly differs from the expected Benford's law distribution. The formula is given with the next equation:

$$Z_i = \frac{|p_{oi} - p_i| - \frac{1}{2n}}{\sqrt{\frac{p_i(1-p_i)}{n}}}$$

where Z_i is Z-statistic for the digit i ($i = 1, 2, \ldots, 9$ for the first digit and $i = 0, 1, \ldots, 9$ for the second digit), p_{oi} is the observed frequency proportion of the digit i, p_i is the expected frequency proportion of the digit i according to the Benford's law, n is the number of observations of the examined variable, the term $\frac{1}{2n}$ is Yates' correction factor and it is used when it is smaller then the absolute difference $|p_{oi} - p_i|$ in the numerator. If the value of Z-statistic exceeds the critical value 1.96, the null hypothesis is rejected at 5% of significance level.

Chi-square statistic is used to test whether the "whole distribution" of the observed frequencies of the first and the second digit differs from the expected distribution under the Benford's law. While z-test tests each digit separately, this test is conducted over all digits at the same time (simultaneously), and that is its advantage. If the test rejects the null hypothesis then this is a signal for data manipulation and it is recommended to look deeper into the data. The Chi-square statistic is calculated as is shown in the next formula:

$$\chi^2 = \sum_{i=1}^{K} \frac{(O_i - E_i)^2}{E_i} = n \sum_{i=1}^{K} \frac{(p_{oi} - p_i)^2}{p_i}$$

where O_i is the observed frequency of the digit i, E_i is the expected frequency of the digit i implied by the Benford's law ($E_i = np_i$) and K represents the number of bins (9 for testing of first digit and 10 for testing the second digit). The number of degrees of freedem for statistic χ^2 is $K - 1$. The observed value of Chi-square test statistic is compared to a critical value and the higher it is, the more data deviates from the Benford's law. As for Z-statistic, we also use 5% significance level, and critical values for the first digit and the second digit tests are 15.507 and 16.919, respectively. Once they exceed, the null hypothesis is rejected.

There is also the Mean Absolute Deviation (MAD) test. This test ignores the dataset size and thus it is indicated to large databases, as opposite as previous ones[582]. It is mathematically expressed as:

$$MAD = \frac{1}{n}\frac{\sum_{i=1}^{K}|O_i - E_i|}{K} = \frac{\sum_{i=1}^{K}|p_{oi} - p_i|}{K}$$

where O_i, E_i, p_{oi}, p_i, K, i and n were introduced earlier. There are no objective critical scores for the MAD test. Nigrini[583] sugested critical scores for conformity, for nonconformity, and for some in-between categories based on personal experience. For the first digit, range between 0.000 to 0.006 refers to close conformity, range between 0.006 to 0.012 refers to acceptable conformity, range between 0.012 to 0.015 refers to marginally acceptable conformity, and range above 0.015 refers to nonconformity. While, for the second digit, range between 0.000 to 0.008 refers to close conformity, range between 0.008 to 0.010 refers to acceptable conformity, range between 0.010 to 0.012 refers to marginally acceptable conformity, and range above 0.012 refers to nonconformity. We will conduct testing with z and Chi-square tests. In some cases we will calculate MAD statistic, to confirm the previous results.

3. RESULTS

First, we give descriptive statistics for four considered companies, to check two conditions which have to be meet to apply Benford's law on financial statements data. First, the mean value must be greater than the median of the observations. Second, the skewness must be positive[584]. As shown in the Table 1, the both conditions are satisfied.

Table 1. Descriptive statistics for the four considered companies

Company	Mean	Median	Skewness	*N*
I	5,291,038.671	1,029,818.00	3.275	149
II	2,206,095.427	382,484.00	3.178	143
III	5,622,980.058	619,015.00	3.572	138
IV	3,938,823.083	644,350.50	3.359	132

Source: Authors' calculations

[582] Nigrini (2012), op. cit.

[583] Ibid

[584] Özarı & Ocak (2013), op. cit.

3.1. Testing first digit

Tables from 2-5 demonstrate testing first digit (with z test) of four considered insurance companies reported in the balance sheets and income statements.

In Table 2 is presented result for the Company I. The observed value of the Chi-square test statistic is 8.471 and it is less than the critical value (which is 15.507, 8 degrees of freedom). This means that there is no evidence of manipulations in the financial report for this company for the first digit.

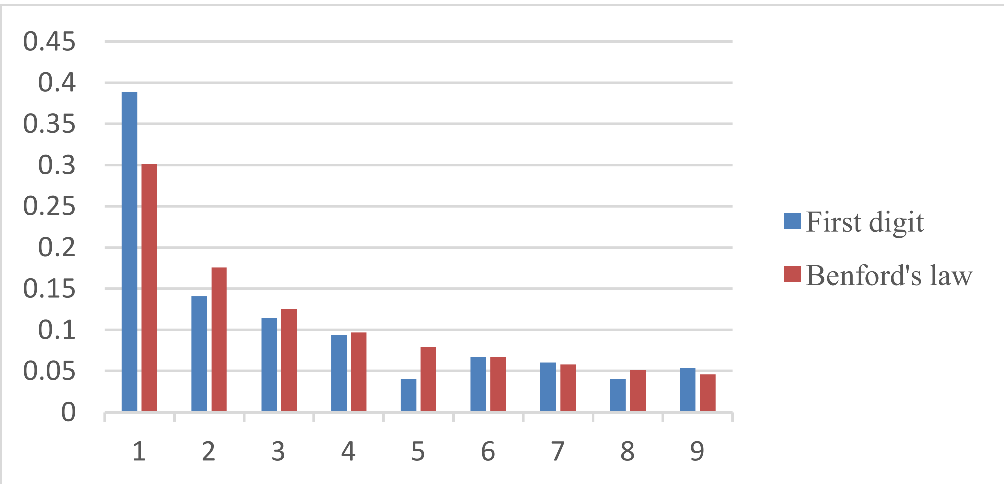
When we use *z* test, the only number that is not consistent and statistically significant is 1. The number 1 shows the greater recurrence than expected according to Benford's law, the difference reached 8.826%. This means that more attention should be paid to this number. But if we use significance level 0.01, we can conclude that there is no evidence that "individual distribution" significantly differs from the expected Benford's law distribution (because all realized values are less than critical value 2.575).

Table 2. Distribution of the first digit in Company I

Number	1	2	3	4	5	6	7	8	9
Observed Prop.(%)	38.926	14.094	11.409	9.396	4.027	6.711	6.04	4.027	5.369
Expected Prop.(%)	30.1	17.61	12.49	9.69	7.92	6.7	5.8	5.12	4.58
Absolute Deviation Rate(%)	8.826	3.516	1.081	0.294	3.893	0.011	0.240	1.093	0.789
Z-statistic	2.259*	1.019	0.275	0.121	1.608	0.005	0.125	0.419	0.264

Source: Authors' calculations

Figure 1. First digit vs Benford's law frequency for Company I



Source: Authors' calculations

Figure 1 presents frequencies of the first digit vs Benford's law, in Company I.

In Table 3 is presented result for the Company II. The observed value of the Chi-square test statistic is 22.84 and is greater than the critical value (15.507, at 8 degree of freedom). This indicates the possibility of manipulation in the financial report for this company in a first digit. This is also confirmed by the MAD test (MAD=0.032), which also shows the nonconformity with Benford's law.

When we use *z* test, the only number which is not consistent and statistically significant is 5. The number 5 shows the greater recurrence than expected according to Benford's law, the difference reached 8.863%. This means that more attention should be paid to this digit.

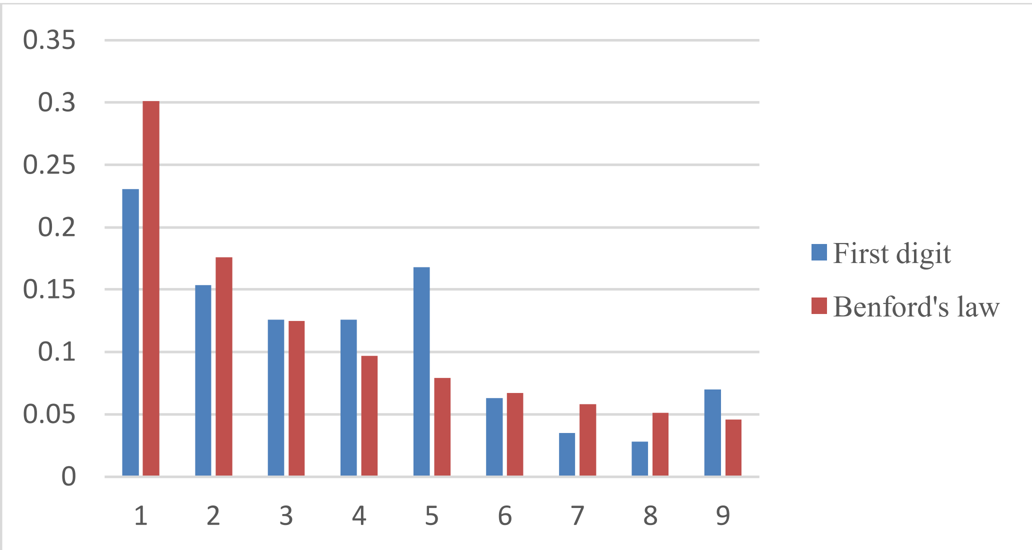
Table 3. Distribution of the first digit in Company II

Number	1	2	3	4	5	6	7	8	9
Observed Prop.(%)	23.077	15.385	12.587	12.587	16.783	6.294	3.496	2.79	6.99
Expected Prop.(%)	30.1	17.61	12.49	9.69	7.92	6.7	5.8	5.12	4.58
Absolute Deviation Rate(%)	7.023	2.225	0.097	2.897	8.863	0.406	2.304	2.33	2.41
Z-statistic	1.739	0.589	0.035	1.03	3.779*	0.027	0.999	1.07	1.18

Source: Authors' calculations

Figure 2 presents frequencies of the first digit vs Benford's law, in Company II.

Figure 2. First digit vs Benford's law frequency for Company II



Source: Authors' calculations

In Table 4 is presented result for Company III. The observed value of the Chi-square test statistic is 7.549 and is less than the critical value (15.507, at 8 degree of freedom). This means that there is no evidence of manipulations in the financial report for this company for the first digit.

When we use *z* test, the only number that is not consistent and statistically significant is 1. The number 1 shows the less recurrence than expected according to Benford's law, the difference reached 8.361%. This means that more attention should be paid to this figure. But if we use significance level 0.01, we can conclude that there is no evidence that "individual distribution" significantly differs from the expected Benford's law distribution ((because all realized values are less than critical value 2.575).

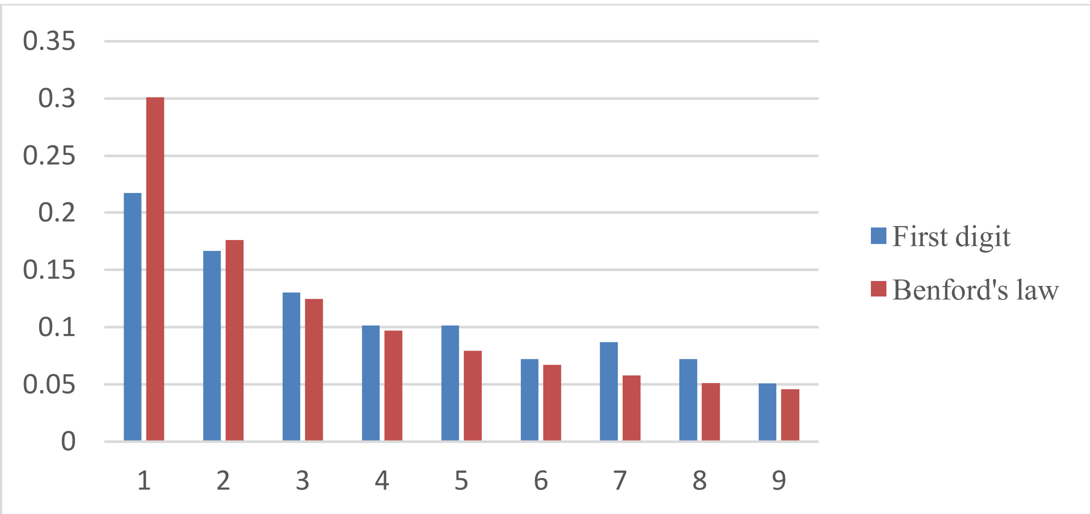
Table 4. Distribution of the first digit in Company III

Number	1	2	3	4	5	6	7	8	9
Observed Prop.(%)	21.739	16.667	13.043	10.145	10.145	7.246	8.696	7.25	5.07
Expected Prop.(%)	30.1	17.61	12.49	9.69	7.92	6.7	5.8	5.12	4.58
Absolute Deviation Rate(%)	8.361	0.943	0.553	0.455	2.225	0.546	2.896	2.13	0.49
Z-statistic	2.048*	0.179	0.068	0.037	0.810	0.086	1.273	0.94	0.07

Source: Authors' calculations

Figure 3 presents frequencies of the first digit vs Benford's law, in Company III.

Figure 3. First digit vs Benford's law frequency for Company III



Source: Authors' calculations

In Table 5 is presented result for Company IV. The observed value of the Chi-square test statistic is 16.413 and is greater than the critical value (15.507, at 8 degree of freedom). This indicates the possibility of manipulation in the financial report for this company for the first digit. This is also confirmed by the MAD test (MAD=0.03), which also shows the nonconformity with Benford's law.

When we use *z* test, the only number that is not consistent and statistically significant is 2. The number 2 shows the greater recurrence than expected according to Benford's law, the difference reached 8.148%. This means that more attention should be paid to this figure. But if we use significance level 0.01, we can conclude that there is no evidence that "individual distribution" significantly differs from the expected Benford's law distribution (because all realized values are less than critical value 2.575).

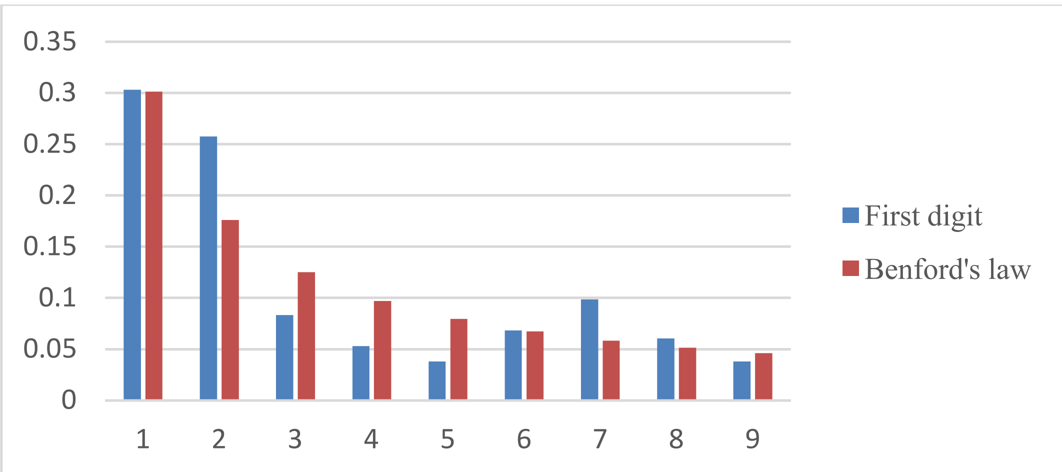
Table 5. Distribution of the first digit in Company IV

Number	1	2	3	4	5	6	7	8	9
Observed Prop.(%)	30.303	25.758	8.333	5.303	3.788	6.818	9.848	6.061	3.788
Expected Prop.(%)	30.1	17.61	12.49	9.69	7.92	6.7	5.8	5.12	4.58
Absolute Deviation Rate(%)	0.203	8.148	4.157	4.387	4.132	0.118	4.048	0.941	0.792
Z-statistic	0.051	2.343*	1.313	1.557	1.597	0.054	1.804	0.293	0.227

Source: Authors' calculations

Figure 4 presents frequencies of the first digit vs Benford's law, in Company IV.

Figure 4. First digit vs Benford's law freqency for Company IV



Source: Authors' calculations

3.2. Testing second digit

Tables from 6-9 demonstrate testing second digit (with z test) of four considered insurance companies reported in the balance sheets and income statements.

Table 6 presents result for the Company I. The observed value of the Chi-square test statistic is 15.488 and it is less than the critical value (16.919, at 9 degree of freedom). This means that there is no evidence of manipulations in the financial report for this company for the second digit.

When we use *z* test, the only number that is not consistent and statistically significant is 5. Table 6 shows that the number 5 has greater frequency than expected by 5.095%, and it is statistically significant. This means that more attention should be paid to this digit. Also, this Table shows the number 0 has greater frequency than expected by 0.782%, but it is not statistically significant. The number 9 shows a decrease from the expected frequency of 2.46%, but also it is not statistically significant. This result means that this insurance company do not round-up or down the financial report. We can also use significance level 0.01. In that case, we confirm that the number 5 is not statistical significant (because realized value is less than critical value 2.575).

Table 6. Distribution of the second digit in Company I

Number	0	1	2	3	4	5	6	7	8	9
Observed Prop.(%)	12.752	16.778	6.711	12.080	10.738	14.765	6.04	8.725	5.369	6.04
Expected Prop.(%)	11.97	11.39	10.88	10.43	10.03	9.67	9.34	9.04	8.76	8.50
Absolute Deviation Rate(%)	0.782	5.388	4.169	1.650	0.708	5.095	3.30	0.315	3.391	2.46
Z-statistic	0.168	1.942	1.502	0.525	0.151	1.966*	1.243	0.134	1.319	0.93

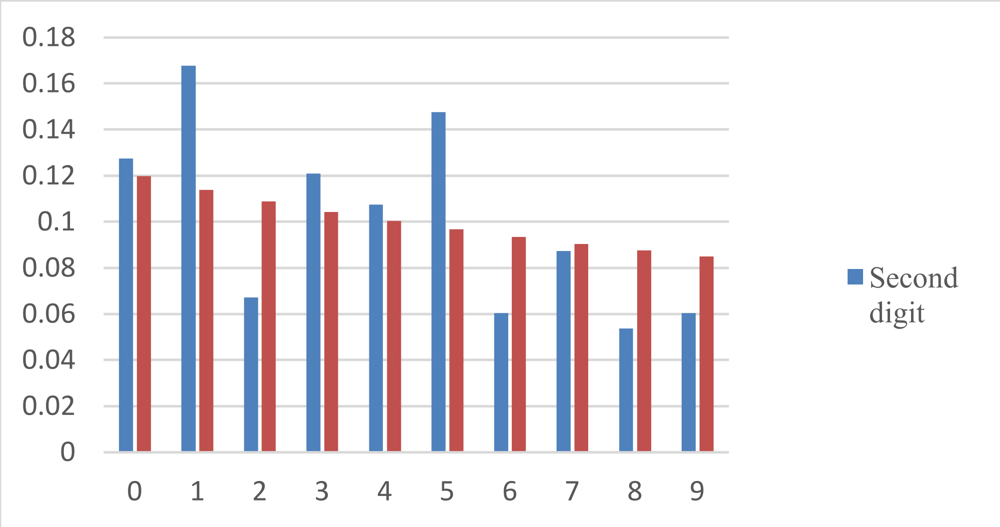
Source: Authors' calculations

Figure 5 presents frequencies of the second digit vs Benford's law, in Company I.

Table 7 presents result for Company II. The observed value of the Chi-square test statistic is 9.362 and it is less than the critical value (16.919, at 9 degree of freedom). This means that there is no evidence of manipulations in the financial report for this company for the second digit.

When we use *z* test, the only number that is not consistent and statistically significant is 7. This Table shows that the number 7 has a less frequency than expected by 5.544%, and it is statistically significant. This means that more attention should be paid to this digit. We can also use significance level 0.01. In that case, we confirm that the number 7 is not statistical significant (because realized value is less than critical value 2.575).

Figure 5. Second digit vs Benford's law frequency for Company I



Source: Authors' calculations

Also, Table 7 shows the number 0 has greater frequency than expected by 3.415%, but it is not statistically significant. The number 9 shows an increase from the expected frequency of 1.29%, but also not statistically significant. This result means that this insurance company does not round-up or down numbers in the financial report.

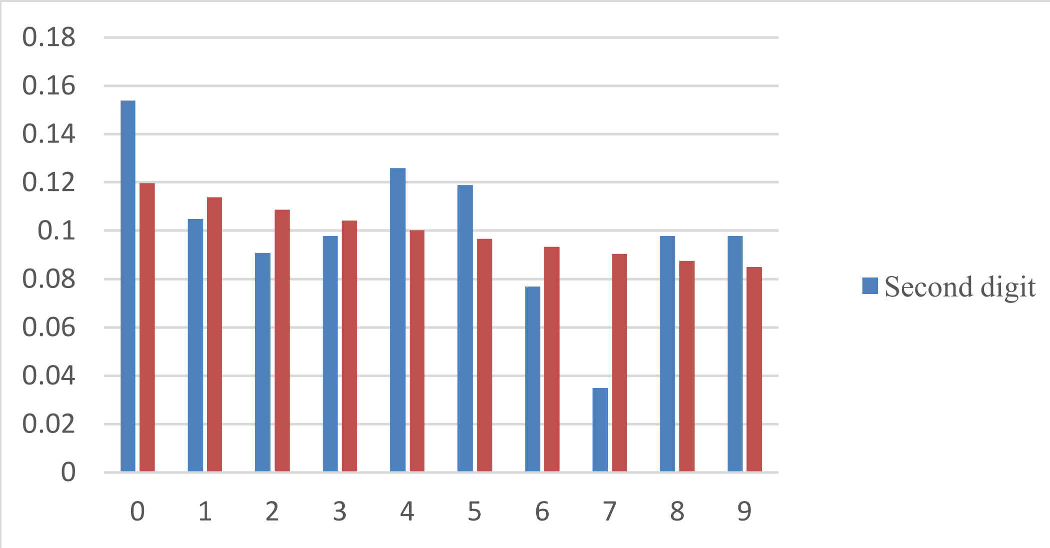
Table 7. Distribution of the second digit in Company II

Number	0	1	2	3	4	5	6	7	8	9
Observed Prop.(%)	15.385	10.489	9.091	9.790	12.587	11.888	7.692	3.496	9.79	9.79
Expected Prop.(%)	11.97	11.39	10.88	10.43	10.03	9.67	9.34	9.04	8.76	8.50
Absolute Deviation Rate(%)	3.415	0.901	1.789	0.64	2.557	2.218	1.648	5.544	1.03	1.29
Z-statistic	1.129	0.207	0.553	0.113	0.879	0.756	0.533	2.17*	0.288	0.40

Source: Authors' calculations

Figure 6 presents frequencies of the second digit vs Benford's law, in Company II.

Figure 6. Second digit vs Benford's law frequencies for Company II



Source: Authors' calculations

Table 8 presents result for Company III. The observed value of the Chi-square test statistic is 7.736 and it is less than the critical value (16.919, at 9 degree of freedom). This means that there is no evidence of manipulations in the financial report for this company for the second digit.

When we use *z* test, this Table shows the number 0 has a less frequency than expected by 3.999%, but it is not statistically significant. The number 9 shows a decrease from the expected frequency of 0.53%, but also not statistically significant. This result means that this insurance company does not round-up or down the numbers in the financial report.

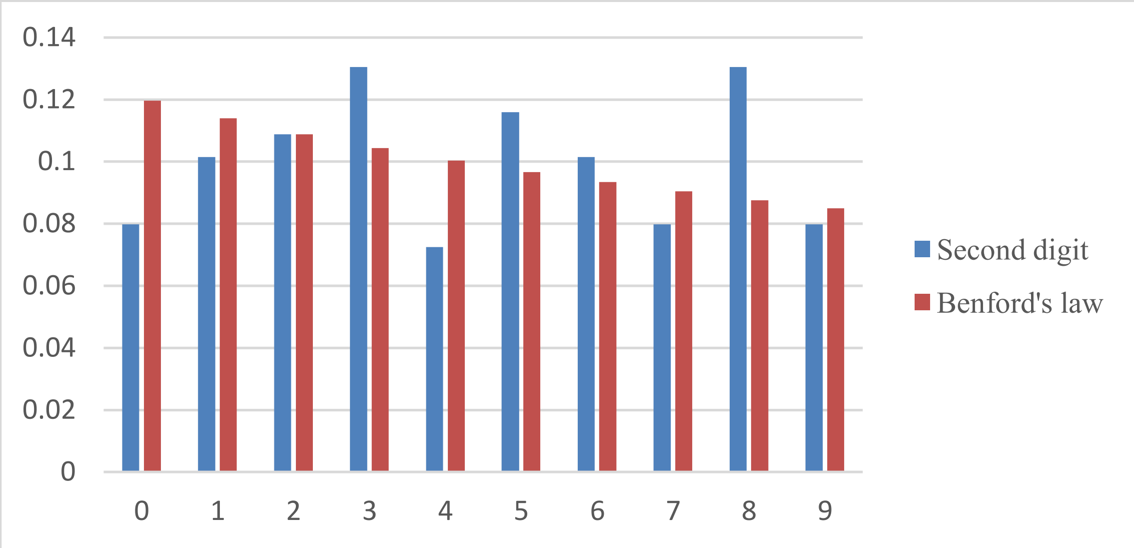
Table 8. Distribution of the second digit in Company III

Number	0	1	2	3	4	5	6	7	8	9
Observed Prop.(%)	7.971	10.145	10.869	13.043	7.246	11.594	10.145	7.971	13.04	7.97
Expected Prop.(%)	11.97	11.39	10.88	10.43	10.03	9.67	9.34	9.04	8.76	8.50
Absolute Deviation Rate(%)	3.999	1.245	0.011	2.613	2.784	1.924	0.805	1.069	4.28	0.53
Z-statistic	1.316	0.326	0.004	0.865	0.947	0.621	0.179	0.289	1.629	0.07

Source: Authors' calculations

Figure 7 presents frequencies of the second digit vs Benford's law, in Company III.

Figure 7. Second digit vs Benford's law frequency for Company III



Source: Authors' calculations

Table 9 presents result for Company IV. The observed value of the Chi-square test statistic is 13.497 and it is less than the critical value (16.919, at 9 degree of freedom). This means that there is no evidence of manipulations in the financial report for this company for the second digit.

When we use z test, this Table shows that the number 0 has a less frequency than expected by 4.394%, but it is not statistically significant. The number 9 shows an increase from the expected frequency of 5.14%, but also not statistically significant. This result means that this insurance company does not round-up or down the numbers in the financial report.

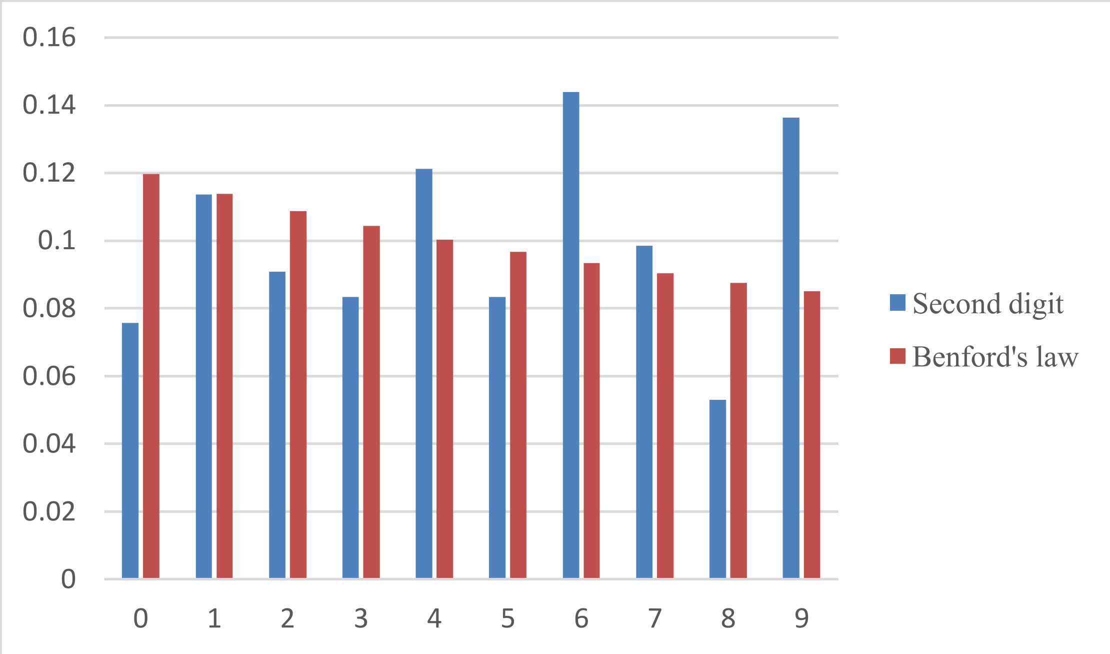
Table 9. Distribution of the second digit in Company IV

Number	0	1	2	3	4	5	6	7	8	9
Observed Prop.(%)	7.576	11.364	9.091	8.333	12.121	8.333	14.394	9.849	5.303	13.64
Expected Prop.(%)	11.97	11.39	10.88	10.43	10.03	9.67	9.34	9.04	8.76	8.50
Absolute Deviation Rate(%)	4.394	0.026	1.789	2.097	2.091	1.337	5.054	0.809	3.457	5.14
Z-statistic	1.421	0.009	0.660	0.646	0.655	0.372	1.846	0.172	1.251	1.959

Source: Authors' calculations

Figure 8 presents frequencies of second digit vs Benford's law, in Company IV.

Figure 8. Second digit vs Benford's law frequance for Company IV



Source: Authors' calculations

Looking at the financial statements of four companies operating in the non-life insurance industry sector in Serbia, we can generally conclude that there is no manipulative financial reporting. Sporadic cases show deviations, but this only indicates that further tests are needed to confirm agreement or disagreement with Benford's law.

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