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Benford's Law in the Forensic Analysis of Cash Flow Statements of Business Entities in Bosnia and Herzegovina

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Abstract

This paper examines the application of Benford's Law in the forensic analysis of cash flow statements of business entities in Bosnia and Herzegovina. Through empirical research, the following hypotheses were tested: increasing and decreasing items in cash flow statements follow Benford's Law, and there is no statistically significant difference in the first-digit distribution between increasing and decreasing items. The results show that decreasing items follow Benford's Law, while increasing items exhibit statistically significant deviations.

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Additionally, for most digits, no statistically significant difference was found between increasing and decreasing items, except for the digit 3. The findings indicate the need to educate auditors about the application possibilities of Benford's Law, as well as its wider use with the aim of reducing audit costs and increasing audit efficiency.

Keywords: *Forensic analysis, Financial statement audit, Cash flow statement, Benford's Law, Manipulation in cash flow data.*

1. Introduction

In recent times, the use of forensic analysis tools in the audit process of financial statements has become increasingly common. Although seemingly similar fields, forensic accounting and financial statement audit differ in many ways. In order to reduce certain limitations of financial statement audit—primarily cost constraints and reliance on the materiality threshold—methods of forensic analysis are being used more frequently in audits, especially among audit firms categorized as the *"Big Four."*

The research conducted in this paper aims to test the usability of Benford's Law, as a specific forensic tool, on a sample of financial statements of business entities that are subject to audit. Benford's Law is originally a mathematical tool but also a forensic method used to determine whether the examined financial statements contain unintentional errors or fraud. Benford primarily focused his research on the first digit in a data set, which is the law is also known as the First-Digit Law, although it can be applied to multiple digits in a dataset. Through this law, Benford established that the sequence of digits in a naturally occurring set of numbers appears with a certain probability. If deviations are identified, it serves as a warning that the numbers may have been falsified (Belak, 2011). Benford's Law emphasizes that fabricated or manipulated digits exhibit a slightly different pattern of occurrence in nature compared to valid or random digits. Therefore, Benford's Law can be used to detect irregularities in financial statements.

The relevance of the research topic is based on a preliminary review of the literature aimed at presenting existing knowledge in the field. A study by Milojević and Terzić (2020), conducted on 45 micro-enterprises in Serbia show that Benford's Law can be effectively

applied to detect fraud in financial statements, but only in combination with other techniques and models for proving financial statement fraud. Drawing conclusions solely from Benford's Law would be incorrect, as deviations in digit frequencies within the analyzed financial data may indicate employee error rather than intentional fraud. A study by Isaković-Kaplan, Demirović, and Proho (2021), conducted on a sample of 166 companies listed on the stock exchange in Bosnia and Herzegovina, tested the conformity of revenue and expense data from the income statements of these companies with Benford's Law, examining both first-digit and first-two-digit distributions. Based on the findings of these studies, the idea is the present research may contribute to the auditing profession and assist in detecting manipulations that are difficult to notice if auditors rely solely on the materiality threshold.

The structure of this paper consists of a literature review, research methodology, results and discussion, and concluding remarks accompanied by a list of references. The literature review explains the role, methods of preparation and presentation of cash flow statements, as well as the types of manipulations that appear in cash flow statements and the manner in which Benford's Law can be applied to cash flow data. While prior studies primarily focus on income statement data, empirical evidence on cash flow statements—particularly distinguishing between inflows and outflows—remains limited. The research will be conducted on a sample of increasing and decreasing items from cash flow statements. The research methodology is quantitative in nature, involving tests of conformity between cash flow statement data and Benford's Law, using descriptive statistics and statistical tests such as MAD, the z-test, the chi-square test, and the K–S test. The results of the empirical research are discussed with a focus on giving recommendations for future auditing practice.

2. Literature Review

The International Accounting Standard (IAS) 1 – Presentation of Financial Statements requires legal entities to prepare financial statements. According to IAS 1, financial statements provide a structured representation of an entity's financial position and financial performance, with the objective of supplying information about the entity's financial position, financial performance, and cash flows that is useful for decision-making by a wide range of users of financial statements (IFRS Foundation, 2017).

Additionally, IAS 7 – Statement of Cash Flows emphasizes that the cash flow statement, in combination with other components of the financial statements, provides information to users for assessment the changes in an entity's net assets, its financial structure (including

liquidity and solvency), and its ability to influence the amount and timing of cash flows to adapt to changing circumstances and opportunities. The cash flow statement is not only essential for creditors to determine a company's liquidity and solvency but also for management in financial management and short-term planning. Due to the significance of this statement and the information it provides, it also represents fertile ground for fraud in financial reporting.

The Association of Certified Fraud Examiners (ACFE) defines financial statement fraud as the intentional misrepresentation or recording of data that is misleading which, with all other available information, would cause a user of the financial statements to change their judgment or decision (Rezaee & Riley, 2014). According to the provisions of International Standard on Auditing (ISA) 240, frauds are classified into two types:

1) Misstatements resulting from fraudulent financial reporting
2) Misstatements due to misappropriation of assets (IFAC, 2009, 158)

The pressures to report falsely are numerous, and when it comes to the cash flow statement, management's aspiration will always be to show positive cash flow and efficient use of cash and cash equivalents, because an entity's ability to generate cash is the most important indicator of its success.

Fraud in the cash flow statement represents a specific category of financial statement fraud. Howard M. Schilit, author of Financial Shenanigans: How to Detect Accounting Gimmicks and Fraud in Financial Reports, classified these types of fraud into four categories:

1) Shifting inflows from the financing activities section into the operating activities section,
2) Shifting outflows from the operating activities section into the investing activities section.
3) Inflating cash flow from operating activities through acquisitions and divestitures.
4) Inflating cash flow from operating activities using unsustainable (other, non-recurring) activities. (Schilit, 2010)

Forensic accountants use a range of methods and techniques to efficiently and thoroughly analyze relationships between items in financial statements, thereby contributing to the detection and prevention of fraud. The purpose of the research in this paper is to examine

whether it is possible to identify indicators of manipulation in cash flows by looking solely at the first digit of reported increasing and decreasing items in the cash flow statements of companies in Bosnia and Herzegovina. Consequently, the main hypotheses, H1 and H2, of this research are defined as follows:

H1: Increasing and decreasing items in the cash flow statements of business entities in Bosnia and Herzegovina follow Benford's Law,
H2: There is no statistically significant difference in the first-digit distribution between increasing and decreasing items reported in the cash flow statements of business entities in Bosnia and Herzegovina.

Hypothesis H1 includes the following sub-hypotheses:

H1.1: The first digit of increasing items reported in the cash flow statements of business entities in Bosnia and Herzegovina follows Benford's Law.

H1.2: The first digit of decreasing items reported in the cash flow statements of business entities in Bosnia and Herzegovina follows Benford's Law.

Benford's Law is not merely a product of pure mathematical curiosity, it is also a tool that can be applied across a wide range of computer applications utilizing statistical databases to detect fraud. The tests conducted in this study are also used by the U.S. Internal Revenue Service (IRS) to detect tax evasion (Miller, 2017).

Considering that tax authorities worldwide use it as a tool for detecting fraud—where the input data are financial in nature—it can be concluded that using data from published financial statements of companies under analysis can provide insights into their fair and accurate presentation. The conditions that cash flow statement data must meet for the application of Benford's Law are as follows:

1) The figures in the statements should be at least four digits long. Simulations have shown that numbers should have four or more digits for good conformity with Benford's Law. However, if this requirement is not strictly met, the overall pattern does not necessarily break down. When numbers have fewer than four digits, there is only a slight bias toward lower digits. Therefore, as long as small two- or three-digit numbers are not excessively mixed with larger numbers, the bias is not significant enough to justify adjusting the

expected digit frequencies. Numbers with fewer than four digits are very rare in real financial data, as there may occasionally be small inflows or outflows, but these are typically significant enough to be recorded in the statements by accountants.

2) A sample of input data larger than 1,000 units is required. Thus, the analysis is considered valid only if the fraud examiner, based on the collected cash flow statements, ultimately has 1,000 or more inflows and 1,000 or more outflows from the cash flows.

3. Research Methodology

In this paper, a quantitative study was conducted to test hypotheses H1 and H2. An external data source was used—an online database of financial statements available from the stock exchange. The statistical variables employed in the quantitative data analysis were the increasing and decreasing items of the cash flow statements (which were expressed numerically, as they consist of financial data).

The terms “increasing” and “decreasing” items of the cash flow statement were used because business entities in Bosnia and Herzegovina are not legally or otherwise required to follow a specific method for preparing cash flow statements. Data collection revealed that most companies in the Federation of Bosnia and Herzegovina use the indirect method, while a few use the direct method, and all companies in the Republika Srpska use the direct method for preparing cash flow statements. IAS 7 (paragraph 18) requires that an entity report cash flows from operating activities using either the direct or indirect method.

The study considered business entities classified as medium and large enterprises under the Law of Accounting and Auditing, due to their obligation to prepare cash flow statements. Due to limited access to financial statements of companies in Bosnia and Herzegovina—including both entities, the Federation of Bosnia and Herzegovina and Republika Srpska—since financial reporting in Bosnia and Herzegovina is generally characterized by a lack of transparency, the empirical research used financial statements of companies listed on the Sarajevo Stock Exchange and the Banja Luka Stock Exchange. The data were processed using Excel and SPSS (Statistical Package for the Social Sciences).

The sample includes all business entities listed on the Sarajevo Stock Exchange that published financial statements for 2023 (total 133 companies), while 13 financial statements were taken from the Banja Luka Stock Exchange, also published for 2023. year. Additionally,

the sample includes 10 limited liability companies whose statements were obtained from their official websites. This resulted in a total of 156 cash flow statements. Among the limited liability companies, 7 were registered in the Federation of Bosnia and Herzegovina, while 3 were registered in Republika Srpska. Overall, 140 analyzed entities are registered in the Federation of Bosnia and Herzegovina, and 16 entities are registered in Republika Srpska. In total, 146 joint-stock companies and 10 limited liability companies were analyzed. In the sample, 112 entities prepared their cash flow statements using the indirect method, while 44 entities prepared their cash flow statements using the direct method.

The total increasing items within operating activities in the sample amount to 7,044,795,436.43 BAM, while the decreasing items of operating activities total 5,170,489,214.04 BAM. Regarding investing activities, the total increasing items are 868,412,481.20 BAM, and the decreasing items amount to 1,656,071,885.08 BAM. Finally, the increasing items of financing activities for the companies in the sample total 817,065,139.00 BAM, while the decreasing items amount to 1,468,547,755.57 BAM.

Benford's Law states that in many data sets (mathematical tables, real-world data, etc.), leading digits are not uniformly distributed but follow a specific logarithmic distribution. Specifically, Benford's Law is based on a logarithmic distribution, and the general formula for the first digit is:

$$P(d) = \log\left[1 + \frac{1}{d}\right], \text{ where } d \in (1,2,3\ldots 9).$$

In fact, the probability of the digit 1 appearing as the first digit is 30.10%. Similarly, the probabilities of the digits 2 through 9 appearing as the first digit are calculated using the same method. Using the same formula, the probability of the first two digits appearing can also be calculated, where d ∈ (10,11,13… 99).

The probability of each first digit can be presented in Table 1:

Table 1. Probability of the First Digit According to Benford's Law

Digit	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Probability (%)	30.1	17.6	12.49	9.69	7.91	6.69	5.79	5.11	4.57

Source: Benford (1938)

For the purpose of testing whether a given data distribution follows Benford's first-digit distribution, the conceptual framework of the research employs the following tests, according to Nigrini (2012):

- Z-test;
- MAD (Mean Absolute Deviation);
- Chi-square test;
- K–S (Kolmogorov–Smirnov) test.

The Z-test is used to assess whether the actual proportion of digits deviates from the expected proportion, with a "rule of thumb" threshold of 1.96. Accordingly, if the empirical Z-values exceed the critical value of 1.96 ($\alpha = 5\%$), this indicates a potential accounting fraud. As defined by Resić, Delalić, Balavac, and Abdić (2010), the Z-test is used to determine the relative position of a variable's modality within a series and it is suitable for comparing the position of data across different series.

Since the Z-test can treat even small deviations as significant in large data sets, the Mean Absolute Deviation (MAD) measure was used. MAD considers the absolute value of the difference between proportions, regardless of whether the value is positive or negative. A higher MAD indicates a larger average difference, although it should be noted that MAD does not generate objective critical values necessary for decision-making.

Drake and Nigrini (2000) provided specific guidelines for determining critical values and ranges for testing conformity with Benford's Law, which are presented in Table 2:

Table 2. Critical Values and Conclusions for MAD Values

Digit	Range	Conformity
First Digit	0.000 – 0.006	High
	0.006 – 0.012	Acceptable
	0.012 – 0.015	Marginally Acceptable
	Above 0.015	Non-Acceptable

Source: Drake and Nigrini (2000)

Next, the chi-square test is also used. The resulting chi-square value is compared with the critical value at the chosen significance level. A limitation of the chi-square test is that

conclusions based on small samples may not be reliable, making the test less useful for small data sets. To determine the critical value for the chi-square test, the Excel function `CHISQ.INV.RT` is used, which returns the inverse of the right-tailed one-way test, where the critical region is located at the right end of the distribution. The function requires two inputs: the significance level (probability), which in this study is 0.05 (α = 5%), and the degrees of freedom (k-1), where (k) is the number of observed groups (9 in this case), giving 9–1 = 8 degrees of freedom.

The K–S test (Kolmogorov–Smirnov test) is based on calculating the maximum deviation from the distribution predicted by Benford's Law. It is a nonparametric test used to verify whether the analyzed variable follows a specified theoretical distribution for samples larger than 50 observations. The p-value from the K–S test is considered statistically significant if it is less than 0.05; in this case, the hypothesis that the distribution of the analyzed variable conforms to the specified theoretical distribution is rejected.

Nigrini (2011), through a series of studies, identified recommended critical values for first-digit tests to be used in drawing conclusions. These values are presented in Table 3.

Table 3. Recommended Critical Values for Statistical Tests

Test	**First Digit**
MAD	0.015
Z-test	1.96
Chi-square	15.51
K–S test	0.0425 (increasing items) 0.0393 (decreasing items)

Source: Calculations Based on Nigrini (2011)

In general, it is well established that Benford analysis results are more reliable when the entire population is analyzed rather than a sample, because a larger number of transactions or items in the data set makes the analysis more representative (Durtschi et al., 2004). For accounting data to follow Benford's Law, an additional requirement is that the arithmetic mean is greater than the median and that there is positive skewness. Furthermore, the higher the ratio of the mean to the median, the closer the collected accounting data align with Benford's distribution (Wallace, 2002).

4. Results and discussion

Descriptive statistics for the variables increasing and decreasing items are presented in Table 4:

Table 4. Descriptive Statistics for Increasing and Decreasing Items

Descriptive Statistics	Condition	Increasing Items	Decreasing Items
N	> 1000	1,024	1,199
Mean	> Median	8,548,015.67	6,826,596.31
Median		260,691.50	352,311.00
Mode		1,000,000.00	50,000.00
Standard Deviation		37,064,808.19	24,047,641.69
Variance		1.374E+15	5.783E+14
Skewness	> 0	8.341	7.295
Standard Deviation of Skewness		0.076	0.0071
Kurtosis		86.99	67.25
Standard Deviation of Kurtosis		0.153	0.141
Minimum		1.00	1.00
Maximum		521,784,929.00	325,076,505.00

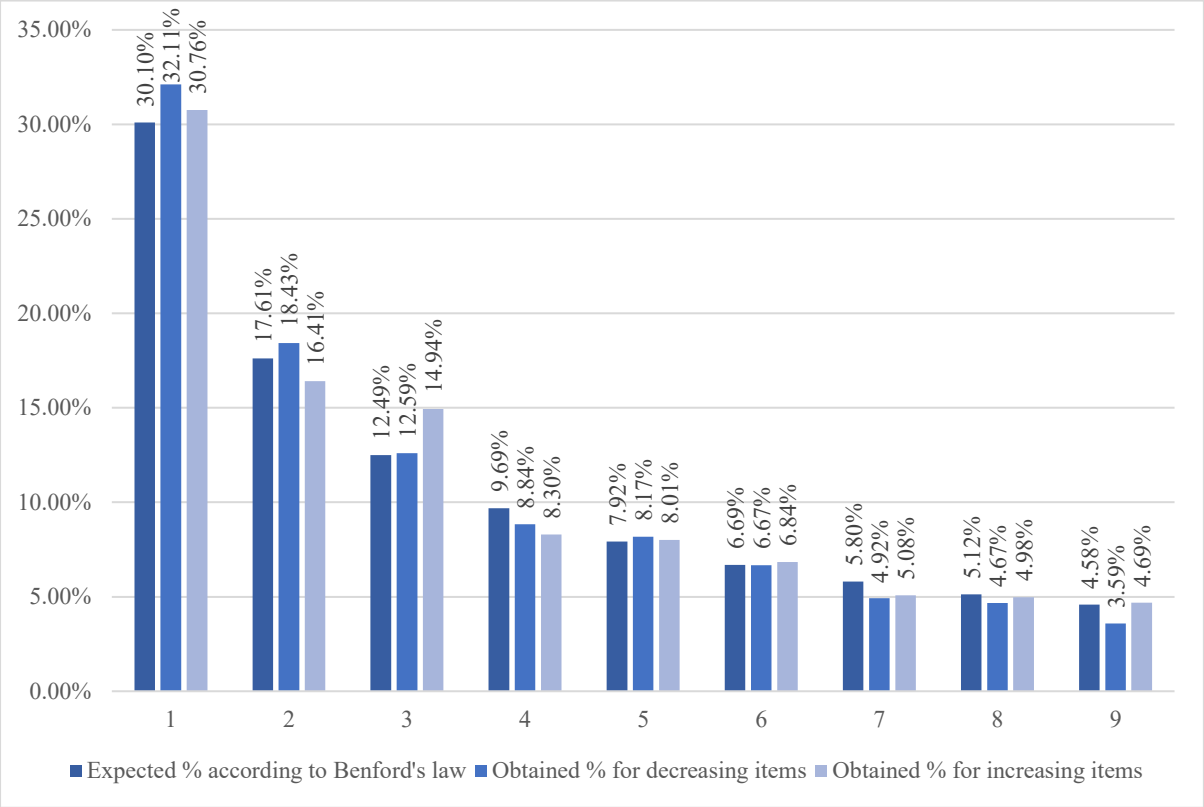
Source: Author's Calculations

The descriptive statistics in *Table 4* confirm that the conditions for applying Benford's Law are met, given that the number of increasing items is 1,024 and the number of decreasing items is 1,199. The arithmetic mean of the *increasing items* variable is greater than its median, and similarly, the arithmetic mean of the *decreasing items* variable is also greater than its median. The skewness measures for both variables are positive, indicating the suitability of applying Benford's Law.

Appendix 1 presents the calculations of MAD, Z-test, upper and lower bounds, chi-square, and K–S test for the first digit of increasing items in the cash flow statements from the sample. Appendix 2 contains the corresponding calculations for the first digit of decreasing items in the analyzed cash flow statements.

Figure 2 illustrates the expected versus observed frequency of the first digit for both decreasing and increasing items in the collected cash flow statements. At first glance, the deviations appear minor; however, as noted, they were formally verified using statistical tests.

Figure 2. Expected and Observed Frequency of the First Digit for Decreasing and Increasing Items



Source: Author's Calculations

Table 5 provides a summary of the obtained values from the conducted tests (MAD, Z-test, chi-square, and K–S test) for the first digit of increasing and decreasing items in the cash flow statements, and compares them with the critical values recommended by Nigrini (2011).

Table 5. Overview of Statistical Tests for Increasing and Decreasing Items – First Digit

Test	**Obtained Values – Increasing Items**	**Obtained Values – Decreasing Items**	**Critical Values According to Nigrini (2011)**
MAD	0.0691	0.0638	0.015
Z-test	0.0460 – **2.1566**	-0.0332 – 1.7727	1.96
Chi-square	8.9852	7.7263	15.51
K–S test	-0.0191 – 0.0054	-0.0294 – 0.0000	0.0425 (UV) 0.0393 (UM)

Source: Author's Calculations

The table above provides an overview of the test results for the distribution of the increasing and decreasing items in the cash flow statements, based on the four statistical tests from the research conceptual framework and compared with the recommended critical values by Nigrini (2011).

The following Table 6 presents the results of testing for the existence of statistically significant differences between the first-digit distributions of increasing and decreasing items.

Table 6. Results of Testing for Statistically Significant Differences Between the First-Digit Distribution of Increasing and Decreasing Items

Digit	Frequency – Increasing Items	Frequency – Decreasing Items	% – Increasing Items	% – Decreasing Items	Z-test
1	315	385	0.3076	0.3211	0.9011
2	168	221	0.1641	0.1843	1.7083
3	153	151	0.1494	0.1259	**2.0634**
4	85	106	0.0830	0.0884	0.5696
5	82	98	0.0801	0.0817	0.1378
6	70	80	0.0684	0.0667	0.1457
7	52	59	0.0508	0.0492	0.1582
8	51	56	0.0498	0.0467	0.3840
9	48	43	0.0469	0.0359	1.5932

Source: Author's Calculations

Based on the calculated frequencies of digits 1–9 for increasing and decreasing items, Z-test statistics were computed to determine whether there is a statistically significant difference between the first-digit distributions of increasing and decreasing items in the cash flow statements.

Based on the conducted tests, it can be concluded that the MAD, chi-square, and K–S tests do not indicate significant deviations in the first-digit distribution of either the increasing or decreasing items when compared to Benford's distribution. However, regarding the Z-test, the results show that there is no significant deviation from Benford's Law for the decreasing items, while a statistically significant deviation is observed for the *increasing items*.

Specifically, the Z-test for the increasing items ranges from 0.0460 to 2.1566 for digits 1–9, exceeding the critical value of 1.96 according to Nigrini (2011). Additionally, it can be

observed that the results of all tests for the *decreasing items* are further from the critical thresholds compared to the *increasing items*, suggesting a lower likelihood of manipulation in the decreasing items. This is understandable, as most cash flow-related frauds tend to focus on inflating cash flows within operating activities. However, it is important to emphasize the sensitivity of the Z-test in large samples and the box deviations as indicators of risk, not evidence of fraud.

Hypothesis H1 stated: *The increasing and decreasing items in the cash flow statements of business entities in Bosnia and Herzegovina follow Benford's Law.* This hypothesis was tested in the part of the research presented above. This hypothesis also included the following sub-hypotheses: *H1.1. The first digit of increasing items presented in the cash flow statements of business entities in Bosnia and Herzegovina follows Benford's Law* and *H1.2. The first digit of decreasing items presented in the cash flow statements of business entities in Bosnia and Herzegovina follows Benford's Law.* Based on the research conducted on the first digit, it can be concluded that hypothesis H1.2 is accepted, i.e., the decreasing items in the cash flow statements follow Benford's Law, while hypothesis H1.1, concerning the increasing items, is rejected.

Regarding the testing of Hypothesis H2: *There is no statistically significant difference in the distribution of the first digit between increasing and decreasing items in the cash flow statements of business entities in Bosnia and Herzegovina*, the results of the z-test indicate that for eight digits no statistically significant differences were observed. However, for the digit 3, a statistically significant difference was detected, with a z-score of 2.06, exceeding the critical value of 1.96. Consequently, for this particular digit, the hypothesis asserting the absence of a statistically significant difference in the distribution of the first digit between increasing and decreasing items in the cash flow statements is rejected, at least partially.

It is important to emphasize that deviations in the frequencies of increasing and decreasing items in cash flow statements, when analyzed using Benford's Law, serve only as indicators of potential manipulation in a company's inflows or outflows. Actual fraud in a company's cash flow can be detected exclusively through a detailed reconstruction of the cash flow statements, where a thorough examination of payments and disbursements provides evidence of cash manipulation.

Nevertheless, auditors can and should use Benford's Law to identify deviations in numerical magnitudes, both in financial statements and in the general ledger, from the expected distribution of digits. Generally speaking, spikes above the Benford distribution line represent numbers of interest. Results indicating digits that occur less frequently than expected are typically disregarded, unless the specific audit objective warrants otherwise. Importantly, the integration of Benford's Law into standard audit procedures does not require substantial additional investment in software or auditor equipment, which facilitates its application across audit firms without exception.

5. Conclusion

The study investigated the application of Benford's Law in the forensic analysis of cash flow statements of business entities in Bosnia and Herzegovina. Through empirical research, two main hypotheses and two sub-hypotheses were tested. This research provides insight into the use of Benford's Law in the forensic analysis of cash flow statements and highlights the need for greater education and the application of forensic tools in auditing practice in Bosnia and Herzegovina.

Based on the conducted tests (MAD, chi-square, and K-S test), it was concluded that there are no significant deviations in the distribution of the first digit for the variables representing increasing and decreasing items compared to the Benford distribution. However, the z-test indicates a significant deviation for increasing items, whereas no deviation is observed for decreasing items. The results suggest a lower likelihood of fraud in decreasing items compared to increasing items in cash flow statements. So that, hypothesis H1, which asserts that increasing and decreasing items follow Benford's Law, is partially accepted for decreasing items but rejected for increasing items. Hypothesis H2, which states that there is no statistically significant difference in the first-digit distribution between increasing and decreasing items, is partially rejected for the digit 3, where a statistically significant difference exists, while the hypothesis is accepted for all other digits.

Considering the results of the conducted research, it is recommended that Benford's Law be integrated into standard audit procedures to reduce audit costs and enhance efficiency. Training audit personnel for the application of Benford's Law is relatively straightforward and can be implemented quickly, given that the necessary tools are already available in programs such as Microsoft Excel, which are routinely used in auditing practice.

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Sažetak

Predmetni članak istražuje primjenu Benfordovog zakona u forenzičnoj analizi izvještaja o novčanim tokovima privrednih subjekata u Bosni i Hercegovini. Kroz empirijsko istraživanje testirane su hipoteze: uvećavajuće i umanjujuće stavke izvještaja o novčanim tokovima slijede Benfordov zakon, te nema statistički značajne razlike u distribuciji prve cifre između uvećavajućih i umanjujućih stavki. Rezultati su pokazali da umanjujuće stavke slijede Benfordov zakon, dok uvećavajuće stavke pokazuju statistički značajno odstupanje. Također, za većinu cifara nije pronađena statistički značajna razlika između uvećavajućih i umanjujućih stavki, osim za cifru 3 (tri). Rezultati istraživanja ukazuju na potrebu edukacije revizora o mogućnostima primjene Benfordovog zakona, te širu primjenu istog s ciljem smanjenja troškova revizije i povećanja njene efikasnosti.

Ključne riječi: *Forenzična analiza, Revizija finansijskih izvještaja, Izvještaj o novčanim tokovima, Benfordov zakon, Manipulacije vrijednostima novčanih tokova.*

Appendix 1. Statistical Tests for the Variable "Increasing Items" – First Digit

Digit	Benford Frequency	Observed Frequency	% Expected According to Benford	% Observed According to Benford	MAD	Z - test	Upper Bound	Lower Bound	Chi-square	K-S test
1	308	315	0.3010	0.3076	0.0066	0.4250	337	279	0.1490	-0.0066
2	180	168	0.1761	0.1641	0.0120	0.9980	205	156	0.8426	0.0054
3	128	153	0.1249	0.1494	0.0245	2.1566	149	107	4.9268	-0.0191
4	99	85	0.0969	0.0830	0.0139	1.5547	118	80	2.0395	-0.0052
5	81	82	0.0792	0.0801	0.0009	0.0460	99	64	0.0100	-0.0061
6	69	70	0.0669	0.0684	0.0015	0.1231	85	52	0.0326	-0.0075
7	59	52	0.0580	0.0508	0.0072	0.9810	75	44	0.9200	-0.0003
8	52	51	0.0512	0.0498	0.0014	0.1334	67	38	0.0389	0.0011
9	47	48	0.0458	0.0469	0.0011	0.0888	61	33	0.0258	0.0000
Total	**1,024**	**1,024**	**1.0000**	**1.0000**	**0.0691**	**-**	**-**	**-**	**8.9852**	**-**

Source: Author's Calculations

Appendix 2. Statistical Tests for the Variable "Decreasing Items" – First Digit

Digit	Benford Frequency	Observed Frequency	% Expected According to Benford	% Observed According to Benford	MAD	Z - test	Upper Bound	Lower Bound	Chi-square	K-S test
1	361	385	0.3010	0.3211	0.0201	1.4598	393	329	1.6095	-0.0201
2	211	221	0.1761	0.1843	0.0082	0.6968	237	185	0.4601	-0.0283
3	150	151	0.1249	0.1259	0.0010	0.0648	173	127	0.0103	-0.0294
4	116	106	0.0969	0.0884	0.0085	0.9851	137	96	0.8925	-0.0209
5	95	98	0.0792	0.0817	0.0025	0.2677	114	76	0.0973	-0.0234
6	80	80	0.0669	0.0667	0.0002	-0.0332	98	63	0.0006	-0.0232
7	70	59	0.0580	0.0492	0.0088	1.3408	86	53	1.5981	-0.0144
8	61	56	0.0512	0.0467	0.0045	0.6691	77	46	0.4730	-0.0099
9	55	43	0.0458	0.0359	0.0099	1.7727	70	40	2.5849	0.0000
Total	**1,199**	**1,199**	**1.0000**	**1.0000**	**0.0638**	**-**	**-**	**-**	**7.7263**	**-**

Source: Author's Calculations