

## Benford's Law

### Cross References

- [www.irs.gov/irm](http://www.irs.gov/irm)

#### Author's Comment

The following article is entirely an author's comment. Information presented should be considered the opinion of the author and not that of an authoritative citation.

Have you ever heard of Benford's Law? I had never heard of it until reading an article in a recent trade journal written for tax accountants. I did not pay much attention to the article until it was pointed out that the IRS mentions it in their Internal Revenue Manual, Part 4, Examining Process, Section 4.1.10.3.1, PAC Inventory Sources, letter L, which says: "Benford's Law Analysis—used to identify problematic preparers."

Mention "problematic preparers," and with all the possible preparer penalties facing our profession, I took notice. How does Benford's law identify problematic preparers?

Benford's law is also called the first-digit law, and refers to the frequency distribution of digits in many real-life sources of data. The law predicts the percentage of time a particular digit will occur as the first digit in a data set of numbers, assuming the data set is a random set of numbers and not made up by some human. For example, the number 1 occurs as the leading digit about 30% of the time, while the number 9 occurs as the leading digit about 5% of the time. The law is based upon a mathematical formula and is named after physicist Frank Benford. The results of the mathematical formula are contained in the following table:

<i>First Digit</i>	<i>Percentage</i>
1 .....	30.1%
2 .....	17.6%
3 .....	12.5%
4 .....	9.7%
5 .....	7.9%
6 .....	6.7%
7 .....	5.8%
8 .....	5.1%
9 .....	4.6%

For example, if you have 1,000 transactions in an expense journal, you should expect about 301 of the dollar amounts to have a first digit of 1 (\$1.95, \$102.25, and \$1,513.45 are all examples of numbers where the first digit equals 1). If 294 dollar amounts have a first digit of 1, this would be within the expected range. However, if only 115 dollar amounts

have a first digit of 1, this would be suspect. This is because if a human were to make up the numbers, the tendency is to distribute the first digits fairly uniformly.

You can now imagine what the IRS might be thinking when using Benford's Law to conduct audits. If a preparer is suspected of making up numbers on a tax return, applying Benford's Law could confirm an auditor's suspicion. Or, it could be used like the Discrimination Information Function (DIF) score used by the IRS to flag certain returns for potential audit.

I of course was suspicious as to whether the law actually works. So I took out my personal checkbook register for 2012 and wrote down the number of times each digit appeared as the first digit in the dollar amount for each expense. I had 211 total withdrawals (checks, ATM, bank fees, etc.) during the year. The following table compares my results with what Benford's Law says should be the results:

<i>First Digit</i>	<i>My Personal Checkbook %</i>	<i>Benford's Law %</i>
1 .....	34.1% .....	30.1%
2 .....	16.1% .....	17.6%
3 .....	7.6% .....	12.5%
4 .....	16.1% .....	9.7%
5 .....	4.7% .....	7.9%
6 .....	4.3% .....	6.7%
7 .....	6.6% .....	5.8%
8 .....	2.4% .....	5.1%
9 .....	8.0% .....	4.6%

I can assure you that I did not make up the numbers. The percentages are based on all of the actual expenses recorded in my personal check register for 2012. It could be my imagination, but for the most part, the percentages are pretty close to what Benford's Law says they should be. One number that appears off reflects the fact that when I withdraw cash at an ATM, I usually go for \$400.

Benford's Law does not work for assigned numbers, such as check numbers, invoice numbers, zip codes, or where numbers are influenced by human thought, such as assigning a sales price for a product based on a physiological threshold (pricing an item at \$9.95 instead of \$10.00). Benford's Law is also less accurate the smaller the data set. It may be difficult to use it for a handful of entries on a particular tax return. It would be more effective to combine data from all tax returns prepared by a particular tax return preparer during the tax season.

This may be what the IRS means in the Internal Revenue Manual when it says it is "used to identify problematic preparers." If a preparer has a habit of making up a number for charitable contributions for each client with low or no charitable contributions, Benford's Law could detect this problem.