Identifying Fraud Can Be as Easy as 1, 2, 3: Applying *Benford's Law* to Forensic Analyses and Investigations

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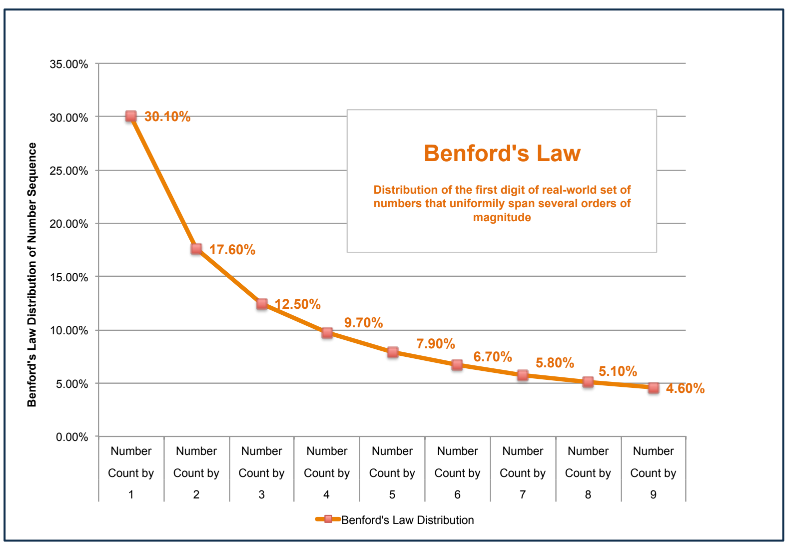
As a follow up on my March 2017 article titled *Lies, Damned Lies and Statistics – Using Data Mining Techniques to Find the True Facts*, I wanted to share a little known mathematical theorem dating from 1938 known as *Benford's Law*. People who commit fraud are unaware of the existence of *Benford's Law* and how its use in forensic analysis and fraud investigations can identify possible fraud. In application, the identification of fraud can be as simple as 1 – 2 – 3 if you understand how to apply *Benford's Law* to accounting data. *Benford's Law* allows you to predict how often each number 1 through 9 will appear as the first non-zero digit in the data set and its application can cover any naturally occurring data set from accounting data to census data.



Considering that independent research indicates that employee fraud costs the average company 5% of its revenues a year, which totals $3.7 trillion on a global basis[1], the use of creative techniques like *Benford's Law* aides in the identification of fraud and finding those who commit it. According to the *2017 Global Fraud & Risk Report*, 82% of surveyed executives reported falling victim to at least one instance of fraud in the past year, up from 75% in 2015.[2]

1 See *Report to the Nations on Occupational Fraud and Abuse: The 2014 Global Fraud Study*, p. 5.

2 See *2017 Global Fraud & Risk Report: Building Resilience in a Volatile World*, p. 4.

How *Benford's Law* Came About

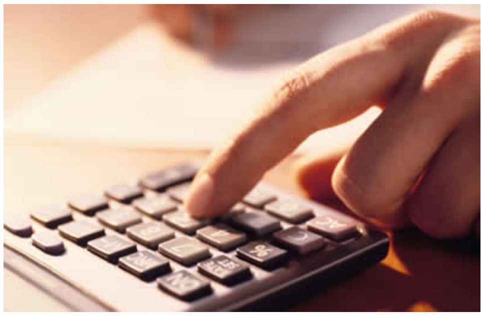
The foundation of *Benford's Law* dates to 1881 when the astronomer and mathematician Simon Newcomb first published what has become known as *Bedford's Law*. Newcomb observed that library copies of books of logarithms were more worn in the beginning pages with lower numbers and less worn on later pages with higher numbers. Almost 50 years later, the physicist Frank Bedford observed the same phenomenon. Unlike Newcomb, Benford applied the analysis of the observation to a much broader set of data. In 1995, the mathematician Theodore Hill provided a more advance proof of *Benford's Law* that also applied the theorem to stock market, census and accounting data. In the application to auditing and accounting data, *Bedford's Law* can be applied to a broad spectrum of transactions.

Acceptance of *Benford's Law* Methodology by the Courts

The application of *Benford's Law* has been accepted by many courts in the United States as a proper methodology to detect fraud. Beginning as early as 1993, in *State of Arizona* v. *Wayne James Nelson* (CV92-18841), the accused was found guilty of trying to defraud the state of nearly $2 million. The defendant, Wayne Nelson, was a manager in the office of the Arizona State Treasurer who diverted funds to a bogus vendor. Because human choices are not random, invented numbers are highly unlikely to follow *Benford's Law*. As is often the case in fraud, the embezzler started small and then increased the dollar amounts of the theft. Most of the amounts were just below $100,000, a threshold where internal accounting controls would apply more scrutiny to the processing of payments. By keeping the amounts just below this threshold, Nelson was able to conceal the fraud for a period of time until an investigation where *Benford's Law* was applied. The beauty of Benford's Law is the extensive peer review and academic testing of the methodology to a wide range of data sets, including being an acceptable tool used in auditing by the accounting professionals. Accordingly, the application of *Benford's Law* in any litigation context should pass any *Daubert* challenge.

<u>Where Can *Benford's Law* be Applied?</u>

With corporate data sets and databases becoming larger and more complex, there is almost an unlimited application of Benford's Law to the analysis of data to identify anomalies, verify data integrity, identify duplicate transactions and most important identify potential fraud. Types of data where *Benford's Law* can be applied include, but may not be limited to, the following types of data and databases:



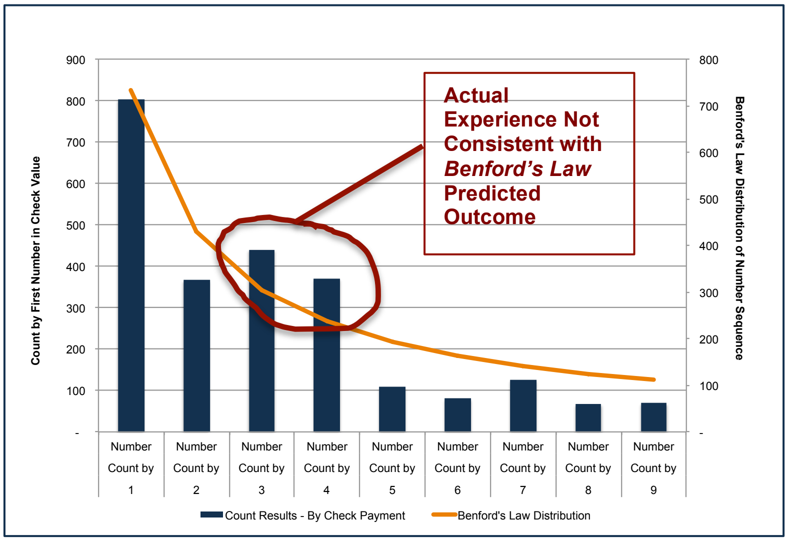
- Check payments;
- Accounts payable;
- Accounts receivables;
- General ledger transactions;
- Bank balances;
- Customer refunds
- Accounting software conversions;
- Loan balances;
- Expense reports;
- Stock prices;
- Inventory prices; and
- Purchase orders

Common types of data sets where *Benford's Law* may not be useful included data sets with 500 or less transactions, data generated by formulas and where data may be restricted by a maximum or minimum number (e.g., hourly wage rates).

Benford's Law also can be applied in to more than just the first digit in a transaction process and can include the analysis of the first, second and third digits for similar anomalies.

A Case Study where Barnes & Co. has Applied ***Benford's Law*** in a Forensic Investigation

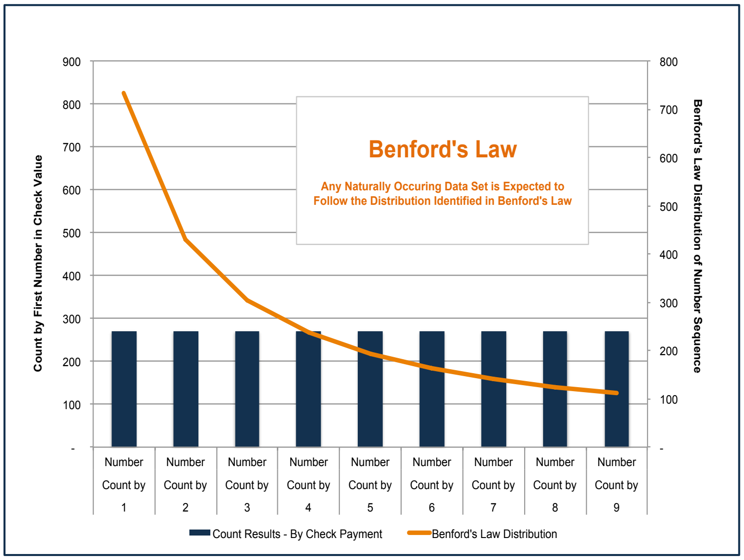
Recently, Barnes & Company was retained by management of a nationally known political consulting practice to review its disbursement and payment processes. Management had suspicion that there may be some irregularities within its accounting department and accounting personnel. Identifying a starting point by management was daunting due to the large volume of transactions, which included a high volume of television and radio media buys, print and advertising, payroll, payments to consultants and other third-party payment transactions. To begin the engagement, we started by analyzing all check disbursements to see if the first digit of each check or ACH transfer complied with the expected distribution outlined in *Benford's Law*. The results indicated that payments within the $30,000 to $40,000 range were above the expectation level predicted by *Benford's Law*. A closer analysis of all the payments within this range identified payments to two fake vendors totaling more than $250,000. A multi-year analysis identified that the fraud had been ongoing for more than three years with total payments to the two fake vendors totaling more than $1 million.



The company's internal control policy required two signatures on any checks of $50,000 or more. Accordingly, the fraud was targeting payment amounts that just below the threshold where the fraud would be identified internally. Our analysis also indicated that the company maintained no internal controls on how vendors where authorized to be added to the accounts payable system.

Numbers in Any Naturally Occurring Data Set are Expected to Follow *Benford's Law*

A common occurrence identified in fraud investigations is where the perpetrator attempts to conceal their actions by spreading the illicit transactions evenly across the number spectrum not realizing that within any naturally occurring data set the predicted outcome is expected to yield the distribution identified by *Benford's Law*. Any set of numbers that deviate from the predicted outcome should be further investigated to identifying the underlying cause.



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About Barnes & Company

Barnes & Company is a boutique management consulting firm providing sophisticated financial and economic damage analyses and expert services related to commercial damages, business and intellectual property valuation and fraud investigations. (www.barnesco.com)