

## **Application of Benford's Law on Stock Turnover**

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**ABSTRACT:** *This paper is study conducted on the existence of Benford Law. This paper tests the usage of this law on stock turnover of the shares in the Indian Stock Exchange. With the data available online from BSE, the stock turnover conforms to Benford Law. This paper studies four Indian stocks from the period 1998-2018. Based on the data analysed, it can be concluded that: the four stocks studied obeys the Benford Law.*

**KEYWORDS:** *Benford Law, Share Turnover, Indian Stock Exchange, BSE*

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### **I. INTRODUCTION**

Benford Law is an observation of the frequency distribution of leading digits in many real life numerical data sets. According to this law, in tables of statistics or lists of data, the probability of 1 being the leading digit is greater than the probability of the digit being a higher number. It postulates that in naturally occurring data sets, the leading digit is significantly small. This law can be taken back to 1881, when astronomer Simon Newcomb realised that the earlier pages in the logarithm table book were much more worn out than the other pages. Benford Law has a multitude of uses from fraud detection to genome mapping. It has found its applicability in numerous spaces. It is widely used in detecting frauds in the field of audit. Accountants, internal auditors, statutory auditors, forensic auditors use this law to identify possible instances of misstatements or fraud. Benford Law was used to identify fraudulent data that the Greek Government reported in the European Union. The uses of Benford Law are infinite. In this paper, we explore the existence of this law with reference to share turnover and share prices with respect to the first digit.

### **II. REVIEW OF LITERATURE:**

- a. **(Sartori Cella & Zonalla, 2018)** has used Benford Law to study the transparency of municipal expenditure in Gois, Brazil. He established that Benford Law can be used for a previous analysis of municipal public expenditure, to direct future audits, and serve as one of the variables to measure the degree of transparency of a municipality.
- b. **(Al-Rawashdeh, 2017)** conducted this study to ascertain the existence of indicators of fraud in twenty five insurance companies listed on the Amman Stock Exchange, Jordan. Two groups were tested, one with positive net gain and another with a negative net gain. Upon conducting the research it proved that fraud existed in both groups and stricter laws needed to be in place.
- c. **(Cleary & Thibodeau, 2005)** have reported that the application of Benford Law in detecting fraud can be an expensive route. To overcome this issue, they have suggested test-by-test, digit-by-digit analysis, Chi-square, ANOVA and ACL when using Benford Law.
- d. **(Jie Shawn & Kalaichelvan, 2012)** have tested the significance of round numbers in the European Stock market in accordance with Benford Law. To ensure that their result was accurate they further tested the data with Monte Carlo Simulation and Kuiper's Modified Kolmogorov-Smirnov Goodness of Fit Test. However, they did not find any different conclusion upon conducting the test.
- e. **(Chun-Kai, Weng)** have conducted their study to test whether different aspects affect the stock turnover and earnings as per Benford Law in U.S. and Taiwan. From their study they have found out that the stock market does not have an effect on the volatility of trading volume. Research showed that the rounding of the second digit according to Benford law only existed in income digits. (Chun-Kai & Weng)
- f. **(Krakar & Zgela, 2008)** have checked the accuracy of Benford Law on stock prices and volume in Zagreb Stock Exchange, Croatia. The sets showed to only partially conform to Benford Law, only the stock volume conforms to the law but stock prices do not. He attributes that stock prices vary significantly due to the influence of psychological factors.

### III. RESEARCH DESIGN

**a. Research Methodology:**

The research is an exploratory type of research where we are trying to find out the existence of Benford Law in relation to the share turnover.

**b. Statement of Problem:**

The research is trying to figure out the existence and applicability of Benford Law. This problem stems from different views on the applicability of this law.

**c. Sources of Data:**

Our research is completely based on secondary source of data. We have collected 20 years data of the stock trading volumes from official BSE website.

**d. Hypothesis:**

H0: Benford Law exists.

H1: Benford Law does not exists.

**e. Data Analysis Tool:**

All the data regarding the information on the stock turnover has been collected from the BSE website. Then using Excel the research has been able to determine the output data. The main place of data entry would be an Excel Spreadsheet where the data would be entered, stored and analysed for further use. This data can be analysed at the user's convenience by various forms like charts, bars and diagrams.

**f. Limitations:**

1. Benford law only works if we take data which is greater than five hundred units.
2. This study is fully reliant on secondary data, therefore the analysis and findings depend on the accuracy of the secondary data.
3. We have only taken part of the law. The research only deals with the first digits frequency, however the law extends to the second digit and the last digits frequency.
4. The data set selected is based on convenience and therefore it may not apply to all the stocks in the market.

### IV. RESEARCH OBJECTIVES

The following are the objectives of our research:

- To evaluate the existence of Benford Law in relation to the share turnover.

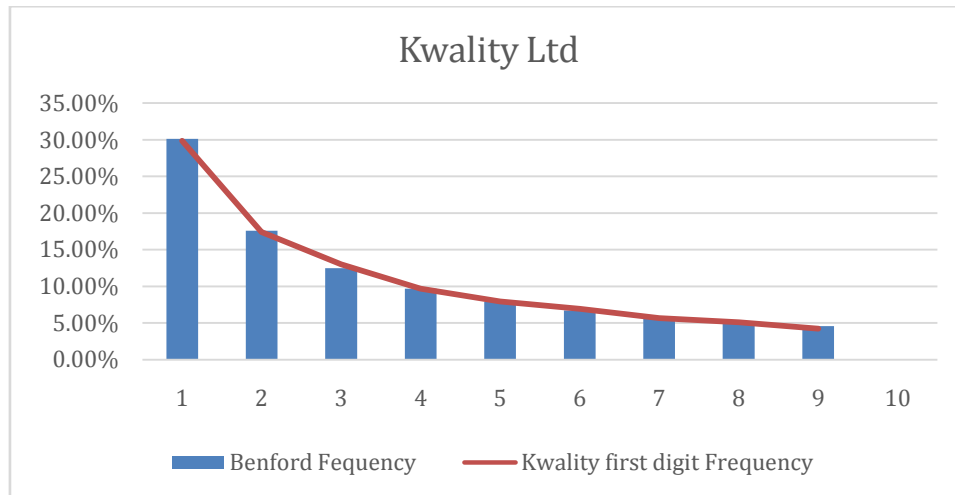
### V. DATA ANALYSIS

According to Benford Law, each digit from 1 to 9, has a frequency which he has established, which presents itself in real data sets.

Kwality Ltd:

Kwality Ltd was incorporated in 1992. Kwality Ltd has been one of the fastest growing dairy company. Kwality has expanded into various businesses ever since it was established.

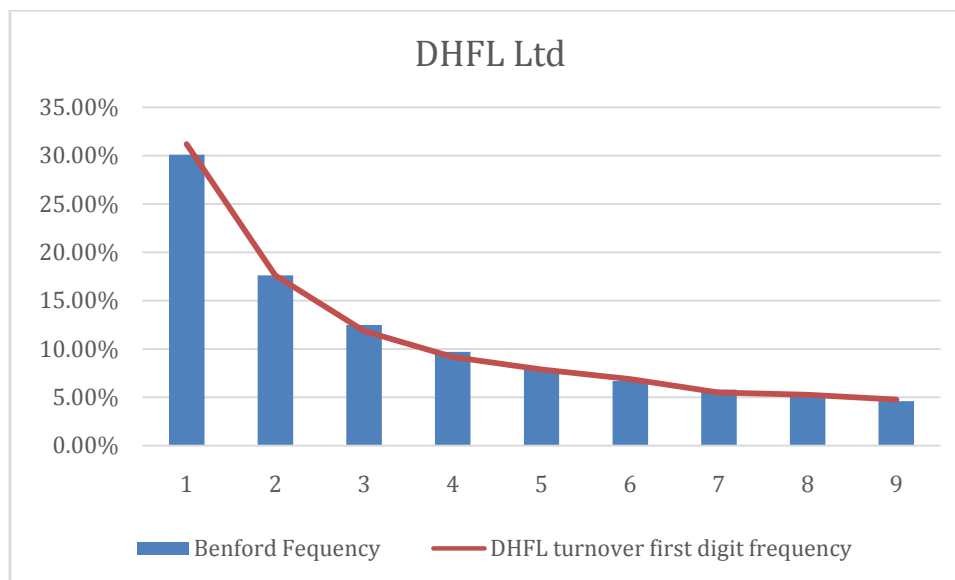
Numbers	Count	Benford Frequency	Turnover first digit frequency
1	1267	30.10%	29.86%
2	740	17.60%	17.44%
3	553	12.50%	13.03%
4	412	9.70%	9.71%
5	338	7.90%	7.97%
6	295	6.70%	6.95%
7	241	5.80%	5.68%
8	217	5.10%	5.11%
9	180	4.60%	4.24%
	4243		



**DHFL:**

Established in 1984, DHFL is a Mid Cap company which has a market cap of Rs 7252.45 Crore, it operates in the finance sector. Dewan Housing Finance Ltd is one of the leading housing loan providers in India.

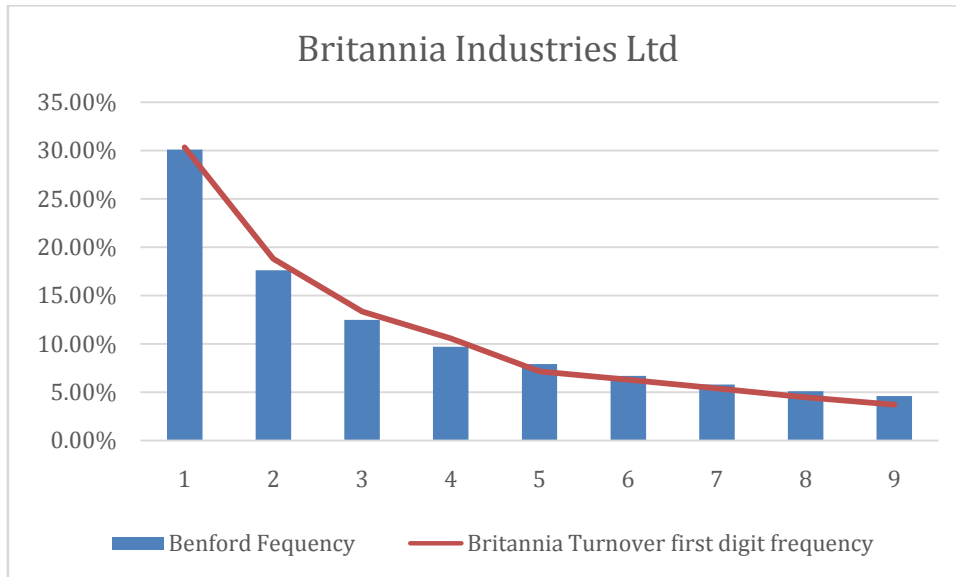
Numbers	Count	Benford Frequency	Turnover first digit frequency
1	1526	30.10%	31.21%
2	861	17.60%	17.61%
3	579	12.50%	11.84%
4	448	9.70%	9.16%
5	384	7.90%	7.85%
6	335	6.70%	6.85%
7	267	5.80%	5.46%
8	257	5.10%	5.26%
9	232	4.60%	4.75%
	4889		



**Britannia Industries:**

Founded in the year 1918, Britannia is a large cap company which has Rs 74330.45 Crore of the Food Processing Market. Britannia Industries

Numbers	Count	Benford Frequency	Turnover first digit frequency
1	1287	30.10%	30.33%
2	798	17.60%	18.81%
3	566	12.50%	13.34%
4	448	9.70%	10.56%
5	303	7.90%	7.14%
6	266	6.70%	6.27%
7	229	5.80%	5.40%
8	189	5.10%	4.45%
9	157	4.60%	3.70%
	4243		



Marico:

Incorporated in the year 1988, Marico is a large cap company which has a market cap of Rs 49356.20 Crore in the personal care sector.

Numbers	Count	Benford Frequency	Turnover first digit frequency
1	1547	30.10%	30.23%
2	904	17.60%	17.66%
3	614	12.50%	12.00%
4	490	9.70%	9.57%
5	413	7.90%	8.07%
6	339	6.70%	6.62%
7	312	5.80%	6.10%
8	271	5.10%	5.30%
9	228	4.60%	4.45%
	5118		



## **VI. FINDINGS**

From our data analysis, we have noticed that H0 has been accepted and H1 has been rejected because the share volume of the companies conforms to Benford Law. The share volumes of the three companies which we have taken, have all proved the existence of this law. According to **(Krakar&Zgela, 2008)**, the law applies to share turnovers in Croatia and we have been able to prove the same in the Indian Stock Market.

From the four companies that we have taken, we have observed that almost all the share turnover conforms to the Law. The frequencies of the numbers for all the four companies are within the boundaries of the frequency.

In the tables above the column 'Count' represents the count of the digits from 1 to 9. While the Turnover first digit frequency shows the frequency of the digits in the data set. Benford's frequency is the frequency stated by the law. The graph shows the relationship between the actual Benford's frequency and the frequency of the stocks turnovers first digit. The bar chart represents Benford's frequency, while the line graph represents the share turnovers first digit frequency.

## **VII. CONCLUSION**

From our research we can conclude that Benford Law is an unexplored area, the uses of this law are limitless but only if more research is conducted. We have noticed that the pattern for the stocks we have taken are quite similar and that it conforms to Benford's frequency. Even though Benford Law is well known, it is only understood by a few. Many researchers recently have been trying to find the use of this Law in understanding various statistical patterns.

We have been able to prove that it exists in share turnover, but more research can lead to identifying many more applications of this law. Further research will also result in the simplification of this law. Research can be done on more stocks and other data relating to shares. This would facilitate better understanding of the law. Benford Law does not limit itself to the first digit only, but also presents itself in the second digit of a number and the last digit as well. In this research, we have limited ourselves to just the first digit.

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