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DETECTION OF RED FLAGS IN CORONAVIRUS VACCINATION DATA AVAILABLE IN PUBLIC DOMAIN

Ashima Negi Research Scholar Department of Management SRK University, Bhopal
Dr Kumkum Singh Department of Management SRK University, Bhopal

Abstract
The research Work utilizes Benford's law technique to detect any discrepancy in the coronavirus vaccination data. The research work analysed the dataset available freely over the cowin website. The research analysis detected possible 7 red flags in the data. Thus, calling for a potential reverification of the vaccination dataset posted on the portal.

Keywords:
Benford's Law, Cowin, red flags

Introduction

Around the world and in almost every country fraud is considered as termite to economic growth. Whenever, a fraud is committed it always affect the economy of the country. When the essence of fraud is prevalent in a country, then the country attracts lesser foreign investments, the stock market falls steeply, investors pull their money out. Thus, an emergency brake is applied automatically to engine of economy. Therefore, government tries to active prevent commitment of fraud and are devising ways to predict the fraud before it hinders the aspects of economy. It is at this place the forensic accounting practices is essential needed. RBI has thus made it compulsory that forensic accounting should be carried out for large advances and restructuring of accounts.

An example of effective use of Forensic Accounting using Benford Law technique could be found in Ketan Parekh Case. Ketan Parekh used 'Pump and Dump' strategy to rig the stock market. He would purchase the stock of companies that were lesser known using the insider trading information. Once the price of that stock increased, he would sell the stocks and would exit silently from the scenarios. Using Benford's law investigating agencies determined red flag for stock rigging. A detailed and extensive investigation was carried out that determined how Ketan Parekh used his connections and reputations to establish illegal alliances from bank and used it for manipulation of stocks.

Thus, this paper would use Benford's law to study a real- world scenario using Benford's law technique to detect possible manipulation of data.

Material and Methods

The following is a real-world case study. India started its coronavirus vaccination campaign in the month of January 2021. To be precise the vaccination kick started on 16th of January 2021. The vaccination program run by the Indian government to vaccinate all its population against the deadly covid-19 virus is the biggest in the world. There is frequent news that makes rounds that India achieved highest single dose vaccination on multiple days. India achieved highest single day vaccination on 17th of September and 23rd of September 2021 as per the reports published in periodicals (Livemint.com). Such vast scale vaccination is a desperate need to contain the spread of covid-19 virus which is notorious for spreading quickly. However, attaining such huge daily vaccination numbers on the backdrop of limited and to some extent restricted supply of vaccines is questionable. This paper presents Benford's law analysis on the daily vaccination data for India. The data is from 16th of January 2021 to 10th Nov 2021. The analysis tries to identify any red flag if present in the daily vaccination data. The data was collected from the website ourworldindata.org. The website aggregates the daily vaccinations performed in each country. For India the website collects the data from the Cowin platform (https://dashboard.cowin.gov.in/). Hence, the data on which the analysis is carried out is collected from trusted sources.

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Analysis

The figure 1 presents the daily vaccination data along with the linear and exponential trend present in it. The linear trend in the data is presented by the equation → Daily Vaccination = 26482t – 220572, t is time. The exponential trend in the data is presented by the equation → Daily Vaccination = $477469e^{0.0113x}$, t is time.

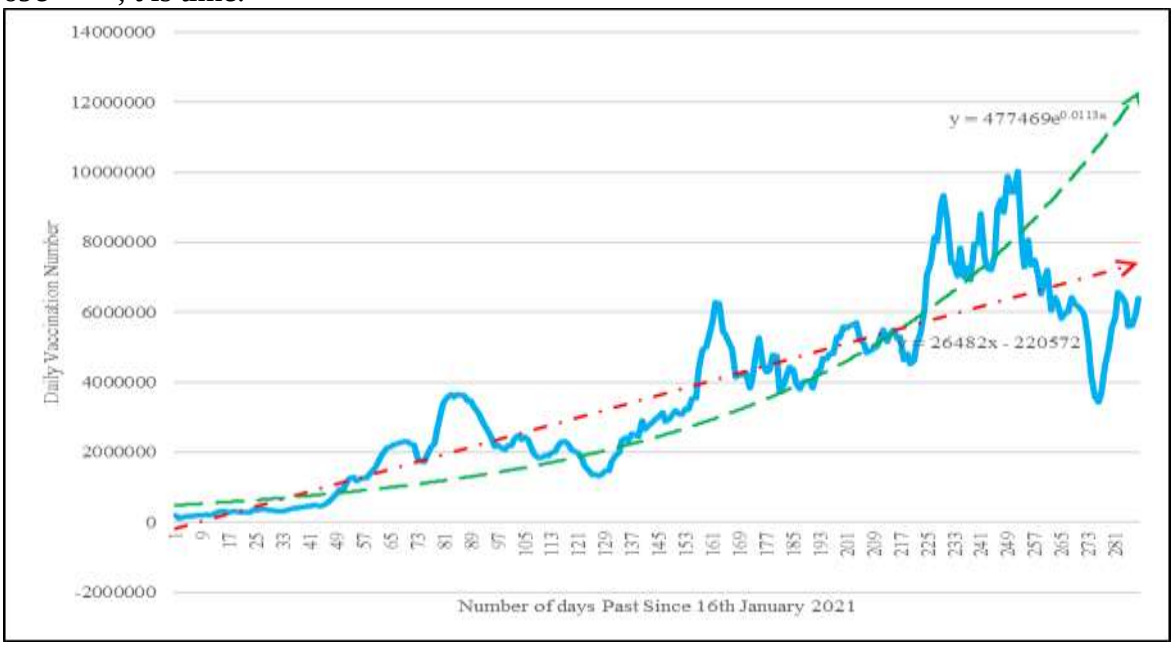

Figure 1 Trend present in daily vaccination numbers in India

From the figure 1 it is visible that the daily vaccination numbers were following a linear trend with a slope of 26482 Vaccinations per day. The exponential trend observed in the daily vaccination data was 1.13 precent per day.

An exponential growth with 1.13 percent per day appears to be too high with a constraint that only 25.6 percent of total Indian population is fully vaccinated. Analysis the linear growth rate of 26482 new vaccinations/ day also appears to be too high. The rate is almost equivalent to the total population of some of the nagar panchayats of India. Such high linear and exponential trends is an indicative of red flags. Hence, subjecting the vaccination data to Benford's law will reveal the presence of red flags if any.

Table 1 Benford's Law – First Digit – Daily Vaccination numbers in India

Digit	Digit Frequency Observed (d_1)	Digit Frequency Observed (%)	Benford's Frequency $=\log_{10}(1/d_1+1)$	Difference	Remarks on vaccination number starting with concerned digit
1	46	15.97%	30.10%	14.13%	** (Red flag)
2	56	19.44%	17.61%	-1.84%	** (Red flag)
3	49	17.01%	12.49%	-4.52%	** (Red flag)
4	45	15.63%	9.69%	-5.93%	** (Red flag)
5	35	12.15%	7.92%	-4.23%	** (Red flag)
6	21	7.29%	6.69%	-0.60%	*
7	19	6.60%	5.80%	-0.80%	*
8	9	3.13%	5.12%	1.99%	** (Red flag)
9	8	2.78%	4.58%	1.80%	** (Red flag)

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Total	288	**100**			

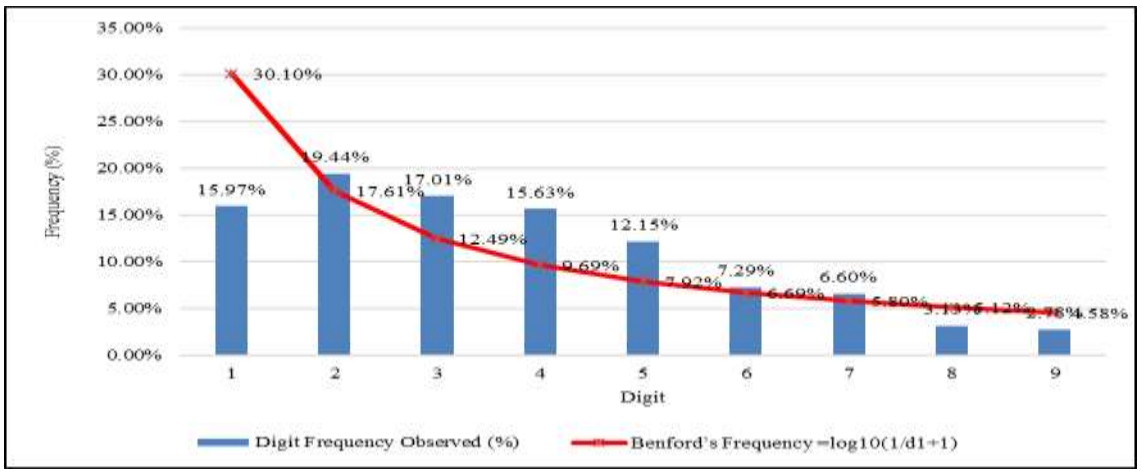

Figure 2 The difference between the observed frequency for digit and Benford's frequency for the digit (Daily Vaccination Numbers)

Conclusion

From the figure 2 it is evident that the daily vaccination numbers in India is not following Benford's law. A huge difference in the observed frequency of the digit '1' and Benford's frequency for the digit '1' is obtained. This turns all the vaccination numbers starting from digit '1' as red flags. Similarly, all numbers starting from the digit 2,3,4,5,8, and 9 turns into red flags as the difference between the observed and Benford's frequency is greater than one percent.

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