OPEN ACCESS
Saudi Journal of Economics and Finance
Abbreviated Key Title: Saudi J Econ Fin
ISSN 2523-9414 (Print) |ISSN 2523-6563 (Online)
Scholars Middle East Publishers, Dubai, United Arab Emirates
Journal homepage: http://saudijournals.com

Original Research Article

Benford's Law Analysis to Determine Audit Priorities (Case Study on the 2020 Central Government Financial Statement Audit)

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DOI: 10.36348/sjef.2021.v05i09.006 | **Received:** 18.08.2021 | **Accepted:** 22.09.2021 | **Published:** 28.09.2021

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Abstract

Audit of State Finance face various challenges such as the limited number of auditors, short audit times, and recently the Covid-19 pandemic has caused limited access for auditors to audit evidence so as to increase audit risk. For this reason, it is necessary to improve audit techniques in determining audit priorities. This study aims to determine whether *Benford's Law* analysis techniques can be useful to help auditors determine audit priorities using a case study on the 2020 Central Government Financial Statement audit. *Benford's Law* analysis was conducted on 186,160 Capital Expenditure transaction data in 2020 from 86 Ministries/ Agencies which were consolidated in the e-Rekon & LK database application managed by the Ministry of Finance. Using *mixed methods*, this research begins by validating data requirements, then testing the first digit, the second digit, and the first two digits of expenditure realization data against *Benford's Law*, both as a whole and by grouping by budget section. The research was continued by determining the audit sample based on the results of *Benford's Law* analysis, and finally assessing the ability of *Benford's Law* analysis to detect errors and/or fraud in expenditure transaction data. The results of this study indicate that there is a discrepancy in the distribution pattern of numbers in the first digit, second digit, and the first two digits of the Capital Expenditure realization data against the distribution pattern expected by *Benford's Law*. The results of the analysis are able to provide information related to transactions that can be considered by the auditor for further analysis. The results of this study also show that the use of *Benford's Law is* able to provide an initial indicator (*red flag*) of the possibility of findings related to expenditure in an examination so that it can be used as a guide for auditors to determine audit priorities

Keywords: Benford's Law, Audit of State Finance, Audit Risk, Government Expenditure.

INTRODUCTION

The American Accounting Association (1973) defines *auditing* in general as a systematic process of objectively obtaining and evaluating evidence regarding assertions about economic actions and events to ascertain the degree of correspondence between these assertions and established criteria and communicating the results to interested users. In the perspective of accounting philosophy, auditing is defined as an *antithesis* activity (denial), namely an argumentative statement that rejects the *thesis* through the internal auditor, the audit committee, and the external audit (Apollo, 2021).

Auditing is often referred to as a consequence of the relationship between principal and agent or what is known as agency theory. Jensen and Meckling (1976) define an agency relationship as a contract between one or more persons (the principal/s) that asks another person (the agent) to perform some services on their behalf, which involves delegating some decision-making authorization to the agent. In this relationship, each party has an interest, and the agent will not always act in the best interests of the principal.

Zimmerman (1977) mentions that agency problems exist in all organizational contexts, between shareholders and management within companies, between management and members in private organizations, and between elected leaders and appointed officials and voters/people in government. Auditing is believed to be one way to maintain the principal's trust in the resources and authority delegated to the agent. Mardiasmo (2018:246) describes the relationship between the parties involved in the audit and the functions that occur between these parties as follows:

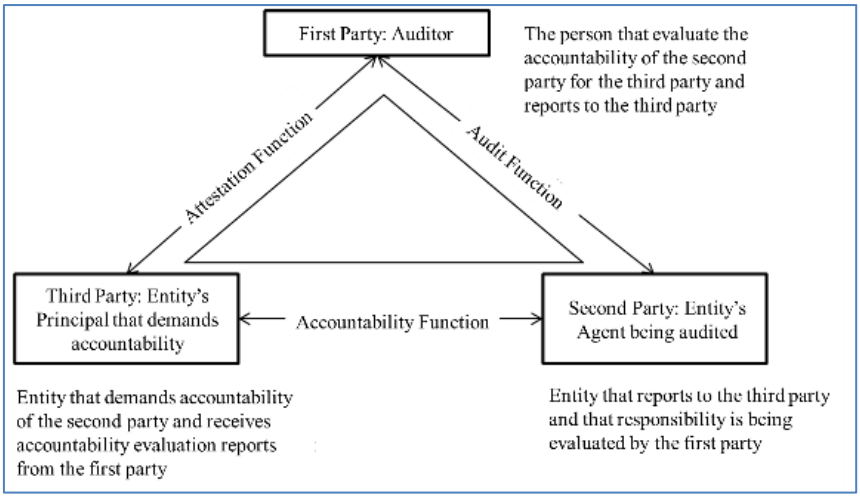

Fig-1: Audit Relationship

As one way to solve agency relationship problems, auditing has its own challenges. There are many problems and challenges faced by auditors in the audit process that can reduce audit quality. Users of financial statements have the hope that the auditor would be able to provide good assurance on the financial statements presented by management, Howeever, the low quality of the audit can reduce the confidence of users of financial statements which can have wider implications. Around two decades ago, there was a case of large-scale audit failures that have attracted worldwide attention, which is the Arthur Andersen case. That case still becomes a topic of discussion to this day, where the professional ethics of the auditor greatly determines the quality of the audit. Mappanyuki (2017) mentions that auditor's ethics has a negative effect on audit quality.

Over time, audit challenges have become more complex. Recently, the Covid-19 pandemic has created disruptions and challenges in almost every aspect of human life, including in the auditing world. The Covid-19 pandemic has significantly accelerated the evolution towards "virtual" auditing, in this case Kalia (2020) said: *This isn't simply a matter of conducting an audit over video chat, or taking a traditional process and moving it on line. You can share computer screens, but you still need clear documented evidence; otherwise an audit is not an audit, it's a conversation*.

The absence of direct face-to-face contact between auditors and auditees, including limited access to the documents needed during the audit process because of social distancing policies, has increased audit risk and could reduce audit quality, as stated by Akrimi (2021) that this pandemic has a considerable impact on audit quality. Serag and Daoud (2021) mention: *The COVID-19 pandemic has led to the emergence of many effects in all fields, and creates many difficulties and challenges for the audit profession. So, auditors should keep pace with the development of the surrounding environment to face the continuous changes and developments in the business environment, and this requires a focus on using modern technology in data analysis and activating modern audit methods such as continuous auditing and remote auditing*.

This challenge is currently being faced by all auditors, both in the private and public sectors, anywhere in the world because Covid-19 has spread to all parts of the world and infects more than 200 countries (worldometers.info, 2021). Public sector audits in Indonesia also face the same challenges. Deputy Chairman of the BPK Agus Joko Pramono said that the pandemic and the enactment of social restrictions would change the way state auditors carry out audits (Setiawan, 2020).

As we know that the Supreme Audit Agency (BPK) has a constitutional mandate (1945 Constitution Articles 23E, 23G, and 23F) to carry out audits on the management and accountability of state financial management. The public as the principal of state finances certainly want adequate assurance on state financial management reports presented by the government, especially with the increasing risk of state financial management during the pandemic. The Chairman of the BPK as quoted by Kompas (2021) stated that the risks of mismanagement, waste, corruption, and fraud could more easily occur in the midst of the Covid-19 pandemic.

As the *Supreme Audit Institution*, BPK also still has latent risk from the ratio of the number of auditors to the breadth of audit coverage, either in terms of the number of reporting entities, the number of transactions, as well as the breadth of its audit area which stretches from Sabang to Merauke. Until the end of 2020, the number of BPK human resources reached 7,150 people and only 60.7 percent of them were auditors, or as many as 4,343 people (BPK, 2021). This number will seem very small when compared to the scope of audits that must be handled.

As an illustration, in 2020, there were at least 636 reporting entities spread from Sabang to Merauke, consisting of: 548 Local Government reporting entities, 86 Ministry/Agency reporting entities, 1 State General Treasurer (BUN) reporting entity, and 1 Central Government consolidated reporting entity (BPK, 2021). This means that for each reporting entity there are only 6 to 7 auditors available, this is still provided that all auditors are active and able to carry out audit tasks. If we look deeper at the object, BPK auditors are faced with the large number and value of transactions. For the Central Government alone, in 2020, there were more than 9 million expenditure transactions that had to be examined by BPK auditors.

Furthermore, BPK is faced with a limited audit time. According to the provisions in Law Number 15 of 2004, BPK is required to submit an Audit Report on the Central Government's Financial Statements to the Parliament (DPR) and Senate (DPD), which is also copied to the President, no later than 2 (two) months after receiving the financial report from the Central Government. The inspection period is of course very short when compared to the amount elements of the Central Government Financial Statements that must be examined, including testing the fairness of the balances of accounts in the Balance Sheet and transactions in the State Budget Realization Report, Operational Report, Cash Flow Report, Excess Budget Balance (SAL) Change Report , Report on Changes in Equity, and the adequacy of CaLK, as well as SPI and compliance with statutory provisions, including follow-up to previous audits.

Seeing these challenges, like it or not, BPK needs to make breakthroughs and innovations in the state financial audit process to maintain audit quality. The Chairman of the BPK on one occasion as quoted by Setiawan (2020) said that BPK is committed to complete its mandatory tasks within the timeframe as regulated by statutory provisions by utilizing technology, developing various new work methods , and using alternative test measures.

Public Relations of the BPK (2021) said that in examining the Financial Statements of Ministries/Agencies, BPK uses a risk approach or Risk Based Audit. Based on this approach, the examiner will conduct in-depth assessment and testing on high-risk accounts as an audit priority, in order to obtain adequate assurance in determining the opinion regarding the fairness of the presentation of financial statements. With various limitations and cost-benefit considerations, it is impossible for the auditor to conduct examination of all transactions reflected in the financial statements, for this reason, an audit sample that is representative of the population or unfair transactions is required.

One way that can be used to select audit samples is digital analysis using *Benford's Law*. Durtschi *et al*. (2004) who performed a digital analysis of two accounts from a large medical center in the western United States using the Benford's Law approach concluded that *Benford's analysis*, when used appropriately, can be a useful tool for identifying *suspect accounts* for further analysis. Da Silva & Carreira (2013) even formulated two alternative models that can help auditors to select audit samples using *Benford's Law*.

Benford's Law is a unique law about how often a number appears at a certain position in a set of numbers (Nigrini, 1996). According to Benford's Law, a set of data in the form of natural numbers follows a certain pattern (Benford, 1938) so that deviations from this law indicate an irregularity in the data. Although *Benford's Law* has been published since 1938, the use of *Benford's Law* in accounting data was only carried out 50 years later by Carslaw (1988), by applying it to the income data of companies in New Zealand, and Thomas (1989) to the income data of companies in the United States. The first study related to the use of *Benford's Law* to detect the possibility of fraud was carried out by Nigrini (1996) by analyzing the relationship between tax evasion and the figures reported by taxpayers in the United States in order to assess taxpayer compliance.

The use of *Benford's Law* as a digital analysis tool is currently getting more attention. As recorded in http://www.benfordonline.net, to date, there have been more than 1,700 studies globally related to *Benford's Law*. The use of *Benford's Law* is also widely recommended by various well-known audit institutions, such as KPMG (Pavlovic, 2019).

Although research related to *Benford's Law* has increased significantly globally, this is not the case in Indonesia. Research related to the use of *Benford's Law* in accounting in Indonesia is still very limited. Several studies in Indonesia that have been successfully traced include Arkan (2010); Shofy & Irianto (2016); Ardiansah & Sudarto (2017); Prasetyo & Djufri (2020); Bwarleling (2020) and Setyawan (2020). Based on the background described above, the authors are interested in conducting research to test the use of *Benford's Law* analysis to determine the audit priority of the Central Government Financial Statements (LKPP). One part of the Central Government Financial Statements that BPK always pays attention to is the State Budget Realization Report which presents expenditure accounts, so that in this study, the use of *Benford's Law* analysis will be focused on the Central Government Expenditures realization data in 2020.

LITERATUR REVIEW

Benford's Law

In the 1880s, Simon Newcomb, an astronomer and applied mathematician who was also a Professor of Mathematics at the United States Navy and Johns Hopkins University, observed an interesting phenomenon that the early pages of algorithm books in libraries were more worn out than the later pages. This shows that the early pages of the algorithm book that contain numbers with small starting digits were more often used than the later pages which contains numbers with large starting digits. The use of an algorithm book as a tool to find the logarithmic value of a particular number should be used like a dictionary, whose pages are used randomly when someone is looking for something. Newcomb then stated that in a set of natural numbers, the probability of the occurrence of the number 1 in the first digit of a number is greater than that of any other number, and the probability continues to decrease until the number 9 (Newcomb, 1881) .

More than half a century later, Frank Benford, an American electrical engineer and physicist, conducted research that corroborated Newcomb's claims. Benford observed a similar phenomenon and then conducted research on the probability of occurrence of a number. Benford chose 20 data sets sourced from various unrelated fields, such as river length, population, magazines, addresses, death rates, and so on, with a total of more than 20 thousand *records*. The frequency of occurrence of numbers 1 to 9 in the first digit was then calculated for each data set, and then the average frequency of occurrence of the numbers 1 to 9 was calculated for the 20 data sets studied. The results show a logarithmic distribution of the first digit if the number consists of three or more digits (Benford, 1938). Benford put the results of the formulation of the frequency of occurrence of numbers into the table as follows:

Table-1: Frequency of Numbers in the First and Second Digits

Number	First Digit	Second Digit
0	0.000	0.120
1	0.301	0.114
2	0.176	0.108
3	0.125	0.104
4	0.097	0.100
5	0.079	0.097
6	0.067	0.093
7	0.058	0.090
8	0.051	0.088
9	0.046	0.085

Source: Benford (1938)

It is a curious fact that individually unrelated numbers, if in a large group, have a distribution conformance to the Law of "*Anomalous Numbers*" (Benford, 1938). This "*Anomalous Numbers*" law became known as *Benford's Law*.

$$P(D_1 = d_1) = log\left(1 + \frac{1}{d_1}\right);\quad d_1 \in \{1,2,\ldots,9\} \tag{2.1}$$

$$P(D_2 = d_2) = \sum_{d_1=1}^{9} log\left(1 + \frac{1}{d_1 d_2}\right);\ d_2 \in \{0,1,\ldots,9\} \tag{2.2}$$

$$P(D_1 D_2 = d_1 d_2) = log\left(1 + \frac{1}{d_1 d_2}\right);\ d_1 d_2 \in \{10, 11,\ldots,99\} \tag{2.3}$$

Where:

P = probability of occurrence of number
D_1 = first digit
D_2 = second digit
D_3 = first two digits
d_1 = integer from 1 to 9
d_2 = integer from 0 to 9
d_1d_2 = integer from 10 to 99

Audit Risk

Arens *et al*. (2014:132) in their book entitled Auditing and Assurance Services: Fiteenth Edition defines audit risk as *"the risk that the auditor will conclude after conducting an adequate audit that the financial statements are fairly stated and an unqualified opinion can therefore be issued when, in fact, they are materially misstated"*. SA Section 312 (PSA No.25) states that Audit Risk consists of three components, namely *inherent risk*, *control risk*, and *detection risk*. Arens et. al. (2014:257) describes the audit risk model as follows:

Nigrini (2012:5) reformulated *Benford's Law* to measure the probability of occurance of a certain number in the first digit, second digit, and first two digits as follows:

$$PDR = \frac{AAR}{IR\ x\ CR} \tag{2.4}$$

Where:
PDR = *Planned Detection Risk*
AAR = *Acceptable Audit Risk*
IR = *Inherent Risk*
CR = *Control Risk*

Central Government Financial Report

The components of LKPP according to Government Regulation No. 8 of 2006 at least consists of: Budget Realization Report (LRA), Balance Sheet, Cash Flow Statement (LAK), Notes to Financial Statements (CaLK). Referring to Government Regulation No. 71 of 2010, since 2016, LKPP has also been equipped with components in the form of Report on Changes in SAL (LP SAL), Operational Report (LO), and Report on Changes in Equity (LPE). The President is obliged to submit LKPP to the BPK no later than 3 (three) months after the end of the regulatory year (Law Number 1 of 2004).

State Financial Management Examination

In accordance to Law Number 15 of 2004, the examination of state financial management & accountability as mandated by the 1945 Constitution Article 23E is carried out by the BPK, which includes all elements of state finances as referred to in Law Number 17 of 2003 concerning State Finances. The scope of BPK's duties includes inspections of the management and accountability of state finances carried out by the Central Government, Regional Governments, Other State Institutions, Bank Indonesia, State-Owned Enterprises, Public Service Agencies, Regional-Owned Enterprises, and forums or other bodies that manage state finances. As mandated by Law Number 15 of 2004, the BPK is required to deliver Audit Results Report (LHP) on LKPP to the Parliament and the Senate, which is also copied to the President, no later than two (2) months after receiving the financial report from the Central Government.

***Benford's Law* Benefits in Auditing**

Durtschi, Hillison, & Pacini (2004) suggest that *Benford's Analysis*, when used properly, is a useful tool to identify suspected accounts for further analysis. Tam Cho & Gaines (2007) mention *that Benford's Law* is a powerful, objective, simple, and effective tool for identifying anomalies in data. Arkan (2010) states that *Benford's Law* can be used effectively as an audit planning instrument. Ardiansah & Sudarto (2017) states that the use of Benford's Law is able to provide a red flag for possible findings related to expenses during examination, which can later be used as one of the variables in assessing an entity's control risk when planning an audit.

RESEARCH METHODOLOGY

Object of research

The object of this research is the Central Government Expenditures realization data in 2020 and BPK's LHP on LKPP in 2020. The Central Government Expenditures realization data in 2020 amounted to 9,541,200 transactions, consisting of Personnel Expenditures, Goods Expenditures, Capital Expenditures, Subsidies, and Social Assistance. Durtschi, Hillison, & Pacini (2004) suggest that analysis using *Benford's Law* should be carried out on certain accounts using all available data. Thus, in this research, the only data that will be tested using *Benford's Law analysis* is data on the realization of Capital Expenditures from 86 Ministries/Agencies for 2020, with a total transaction of 186,160 *records*.

Data Analysis Techniques

This research is conducted using mixed methods approach with descriptive statistics analysis, *Benford's Law* analysis, and qualitative analysis techniques, which are carried out through the following stages: (1) Data Requirements Validation, (2) *Benford's Law Analysis*, and (3) Discussion of Analysis Results.

Data Requirements Validation

Nigrini (2012) and Durtschi, Hillison, and Pacini (2004) provide an explanation regarding the characteristics of data sets which will naturally follow the expected frequency in *Benford's Law*. These characteristics then become non-mathematical guidelines for many researchers in determining data sets that are feasible to be analyzed using *Benford's Law*. In this study, the researchers grouped the characteristics of the data set into 6 (six) criteria, namely:

1) Data describes a measure of facts or events, referred to as Criterion 1.
2) There is no minimum and maximum value limit, referred to as Criterion 2.
3) Data is not a number that is formed for identification purposes, referred to as Criterion 3.
4) Data set is a number resulting from a mathematical combination, referred to as Criterion 4.
5) The size of data set is large with the level of transaction details, referred to as Criterion 5.
6) Data set has a mean greater than the median with a positive skewness, referred to as Criterion 6.

***Benford's Law* Analysis**

Benford's Law analysis is used in this study to determine whether there is a deviation in the frequency of occurrence of numbers in the Central Government Capital Expenditure realization data against the frequency according to *Benford's Law.* Analysis using *Benford's Law* requires a way to assess the suitability of a data with *Benford's Law*. Data sets analyzed using *Benford's Law are* generally data sets with a large number of *records*, so that even a small deviation will have a statistically significant impact. Therefore, a matching test that ignores the number of records is needed, which in this case is a test using Mean Absolute Deviation (MAD) (Nigrini, 2012). The formulation of MAD is as follows:

$$MAD = \frac{\sum_{i=1}^{K} |AP - EP|}{K} \qquad (3.1)$$

Where:
K = number of digits (9 for the first digit, 10 for the second digit and 90 for the first two digits)
AP = actual proportion
EP = expected proportion

Nigrini (2012) states that there are 3 (three) main tests in conducting analysis using *Benford's Law*, namely testing: (1) first digit (FD); (2) second digit (SD); and (3) first-two digits (F2D) which is sometimes called a first-order test. The analysis using this primary testing tool is carried out separately between positive and negative numbers because the urge to manipulate data differs between positive and negative numbers.

In testing the suitability of a data against the expected proportion, Drake & Nigrini (2000) determine the critical value and the conclusions of each deviation value against *Benford's Law* as shown in the following table:

Table-2: Critical Points and Conclusions for MAD Value

Test	Range	*Conformity*
First Digit (FD)	0.000 to 0.006 0.006 to 0.012 0.012 to 0.015 above 0.015	*Close* *Acceptable* *Marginal* *Non*
Second Digit (SD)	0.000 to 0.008 0.008 to 0.010 0.010 to 0.012 above 0.012	*Close* *Acceptable* *Marginal* *Non*
First Two Digits (F2D)	0.0000 to 0.0012 0.0012 to 0.0018 0.0018 to 0.0022 above 0.0022	*Close* *Acceptable* *Marginal* *Non*

Source: Nigrini (2012)

Discussion of Analysis Results

The results of the expenditure transaction data analysis against *Benford's Law* are then discussed further to provide an overview in determining the audit sample for expenditure transactions. The final step is drawing conclusions to find out whether the use of *Benford's Analysis* is effective for detecting audit findings in the Central Government Financial Statements, especially those related to Central Government Expenditures, by comparing the expenditure transaction data test results with the BPK's Audit Results Report on the Central Government Financial Statements.

RESULTS AND DISCUSSION

Descriptive Statistical Analysis

Results of descriptive statistical analysis on transaction data spending of M orking of 86 K / L in 2020 can be seen in Table 3, as follows:

Table-3: Descriptive Statistics of Capital Expenditure Realization Data

Description	Score
Mean	1,026,432,724
Standard Error	62,335,013
Median	51,462,304
Standard Deviation	26,895,228,768
Skewness	0.27
Range	9,657,161,474,294
Minimum Value	2
Maximum Value	9,657,161,474,296
Total value	191,080,715,992,548
Number of Records	186,160

Source: expenditure realization data, processed with *Microsoft Excel*

The results of descriptive statistics analysis shows that the number of Capital Expenditures transactions examined are 186,160 *records* with the lowest transaction value amounting to Rp2 and the highest amounting to Rp9.66 trillion. The total value of Capital Expenditure transactions from the data studied is Rp191.08 trillion, indicating an excess of Rp160.88 billion compared to the realization of Central Government Capital Expenditures reported in the 2020 Audited LKPP. This is, among others, due to the expenditure refund transactions are not used in this study because of its negative value, as raised by Nigrini (2012) that an analysis using *Benford's Law* is conducted separately between positive number with a negative number because the urge to manipulate the data differ between positive and negative numbers.

The results of descriptive statistical analysis by grouping data by organization/Budget Section show that the Budget Section with code 052 is the Budget Section with the least number of transactions, which is 1 transaction, and the Budget Section with code 033 is the Budget Section with the highest number of transactions, which is 49,321 transactions. All Budget Sections have a mean greater than the median, but only 48 Budget Sections have a positive *skewness* or > 0.

Data Requirements Validation

The results of testing the characteristics of data requirements based on Nigrini (2012) and Durtschi, Hillison, & Pacini (2004) which have been grouped into six criteria are as follows:

Table-4: Conclusion of Data Requirement Validation

Criterion	Data Characteristics	Conclusion
1	Data describes a measure of facts or events	Fulfilled
2	There is no minimum and maximum value limit	Fulfilled
3	Data is not a number formed for identification purposes	Fulfilled
4	Data set is a number resulting from a mathematical combination	Fulfilled
5	The size of data set is large with the level of transaction details	Fulfilled
6	Data set has a mean greater than the median with a positive skewness	Fulfilled

Source: Analysis results

Benford's Law Analisis Analysis

First Digit Test of Overall Capital Expenditure

The results of the first digit test of the Capital Expenditure realization data as a whole show a distribution pattern that tends to follow the pattern expected by *Benford's Law* with a MAD of 0.0097. This is in line with what was conveyed by Nigrini (2012) that even though there are abnormalities in the analyzed data, the first digit analysis sometimes still shows a good level of conformity with *Benford's Law*. If referring to the conformity assessment against *Benford's Law* submitted by Nigrini (2012), the level of conformity of the distribution pattern of the first digit of the Capital Expenditure realization as a whole against *Benford's Law* is at the level of Acceptable Conformity. The suitability of this pattern can be seen in Figure 2 below:

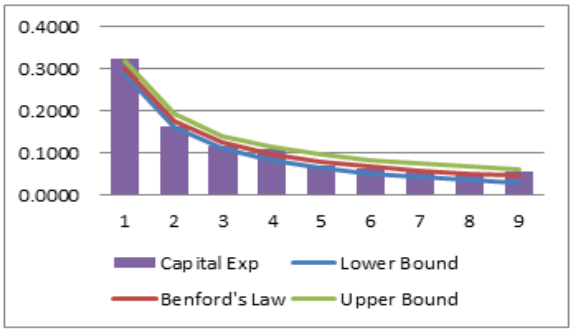

Fig-2: Deviation of the Frequency Distribution of Numbers in the First Digit of Capital Expenditures Realization against *Benford's Law*
Source: Analysis Results

Meanwhile, the distribution deviation value of each number in the first digit of the Capital Expenditure realization data against *Benford's Law* can be seen in Table 5 as follows:

Table-5: Deviation of Distribution of Numbers in the First Digit of Capital Expenditures against *Benford's Law*

FD	Benford's Law	Capital Expenditure	Deviation	Conformity
1	0.3010	0.3241	0.0231	Non
2	0.1761	0.1616	0.0144	Marginal
3	0.1249	0.1167	0.0082	Acceptable
4	0.0969	0.1097	0.0128	Marginal
5	0.0792	0.0703	0.0089	Acceptable
6	0.0669	0.0614	0.0055	Close
7	0.0580	0.0553	0.0027	Close
8	0.0512	0.0475	0.0037	Close
9	0.0458	0.0533	0.0076	Acceptable
MAD			**0 .0097**	**Acceptable**

Source: Analysis Results

Referring to Figure 2 and Table 5, it can be seen that there is a distribution of numbers in the first digit of the Capital Expenditure transaction that is not in accordance with *Benford's Law* pattern, with a level of conformity of *Non Conformity* and *Marginal Conformity*. The frequency of occurrence of the number 1 is higher than expected by *Benford's Law*, reaching 32.41 percent with a conformity level of *Non Conformity*. The frequency of occurrence of numbers 2 and 4 is also not in accordance with *Benford's Law*, with a level of conformity of *Marginal Conformity*. The frequency of occurrence of the number 2 in the first digit is less than expected by *Benford's Law*, while the frequency of occurrence of the number 4 is higher than that expected by *Benford's Law*.

In this study, what needs to be paid attention to are numbers with a higher frequency of occurrence than expected by *Benford's Law* because they are indicated not to have formed naturally? Thus, referring to the results of the first digit test of the Capital Expenditure realization data, what needs to be paid attention to is the Capital Expenditure transactions having numbers 1 and 4 as the first digit of their value? Based on the results of data analysis, there are 60,337 Capital Expenditure transactions with a value having number 1 as the first

digit and 20,416 transactions having number 4 as the first digit.

Second Digit Test of Overall Capital Expenditure

The results of the second digit test of the Capital Expenditure realization data as a whole show that the distribution pattern does not follow the pattern expected by *Benford's Law* with a MAD of 0.0140. If referring to the conformity assessment of *Benford's Law* submitted by Nigrini (2012), the level of conformity of the distribution pattern of the second digit of the Capital Expenditure realization as a whole against *Benford's Law* is at the level of *Non Conformity*, as shown in Figure 3. The distribution deviation value of each number in the second digit of the Capital Expenditure realization data against *Benford's Law* can be seen in Table 6:

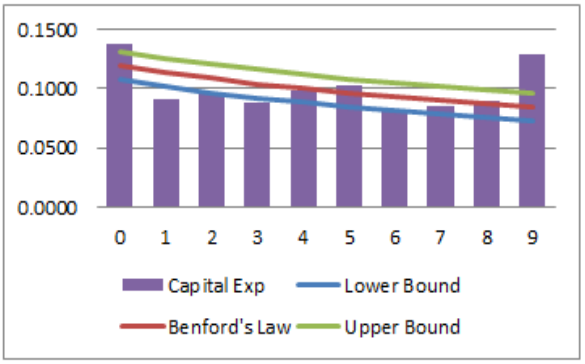

Fig-3: Deviation of the Frequency Distribution of Numbers in the Second Digit of Capital Expenditure Realization Against Benford's Law
Source: Analysis Results

Table-6: Deviation of Distribution of Numbers in the Second Digit of Capital Expenditures Against Benford's Law

SD	Benford's Law	Capital Expenditure	Deviation	Conformity
0	0.1197	0.1373	0.0177	Non
1	0.1139	0.0915	0.0223	Non
2	0.1088	0.0964	0.0124	Non
3	0.1043	0.0878	0.0165	Non
4	0.1003	0.0978	0.0025	Close
5	0.0967	0.1032	0.0065	Close
6	0.0934	0.0828	0.0106	Marginal
7	0.0904	0.0848	0.0056	Close
8	0.0876	0.0896	0.0020	Close
9	0.0850	0.1288	0.0438	Non
MAD			**0,0140**	**Non**

Source: Analysis Results

Referring to Table 6, it can be seen that there is a distribution of numbers in the second digit of the Capital Expenditure transactions that are not in accordance with *Benford's Law* pattern, with a level of conformity of *Non Conformity*. The frequency of occurance of the numbers 0 and 9 is higher than expected by *Benford's Law*. Thus, what needs to be paid attention to is Capital Expenditure transactions with values that have the numbers 0 and 9 as the second digit. Based on the results of data analysis, there are 25,567 Capital Expenditure transactions having the number 0 as the second digit and 23,974 transactions having the number 9 as the second digit.

***First Two Digits Test* of Overall Capital Expenditure**

The first two digits test has a better accuracy rate than the previous two analyses. However, the results of previous tests can still be used as criteria to narrow the focus of testing at this stage. Taking into account the results of the previous test, the first two digits test of the Capital Expenditure realization data is focused on transactions that have numbers 1 and 4 as the first digits of their value and numbers 0 and 9 as the second digits of their value, obtaining 34 groups of transactions. The results of the first two digits test of Capital Expenditure realization data with these criterias show a distribution pattern that does not follow the pattern as expected by *Benford's Law*, with a MAD of 0.0027 or with a conformity level of *Non Conformity*, as shown in Figure 4.

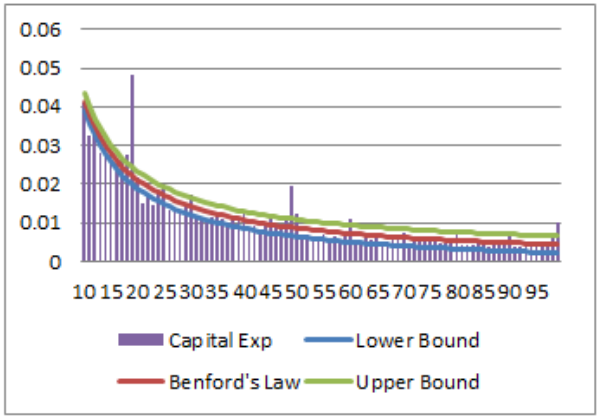

Fig-4: Deviation of the Frequency Distribution of Numbers in the First Two Digits of Capital Expenditure Realization against *Benford's Law*
Source: Analysis Results

Based on the results of the analysis, out of the 34 transaction groups, there are 9 transaction groups

with the conformity level with *Benford's Law* at the *Non Conformity* level , namely transactions with the first two-digit numbers of 18,19, 30,40, 45, 49, 50, 60, and 99, with a total of 31,869 transactions.

Analysis on Deviation of Capital Expenditure Grouped by Budget Section Distribution against *Benford's Law*

Benford's Law analysis will be more robust if applied to a more homogeneous data set, so that grouping the data into classifications that make it more homogeneous can increase the effectiveness of using *Benford's Law* in the selection of audit samples. In this study, the Capital Expenditures realization data are grouped into Budget Sections or Ministries/Institutions. Based on the results of descriptive statistical analysis, not all Budget Sections meet the criteria for data requirements, especially Criterion 5 and Criterion 6. Only 16 Budget Sections out of 86 Budget Sections, with a total transaction of 124,991, meet the combination of Criterion 5 and Criterion 6. The use of the Budget Section code in this study does not indicate the Budget Section code as stipulated in the legislation, and is only used for research purposes.

First Digit Test of Capital Expenditure Grouped by Budget Section

The results of the first digit test of the Capital Expenditure realization data grouped by Budget Section in 16 Budget Sections show that the conformity level with *Benford's Law* is at the level of *Acceptable Conformity*, with a MAD of 0.0097. However, there are occurrences of the number 1 with a higher frequency than expected by *Benford's Law* in 9 Budget Sections and higher occurrences of the number 4 than expected by *Benford's Law* in 5 Budget Sections. The results of the first digit test of Capital Expenditures realization grouped by Budget Sections can be seen in Figure 5 below:

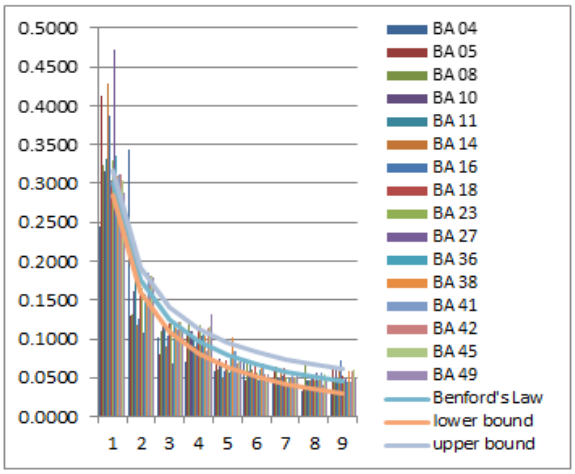

Fig-5: Deviation of the Frequency Distribution of Numbers in the First Digit of Capital Expenditures Realization Grouped by Budget Section against *Benford's Law*
Source: Analysis Results

***Second Digit Test* of Capital Expenditures Grouped by Budget Section**

The results of the second digit test of the Capital Expenditure realization data grouped by Budget Section in the 16 Budget Sections show that the conformity level with *Benford's Law* is at the level of *Non Conformity*, with a MAD of 0.0148. The results of the second digit test of the Capital Expenditures realization based grouped by Budget Sections can be seen in Figure 6 below:

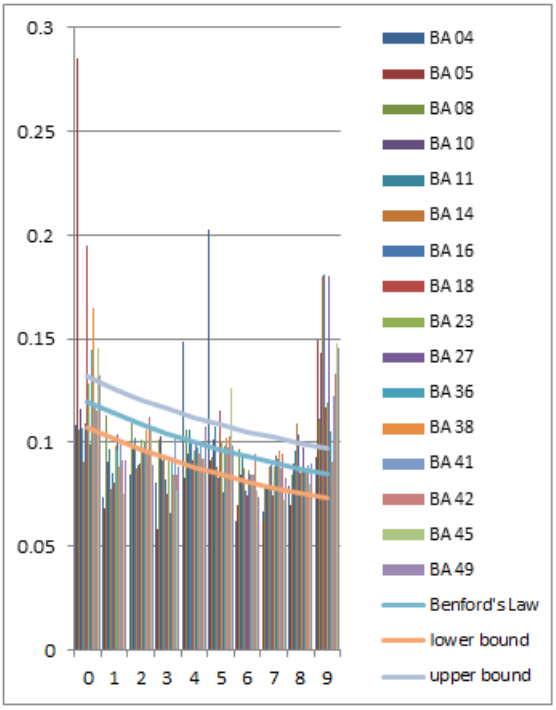

Fig-6: Deviation of the Frequency Distribution of Numbers in the Second Digit of Capital Expenditures Realization Grouped by Budget Section against *Benford's Law*
Source: Analysis Results

The results of the second digit test indicate the occurrence of the number 0 with a higher frequency than expected by *Benford's Law* in 6 Budget Sections and the frequency of occurrence of the number 9 being higher than expected by *Benford's Law* in 14 Budget Sections.

***First Two Digits Test* of Capital Expenditure Grouped by Budget Section**

The results of the first two digits test of the Capital Expenditure realization data grouped by Budget Section in the 16 Budget Sections show that the conformity level with *Benford's Law* is at the *Marginal Conformity* level, with MAD of 0.0019. Based on the results of the analysis, there are several groups of the first two-digit numbers that must be paid attention to because the frequency of occurrence is higher than expected by *Benford's Law*, namely 19, 49, and 99. The frequency of occurrence of the number 19 as the first two digits is higher than expected by *Benford's Law* in

16 Budget Sections or as many as 5,892 transactions. The frequency of occurrence of the number 49 as the first two digits is higher than expected by *Benford's Law* in 15 Budget Sections or as many as 2,369 transactions. The frequency of occurance of the number 99 as the first two digits is higher than expected by *Benford's Law* in 13 Budget Sections or as many as 1,115 transactions. The total amounts to 9,376 transactions. The results of the first two digits test of the Capital Expenditures realization grouped by Budget Section can be seen in Figure 7 below:

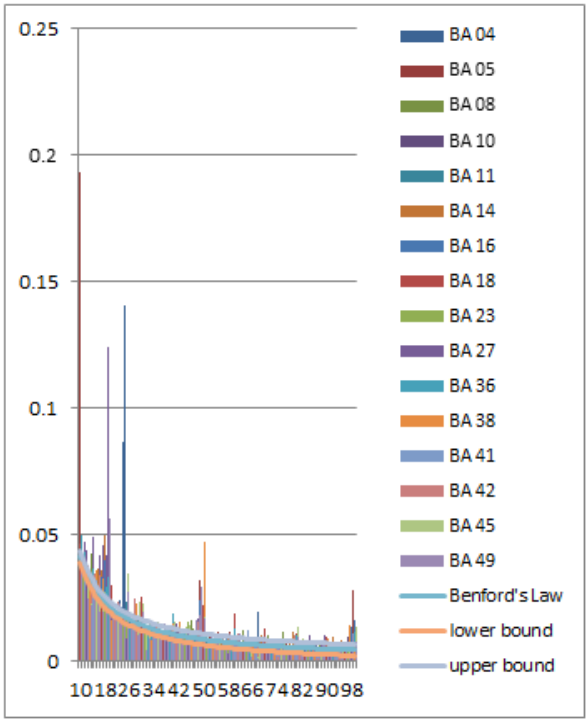

Fig-7: Deviation of the Frequency Distribution of Numbers in the First Two Digits of Capital Expenditure Realization Grouped by Budget Sections Against *Benford's Law*
Source: Analysis Results

DISCUSSION OF ANALYSIS RESULTS

Audit Sampling Determination Based on the Result of *Benford's Law* Analyis

This study can provide an overview in determining the audit sample for state expenditure transactions in the form of Central Government Capital Expenditures as follows:

1) Based on the analysis results of the first digit test of the Capital Expenditure realization data as a whole against *Benford's Law*, 60,337 Capital Expenditure transactions having the number 1 as the first digit were obtained and 20,416 transactions having 4 as the first digit, which deviated from the *Benford's Law* provisions. Therefore, the total transactions that need to be considered for the auditor's attention are 80,753 transactions, or 43.38 percent of the observed transaction data (186,158 transactions).
2) Based on the analysis results of the second digit test of the Capital Expenditure realization data as a whole against *Benford's Law, it was* found that 25,567 Capital Expenditure transactions with a value of 0 as the second digit and 23,974 transactions which had the number 9 as the second digit which deviated from the provisions of *Benford's Law*. Therefore, the total transactions that need to be considered for the auditor's attention are 49,541 transactions or 26.61 percent of the observed transaction data (186,158 transactions).
3) Based on the analysis results of the test of the first two digits test of the Capital Expenditure realization data as a whole against *Benford's Law*, transactions with the conformity level with *Benford's Law* at the *Non Conformity* level are obtained, namely transactions with the first two digits of 18, 19, 30, 40, 45, 49, 50, 60, and 99. Thus, the total transactions that need to be considered for the auditor's attention are 31,869 transactions or 17.12 percent of the observed transaction data (186,158 transactions).
4) Based on the analysis results of the first digit test of the Capital Expenditure realization data grouped by Budget Section against *Benford's Law*, it was found that transactions with values having the numbers 1, 2, 4, 8 and 9 as the first digits in the 16 Budget Sections deviate from the provisions of *Benford's Law*. In this case, the total transactions that need to be considered for the auditor's attention are 35,479 transactions or 28.38 percent of the observed transaction data (124,991 transactions).
5) Based on the analysis results of the second digit test of the Capital Expenditure realization data grouped based on the Budget Section against *Benford's Law*, transactions with values having the numbers 0, 4, 5, 8 and 9 as the second digit in the 16 Budget Sections deviate from the provisions of *Benford's Law*. Therefore, the total transactions that need to be considered for the auditor's attention are 29,072 transactions or 23.26 percent of the observed transaction data (124,991 transactions).
6) Based on the analysis results of the first two digits test of the Capital Expenditure realization data grouped based on the Budget Section against *Benford's Law*, in general, transactions with values having the numbers 19, 49 and 99 as the first two digits in the 16 Budget Sections deviate from the provisions of *Benford's Law*. The frequency of occurrence of the number 19 as the first two digits is higher than what *Benford's Law* expects in 16 Budget Sections, with a total of 5,892 transactions. The frequency of occurrence of the number 49 as the first two digits is higher than expected by *Benford's Law* in 15 Budget Sections, or as many as 2,369 transactions. The frequency of occurance of the number 99 as the first two digits is higher than *Benford's Law* expects in 13 Budget Sections, with a total of 1,115 transactions. Thus, the total transactions that need attention are 9,376 or 7.5

percent of all Capital Expenditure transactions in the 16 observed Budget Sections (124,991 transactions).

The Effectiveness of *Benford's Law* Analysis Results in Detecting Error and/or Fraud in Transaction Data

In this study, the analysis results of the Capital Expenditure realization data in the form of the conformity level of the frequency distribution of the Capital Expenditure realization data against *Benford's Law* will be compared with the audit findings presented in the BPK's Audit Results Report (LHP) on the 2020 Central Government Financial Statements. Considering the absence of detailed findings per transaction in the LHP, the comparisons were made using the analysis results of the Capital Expenditure realization data grouped by Budget Section against BPK's LHP findings related to Capital Expenditure grouped by Budget Section, which results are shown in Table 7 below this:

Table-7: Comparison of Capital Expenditure against *Benford's Law* Test Results with Findings Related to Capital Expenditures in BPK's LHP

BA Test	Conclusion of the First Two-Digit Test	Findings Related to Capital Expenditures in BPK's LHP		
		Contract Issues	Wrong Account	Compliance Issues
BA 04	*Non*	✓	-	✓
BA 05	*Non*	-	-	-
BA 08	*Non*	-	✓	✓
BA 10	*Non*	✓	-	-
BA 11	*Marginal*	✓	-	✓
BA 14	*Non*	✓	✓	-
BA 16	*Non*	✓	-	✓
BA 18	*Non*	✓	✓	✓
BA 23	*Acceptable*	✓	-	✓
BA 27	*Non*	✓	-	✓
BA 36	*Non*	-	-	✓
BA 38	*Non*	✓	-	-
BA 41	*Marginal*	-	-	✓
BA 42	*Non*	✓	-	✓
BA 45	*Non*	✓	-	-
BA 49	*Non*	✓	✓	-

Source: Analysis Results

From Table 7, it can be seen from the 13 Budget Sections that have a conformity level with *Benford's Law* at the *Non Conformity* level, there is only 1 Budget Section that has not ben proven that deviations from *Benford's Law* can detect errors/frauds. This means that the *Benford's Law* analysis in this study is proven to be able to effectively detect potential errors and/or fraud in Capital Expenditures and its use allows the reduction of detection risk by providing an adequate audit samples.

CONCLUSION

A case study conducted on Central Government Capital Expenditure realization data in 2020 shows that there is a discrepancy in the distribution pattern of the numbers in the first digit, second digit, and the first two digits of the Capital Expenditure realization data against the distribution pattern expected by *Benford's Law*. The results of the analysis are able to provide detailed information related to transactions that can be considered by the auditor for further analysis. The results of this study also show that the use of *Benford's Law is* able to provide an early indicator (*red flag*) of the possibility of findings related to expenditure in an examination. The discrepancy in the distribution pattern of the Capital Expenditure realization data grouped by Budget Section against *Benford's Law*, when is used to predict the possibility of audit findings, shows a link or relationship. Based on the analysis results of the Capital Expenditures realization data, there are 13 Budget Sections from 16 Budget Sections which are observed to produce a level of conformity with *Benford's Law* at the *Non Conformity* level. Of the 13 Budget Sections, there is only 1 Budget Section that has no findings related to Capital Expenditures that is reported in the BPK's LHP on the 2020 Central Government Financial Statements. This means that the *Benford's Law* analysis in this study has proven to be able to effectively detect potential errors and/or fraud in Capital Expenditures. However, the unavailability of data on errors and/or fraud found at the transaction level makes the effectiveness of determining audit samples using *Benford's Law* analysis difficult to be measured accurately.

Some suggestions for future research are that the study can be done by grouping transactions that are the object of observation in more detail, not only by

Budget Section, but also up to by grouping them by more specific classification, or certain account groups, such as Land Capital Expenditures, Capital Expenditures for Equipment and Machinery, and so on.

In addition, similar research can also be applied to elements other than Government Financial Statement , for example, on the part of other Budget Realization Audit Report, such Revenue transactions (Taxation, Customs, and Non-tax), or elements of the financial statements, such as Balance accounts, Cash Flow Report, Excess Budget Balance Report, and so on. Research can also be carried out in other areas of State Finance management, such as at the Regional Government level or other subjects of State Finance. However, what is important is to ensure that the data set to be analyzed meets the data requirements criteria, so that the results of data analysis are accurate, and there are no errors in concluding.

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