

The First Digits Analysis Until the Fifth Benford Law in Financial Statement

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Abstract – research aims to explore if there is fraud in a financial statement, use the Act stated that Benford's distribution number the first digit until the fifth will follow the trend of lower number. Research methods-in this case study authors use the first digit until fifth of the analysis of the numbers. Having obtained the results of the analysis of the first and fifth digits, the authors make a distinction between implementation using the scale above and below 5%, the rate of occurrence of difference. The findings – from research that has been done can be drawn the conclusion that digit more often appears in accordance with the characteristics of Benford's law, almost in its entirety the company in Benford law, except for the use of the scale specified by the limit of 5%. The data from the financial reports do not follow Benford's model, then there is the assumption of the financial report which examined the possibility of manipulation going on. Conclusions - concludes that Benford's law can serve as indicator tool in detecting the possibility of wrong in financial statements to case studies of PT Astra International Tbk 2000-2010.

Keywords – Benford law; First digits; Fifth digits; Indonesian company.

I. INTRODUCTION

Analysis of Benford's law if we see in the form of a table, consisting of analytical first digit up to fifth with a frequency rate of occurrence number that occurred in the prediction of Benford's law, as presented in the [Table: 1] below:

Table 1: Benford's law : expected digital frequencies

Digit	Position in Number				
	First	Second	Third	Fourth	Fifth
0		0.11968	0.10178	0.1002	0.1000
1	0.30103	0.11389	0.10138	0.1001	0.1000
2	0.17609	0.10882	0.10097	0.1001	0.1000
3	0.12494	0.10432	0.10057	0.1001	0.1000
4	0.09691	0.10031	0.10018	0.1000	0.1000
5	0.07928	0.09668	0.09979	0.1000	0.1000
6	0.06695	0.09337	0.09940	0.0999	0.1000
7	0.05799	0.09035	0.09902	0.0999	0.1000
8	0.05115	0.08757	0.09864	0.0999	0.1000
9	0.04576	0.08499	0.09827	0.0998	0.1000

Source : Nigrini, M. J., 1996. "A taxpayer compliance application of Benford's Law." The Journal of the American Taxation Association 18 (Spring): 72-91

In the figure above we can see the numbers zero to nine, with numbers and we can also see the level of probability of occurrence of the numbers zero to nine at the table column next to it. If we do the analysis, it will be visible to any numbers zero to nine, to the first digit up to the fifth digit of the frequency of occurrence of numbers in small numbers by domination. In the publication of a study performed by [1][2][3] explains how the existence of a fairly strong influence in Benford's law on the application of data analysis performed. In a study of the use of accounting data and Nigrini financial dealing in analyzing tax payments that have been done by the company. Nigrini in research and the study concluded that the average taxpayer in the United States are more likely to commit fraud in the field of taxation, in the sense that they are taxpayers prefer to report their income tax as small as small as possible, so that the taxes will be paid later. In a study of nigrini that also

describes how many policies taken by the taxpayer, where by doing step understatements, and thus will be able to lead to a reduction of the amount of tax to be paid significantly. The research aims to explore if there is fraud in a financial statement, use the Act stated that Benford's distribution number the first digit until the fifth will follow the trend of lower number.

II. LITERATURE REVIEW

In the literature the use of Benford's law, such as studies relating to finance, economics and accounting, in doing by [4], [5], [6], [7], [8], [9], [10], [11]. In their study the look of how a process of documenting as well as authentic evidence of the finding by the application of Benford's law in detecting cheating financial report, there is a common thread which perceives the Benford's law is a model of fraud detection analysis tools that can count on. Good study done in the country of each author identifies that many of the studies that show that companies do research on average perform their management, by performing an act of delaying income they receive, and making a payment evasion nature can lead to bankruptcy for the company. In the documentation of the financial statements they see, look how the company describes the existence of party manipulation more opportunistic nature against the financial statements to which they report. It makes the relationship between the revenue at the company's performance and decrease buttons give negative signals, about how the actual performance of the company. But still it happened a violation of generally accepted accounting principles. and shows that there is a manipulation in the financial report of the company, such as the occurrence of a breach of the agreement that may affect the time continuity of the company. This case is found in a study done by one of the researchers at the top in 2001 to swiss air carriers.

In a study of [12], [13], [14], [15], [16], [17], [18] is still investigating the use of Benford's law in assessing the existence of accuracy over the predictability in the scale of distribution figures for the use of model analysis of first digits, to indicate the occurrence of fictitious report rendering in the join with the artificial manipulation in reporting the number of numbers in the analysis. This testing is inseparable from the process of detection of Benford's law, about the existence of a fraud in describing empirically and scientifically in accordance with the rules of the scale appearance numbers contained on the Benford law. Indeed, if

we look carefully the Benford Law implies the existence of some set of occurrence number that its nature according to the author can not be predicted, as the emergence of the phenomenon of night and day. In the prediction of the emergence of figures ranging from legal Benford single digits up to nine digits shows how can frequency prediction up a series of data, so that it could be the basis of the frequency of occurrences over the cheating that can be caused by a number of anomalies. It is not possible there are as important as frequency prediction between number with numbers that will be analyzed. In the latest study done by one of the above, the authors give an opinion regarding the use of Benford's law in the view of the company's bankruptcy prediction.

III. RESEARCH METHOD

3.1. Data and time of Research

This study conducted by the authors using financial statement data of PT Astra International Tbk listed on the Indonesia Stock Exchange started the year ended 2000-2010. The author conducting this study in April-Mei 2016.

3.2. Analysis data technique

In the model analysis of the conformity level test done by [19], used some of the model verification whether a particular set of data can be considered to follow the model of Benford law on proposing. Then in the context of achieving a conformance testing, do the following steps to get results as they expect. To Test digit number 1 ($T = 1$): Author must Compares f_i with e_i for the First digit of numbers, i.e. for $i = i_1$, $i_1 = 1; \dots; 9$. To Test digit number 2 ($T = 2$): Author must Compares f_i with e_i for the second digit of numbers, i.e. for $i = i_2$, $i_2 = 0; 1; \dots; 9$. To Test digit number 3 ($T = 3$): Author must Compares f_i with for the Third digit of numbers, i.e. for $i = i_3$, $i_3 = 0; 1; \dots; 9$. To Test digit number 4 ($T = 4$): Author must Compares f_i with e_i for the Four digit of numbers, i.e. for $i = i_4$, $i_4 = 0; 1; \dots; 9$. To Test digit number 5 ($T = 5$): Author must Compares f_i with e_i for the Five digit of numbers, i.e. for $i = i_5$, $i_5 = 0; 1; \dots; 9$.

IV. RESULT AND DISCUSSION

These authors view the results of the analysis of financial reporting data PT Astra International Tbk, which has been in sports by using model analysis of

Benford's law. Presented in [Table 1-10] for the year ended 2006-2010.

Table 2 : Result test first digit benford law year ended 2004-2000

Nomor	Year 2004	Year 2003	Year 2002	Year 2001	Year 2000
	Differences	Differences	Differences	Differences	Differences
1	6,01%	1,84%	-1,21%	-1,02%	3,80%
2	-5,11%	1,14%	-1,31%	3,67%	2,73%
3	2,09%	-6,24%	6,77%	8,07%	10,39%
4	-2,05%	6,28%	-0,80%	-7,56%	-5,45%
5	5,28%	2,50%	-2,73%	0,59%	-3,68%
6	0,94%	-3,22%	-1,51%	-1,02%	-4,15%
7	-2,33%	0,45%	-2,84%	-0,13%	-0,71%
8	-2,34%	-0,95%	0,81%	-1,57%	-0,88%
9	-2,49%	-1,80%	2,83%	-1,03%	-2,03%

Sources : Porceed by author

Table 3 : Result test second digit benford law year ended 2010-2005

Nomor	Year 2010	Year 2009	Year 2008	Year 2007	Year 2006	Year 2005
0	2,51%	8,74%	3,86%	0,80%	9,41%	1,17%
1	5,85%	-1,39%	3,72%	-3,59%	4,47%	5,40%
2	-12,29%	-9,17%	-8,37%	-9,24%	-12,29%	-11,85%
3	4,74%	-4,72%	-3,96%	3,05%	-4,91%	-4,59%
4	2,38%	1,40%	-2,84%	3,45%	-4,51%	-4,19%
5	7,49%	9,10%	9,98%	12,67%	8,87%	9,39%
6	7,49%	11,34%	7,82%	8,42%	4,73%	5,02%
7	6,12%	4,91%	7,82%	7,71%	8,88%	9,40%
8	7,50%	9,91%	11,42%	4,88%	3,36%	3,56%
9	4,05%	5,63%	6,39%	7,72%	21,29%	22,54%

Sources : Porceed by author

Table 4 : Result test second digit benford law year ended 2004-2000

Nomor	Year 2004	Year 2003	Year 2002	Year 2001	Year 2000
0	2,89%	6,52%	-2,48%	-1,33%	-6,93%
1	-3,28%	-3,86%	-3,36%	-7,13%	-4,67%
2	-7,72%	-11,66%	-11,12%	-6,40%	-3,91%
3	9,16%	4,64%	3,44%	0,21%	-0,35%
4	-0,57%	2,98%	1,65%	3,45%	-1,63%
5	6,66%	13,60%	11,58%	10,54%	8,31%
6	10,04%	4,02%	10,86%	12,67%	9,99%
7	8,02%	7,44%	8,67%	5,58%	17,56%
8	3,97%	8,82%	10,13%	10,55%	6,64%
9	6,67%	3,34%	6,48%	7,72%	10,84%

Sources : Porceed by author

Table 5 : Result test third digit benford law year ended 2010-2005

Nomor	Year 2010	Year 2009	Year 2008	Year 2007	Year 2006	Year 2005
0	4,82%	3,16%	2,41%	4,64%	-0,18%	1,10%
1	-5,14%	-3,47%	-4,21%	-6,43%	-0,14%	0,39%
2	-1,53%	-1,95%	-4,91%	7,68%	-0,81%	-0,32%
3	2,80%	4,02%	-2,65%	-4,13%	-2,20%	-1,79%
4	3,55%	1,09%	1,09%	7,76%	4,98%	5,77%
5	0,02%	-1,09%	1,87%	-2,57%	0,74%	1,30%
6	-3,51%	-6,24%	1,17%	-0,31%	0,77%	1,34%
7	2,96%	2,69%	1,21%	-1,01%	-4,19%	-3,89%
8	-1,29%	2,73%	-1,72%	-0,98%	-4,86%	-4,60%
9	-2,68%	-0,94%	5,73%	-4,64%	0,17%	0,70%

Sources : Porceed by author

Table 6 : Result test third digit benford law year ended 2004-2000

Nomor	Year 2004	Year 2003	Year 2002	Year 2001	Year 2000
0	4,69%	-4,46%	-0,40%	-6,58%	1,69%
1	-2,03%	-3,00%	1,14%	2,09%	-5,90%
2	2,07%	2,05%	7,20%	-6,50%	4,31%
3	9,54%	2,80%	2,72%	0,73%	-3,28%
4	-0,56%	-2,88%	-6,26%	4,37%	1,85%
5	-3,22%	3,59%	0,55%	5,85%	6,97%
6	0,20%	2,20%	2,09%	3,01%	-4,01%
7	-1,79%	-2,04%	-3,14%	0,89%	-1,43%
8	-5,81%	0,85%	-3,10%	-1,23%	2,00%
9	-3,07%	0,89%	-0,80%	-2,63%	-2,20%

Sources : Porceed by author

Table 7 : Result test four digit benford law year ended 2010-2005

Nomor	Year 2010	Year 2009	Year 2008	Year 2007	Year 2006	Year 2005
0	9,29%	24,51%	17,52%	21,41%	-0,36%	-3,41%
1	-1,04%	-3,54%	-4,21%	0,70%	-5,18%	-4,22%
2	-2,42%	-5,69%	-4,94%	-2,15%	1,02%	3,21%
3	0,33%	-4,25%	-1,31%	-5,72%	-1,04%	0,73%
4	1,72%	-0,65%	0,14%	0,71%	-1,72%	-0,08%
5	-3,79%	-2,81%	-0,58%	-5,00%	-3,10%	-1,74%
6	-1,71%	-2,80%	-2,02%	-7,13%	-1,71%	-0,07%
7	-5,16%	-3,52%	0,88%	-1,42%	-1,71%	-0,07%
8	3,80%	1,52%	0,15%	0,72%	1,73%	4,06%
9	-1,01%	-2,79%	-5,63%	-2,12%	-0,32%	1,59%

Sources : Porceed by author

Table 8 : Result test four digit benford law year ended 2004-2000

Nomor	Year 2004	Year 2003	Year 2002	Year 2001	Year 2000
0	-1,86%	-1,05%	0,51%	2,67%	1,84%
1	3,60%	5,16%	-3,24%	-5,53%	1,01%
2	-1,17%	-0,35%	9,54%	-1,05%	2,70%
3	0,19%	-3,80%	-1,74%	3,42%	-4,08%
4	-1,16%	-1,03%	-0,98%	-4,78%	4,41%
5	7,69%	-0,34%	-2,48%	-0,30%	-1,53%
6	-3,87%	-1,02%	4,30%	4,94%	-0,67%
7	1,57%	1,04%	-6,23%	0,46%	-4,06%
8	-3,19%	1,04%	2,04%	-1,03%	4,42%
9	-1,82%	0,36%	-1,71%	1,21%	-4,05%

Sources : Porceed by author

Table 9 : Result test five digit benford law year ended 2010-2005

Nomor	Year 2010	Year 2009	Year 2008	Year 2007	Year 2006	Year 2005
0	52,69%	58,75%	63,23%	69,07%	6,42%	-0,43%
1	-4,78%	-6,88%	-6,85%	-9,22%	-4,03%	-3,04%
2	-7,76%	-6,09%	-9,21%	-7,67%	-1,79%	-0,43%
3	-6,27%	-7,66%	-5,28%	-5,35%	-2,54%	-1,30%
4	-7,01%	-6,09%	-6,06%	-6,12%	-1,04%	0,43%
5	-4,03%	-3,75%	-9,21%	-7,67%	-4,03%	-3,04%
6	-1,79%	-6,88%	-3,70%	-7,67%	-0,30%	1,30%
7	-7,76%	-8,44%	-8,43%	-9,22%	-3,28%	-2,17%
8	-7,01%	-5,31%	-7,64%	-8,45%	-1,79%	-0,43%
9	-6,27%	-7,66%	-6,85%	-7,67%	6,42%	9,13%

Sources : *Porceed by author*

Table 10 : Result test five digit benford law year ended 2004-2000

Nomor	Year 2004	Year 2003	Year 2002	Year 2001	Year 2000
0	-1,85%	-4,70%	-0,70%	-1,79%	-2,11%
1	-0,37%	-3,18%	-3,02%	1,94%	-4,74%
2	-1,85%	-0,91%	-3,02%	-0,30%	0,53%
3	3,33%	2,12%	0,85%	-3,28%	-1,23%
4	0,37%	1,36%	3,18%	3,43%	5,79%
5	3,33%	3,64%	7,83%	-1,79%	-1,23%
6	-5,56%	-0,91%	-3,80%	0,45%	-3,86%
7	0,37%	-2,42%	0,85%	-7,01%	2,28%
8	-4,07%	2,12%	-0,70%	1,94%	0,53%
9	6,30%	2,88%	-1,47%	6,42%	4,04%

Sources : *Porceed by author*

Visible results analysis of model laws to Benford's first digit until the fifth digit, and for numbers 0 up to 9 fiscal year 2006-2010 in [Table 1-10]. So it can be given the argument that some of the numbers on the yellow color tick gives it a conclusion that, the numbers presented do not follow the model of anomalous numbers contained on the assumption that Benford's law by made by the author, if the figure exceeds the upper limit or lower, then the new limits can be categorized does not follow Benford's law number anomaly.

V. CONCLUSIONS

From the research that has been done can be conclude that Benford's law analysis, the model can be set as a tool or method that can detect when the occurrence of fraud in the company's financial reports, by holding to a model of anomalous numbers which appear on the financial statements. If a company's likelihood not happen cheating in financial statements, then the model number that appears in the financial statements of the company, will follow the model of anomalous numbers contained on the Benford law.

REFERENCES

- [1] Nigrini MJ (1996a) A taxpayer compliance application of Benford's law. The Journal of the American Taxpayer Association 18:72-91.
- [2] Nigrini MJ (1996b) Using Digital Frequencies to Detect Fraud. The White Paper (April/May) 3-6.
- [3] Nigrini MJ (1999) Adding Value with Digital Analysis. The Internal Auditor 56:21-23.
- [4] Schipper, K. (1989). Commentary on earnings management. Accounting Horizons, 3, 91-102.
- [5] DeFond, M., & Subramanyam, K. (1998). Auditor changes and discretionary accruals. Journal of Accounting & Economics, 25, 35-68.
- [6] DeFond, M., & Jiambalvo, J. (1994). Debt covenant violation and manipulation of accruals. Journal of Accounting and Economics, 17, 145-176.
- [7] Dechow, P., Sloan, R., & Sweeney, A. (1996). Causes and consequences of earnings manipulations: An analysis of firms subject to enforcement actions by the SEC. Contemporary Accounting Research, 13, 1-36.
- [8] Xie, H. (2001). The Mispricing of Abnormal Accruals. The Accounting Review, 76, 357-373.
- [9] Bryan, D., Tiras, S., & Wheatley, C. (2002). The interaction of solvency with liquidity and its association with bankruptcy emergence. Journal of Business Finance & Accounting, 29, 935-965.
- [10] Dichev, I. & Skinner, D. (2002) Large-sample evidence on the debt covenant hypothesis. Journal of Accounting Research, 40, 1091-1123.
- [11] Varian H (1972) Benford's Law. The American Statistician 23:65-66
- [12] Pomeranz, F. (1995). Fraud: The root causes. Public Money & Management, 15, 15-18.
- [13] Diekmann, A. (2007). Not the first digit! Using Benford's Law to detect fraudulent scientific data. Journal of Applied Statistics, 34, 321-329
- [14] Tam Cho WK, Gaines BJ (2007) Braking the (Benford) Law: Statistical Fraud Detection in Campaign Finance. The American Statistician 61(3):218-223.
- [15] Levisohn, B., (2009, January 9). Experts day fraud likely to rise. Business Week Online, p.6. Retrieved from EBSCOhost database.
- [16] Battersby, S. (2009). Statistical analyses hint at fraud in Iranian election. New Scientist, 202,
- [17] Malamed, D. (2010). Fraud never sleeps. CA Magazine, 143, 39-41.
- [18] Breunig, C., & Goerres, A. (2011). Searching for electoral irregularities in an established democracy: Applying Benford's Law tests to Bundestag elections in Unified Germany. Electoral Studies, 30, 534-545.
- [19] Nigrini, M. and L. Mittermaier (1997), The Use of Benford's Law as an Aid in Analytical Procedures, Auditing: A Journal of Practice & Theory, Vol. 16, N^o 2, págs. 52-67.
- [20] Newcomb, S. (1881). Note on the frequency of the use of the digits in natural numbers. Amer. Jour. Math. 4 pp 39-40
- [21] Benford, F. (1938), "The Law of Anomalous Numbers," Proceedings of the American Philosophical Society, 78, 551-572.