DISCONTINUITIES IN EARNINGS DISTRIBUTIONS: EVIDENCE FROM SOUTH AFRICA

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Abstract: *There is increasing evidence that earnings management amongst firms creates discontinuity in the earnings distribution. We have verified the evidence of discontinuity in earnings distribution for 246 Johannesburg Securities Exchange listed firms from 2003 to 2018. The assets-scaled income was used as earnings measure to present the empirical histograms; the standardized difference test of significance was utilized to establish the existence of discontinuities at zero. The result shows discontinuities in distributions for earnings level and earnings-change. In addition, except for the unscaled earnings, the evidence supposes that the sample design does not explain the discontinuity in the earnings (earnings change) distributions.*

Key words: earnings management, earnings discontinuity, standardized difference test, empirical histograms

JEL classification: G14, G30, M40, M43.

1. Introduction

There is growing evidence that regulators, investors, analysts, and boards of directors consider earnings as being the most critical performance measure in financial reports issued by listed firms (Chowdhury, Mollah and Al Farooque, 2018), (Pretorius and De-Villiers, 2013), (Francis, Schipper and Vincent, 2003). Many executives have incentives to manage earnings in parallel periods when reporting financial statements. The pressure to manage earnings annually is much stronger because the year-end provides period opportunistic times for management bonus choices (Chowdhury et al., 2018). Dichev et al. (2013)'s Survey reports that about 99.4 % of CFO's 'believe' that at least some managers manipulate their earnings. Earnings management practices have resulted in some corporate scandals in the global capital market. Some of the notable financial scandals related to earnings management, including companies such as Xerox, Adelphia, Enron, and WorldCom, were exposed in the 2000's.

Earnings management to avoid losses has been associated to the cause of discontinuity in the distribution of earnings (Burgstahler & Dichev, 1997). Existing literature on discontinuity in earnings distribution provides evidence of discontinuity in firms' earnings at prima-facie benchmarks (Pududu & De-Villiers, 2016; Gilliam, Heflin & Paterson, 2015; Kerstein & Rai, 2007; Durtschi & Easton, 2005; Dechow, Richardson & Tuna, 2003; Degeorge, Patel, & Zeckhauser, 1999; Burgstahler & Dichev, 1997). The authors extend a study by Burgstahler

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and Dichev (1997) to argue that the earnings distribution is characterized by a dual jump, in which both the bin frequency distribution includes too few observations immediately below the benchmark and too higher observations immediately above the benchmark than are likely. This pattern of earnings distributions is interpreted as similar to the management theory according to which executives employ economic (real) and accounting (discretionary) decisions to avoid losses.

This study verifies the discontinuity around zero on earnings distribution for listed firms on the Johannesburg Securities Exchange (JSE). South Africa (SA) provides a reference to examine for some reasons. First, the JSE remains the largest stock market in Africa, and would serve a primary base to compare with other global exchanges. Second, the focus on SA contributes to the scanty studies on the distribution of earnings in the country, with only one study available as a precursory (Pududu and De-Villiers, 2016).

Although Pududu and De-Villiers (2016) have indicated that there is no clear jump at zero in the distribution of earnings, there are still several significant issues which are yet to be resolved or addressed in the study. The research design, in particular the equity-scaled profit to ordinary shareholders used as earnings measure, could have influenced the unanticipated results. Pretorius and De-Villiers (2013) have noted that earnings metrics based on ordinary shareholders may present upward biased estimates for managers on equity-dependent remuneration schemes relative to other firms. In addition, the study covers short sample periods (2003–2011) for the cross-sections, and an extension of this to accommodate recent earnings information becomes inevitable. What is more, the study was unable to provide a suitable statistical test of significance to support its conclusion of no discontinuity. Result from empirical test based distributional histogram is considered necessary but evidently not sufficient to prove discontinuity because of the likelihood of graphical misjudgment (Burgstahler & Chuk, 2015).

We have extended the frontier of empirical literature on discontinuity in earnings distribution in many ways. We have re-established the presumption for earnings management through providing sufficient evidence on the presence of a test to establish discontinuity evidence for the JSE firms. As according to other studies (Enomoto & Yamaguchi, 2017; Pududu & De-Villiers, 2016; Gilliam, Heflin & Paterson, 2015; Kerstein & Rai, 2007; Durtschi & Easton, 2005; Degeorge et al., 1999; Burgstahler & Dichev, 1997), we have considered the distribution for the earnings and earnings-change. We have conduct robustness checks by analyzing the presence of discontinuity under three different cases, namely: (a) when alternative scaler or earnings measure (scaling sensitivity) is employed; (b) when all the financial services firms (sample selection sensitivity) are eliminated, and (c) when the scaler in designing the earnings metric ('un-scale' sensitivity) is eliminated. The remainder of the paper is structured as follows: sections 2, 3, 4 and 5 accordingly include the literature review and hypotheses, the data and methodology, results and conclusions.

2. Literature Review and Hypotheses

2.1. Empirical Evidence

The literature contends that if firms manage earnings in order to avoid reporting losses, the earnings distribution may become discontinuous at zero by exhibiting a pattern with unusually too few small losses and unusually too many small profits. Burgstahler and Dichev (1997) have provided empirical regularity with the US data and have estimated that about 30-40% of non-financial firms with small losses do manage earnings to attain small profits. The result has revealed that earnings distribution has significantly too few observations immediately below zero than would normally be anticipated and evidently too many observations closely above zero. Degeorge et al. (1999) have proposed a model to detect managed earnings patterns that produce unique distortions in the distribution of actual

earnings. The model has identified how efforts to surpass certain thresholds induce a specific reference to earnings management. They have noticed that observed earnings that fall closely below the zero thresholds are boosted upwards, while earnings far (either below or above) from the zero thresholds are trimmed downward.
Dechow et al. (2003) have stated that if the observed curve is due to earnings manipulation, it would seem reasonable to assume that managers would use accruals since estimates of accruals and forecasts are more flexible to manipulate than the cash flows. They have explored whether the enhancing of discretionary accruals to report small profit is sensible to justify the 'kink' rather than unusual cash flow manipulation of beyond the reference point. They have compared small profit firms (and all other firms) to small loss firms and have directly tested whether increasing discretionary accruals would drive the curve/kink. The result was unable to establish that increasing discretionary accruals was the cause of the kink. Durtschi and Easton (2005) have emphasized that the sample selection criteria, deflation of earnings metrics and the influence of some observations to the left and right of zero are among the factors that could cause the discontinuity. They have revealed that the median price for a company that reports a one-cent loss (profit) is 0.25 (1.31). They have noted that the earnings management game is binary, at least to some extent: a firm that reports losses belong to one valuation model, or if a firm makes a profit, it shall thus be placed in a separate valuation model.
Shuto and Iwasak (2015) have revealed a clear existence of discontinuities at the zero thresholds in the distribution of earnings for Japanese firms. Their study has found that firms with high marginal tax rates and very tight interactions with their respective banks would be more likely to engage in earnings management to report some slightly positive earnings. They have established that such a relationship is more likely pervasive for privately owned firms relative to public firms. Pududu and De-Villiers (2016) have considered distributions of earnings and earnings-change. They have found no evidence that firms managed earnings to avoid small losses or to avoid reporting decreases in earnings. They did note the possibility of analysts and investors being fixated on alternative performance measures.

2.2. Hypotheses Development

Since Burgstahler and Dichev (1997), the evidence of a 'kink' around has been well established for advanced economies. For African economies, the issue is scantily studied, and available evidence (Pududu & De-Villiers, 2016) lacks statistical verification. The lack of clarity poses a challenge for establishing a confronting hypothesis. There have been reported cases of accounting anomalies and scandals, including Leisure Net, Master Bond and Regal Bank. Pududu and De-Villiers (2016) assume that executives do not manage earnings to report small profits (or losses) and reveal evidence of discontinuity. We would expect the absence of breaks in the distribution, indicating no clear jump at zero in the distribution of earnings leading to the first null hypothesis:

H1: There is no evidence of discontinuity in the distribution of the earnings.

Some prior evidence reveals that earnings changes have discontinuity around zero (Gilliam et al., 2015; Degeorge et al., 1999; Burgstahler and Dichev, 1997). Pududu and De-Villiers have found the existence of discontinuity in the earnings-change distribution around the zero thresholds. As required (Enomoto & Yamaguchi, 2017; Pududu & De-Villiers, 2016; Gilliam et al., 2015), we examine whether there is a discontinuity in the distribution of earnings change based on the definition put forward by Burgstahler and Dichev (1997). If there are consistent increases in earning management, the distribution of the earnings change may exhibit significant discontinuity, leading to a second null hypothesis, stated as:

H2: There is no evidence of discontinuity in the distribution of the earnings change.

Some studies argued that the discontinuity in earnings around zero might be attributed to research design as scaling or earnings variable measures and sample criteria (Gilliam et al., 2015). As noted by Pududu and De-Villiers, the permissible enforcement in SA decreases the degree of investor protection expected for equity holders. As a result, some earnings metrics or their scaling that are affected by stricter regulations in financial reporting could likely decrease earnings management and reduce the chance of discontinuity. As such, we do not expect that discontinuity in the distribution is due to the scaling or sampling, and therefore, we test the third null hypothesis:

H3: The discontinuity in the earnings distribution is not due to the sample design.

3. Data and Methods

3.1. Data

Existing literature on the discontinuity in earnings distributions use firms' yearly cross-sectional earnings (Enomoto & Yamaguchi, 2017; Gilliam et al., 2015). Consistent with these studies, we have used annual net income scaled by lagged total assets as a proxy for earnings in the primary analysis, and net income scaled by market value of equity for the robustness check. We have obtained a complete initial sample totaling 4,521 annual net income over the period 2003–2018 for the firms with financial records on the McGregor BFA and other consolidated financial statements. We have eliminated missing values up to 585 observations. The final sample provides a total of 3,936 firm-year in order to evaluate H1 (as presented in Table 1). In considering H2, we have obtained the earnings change and the process involves the loss of some earnings observations to 3,690 for the earnings-change variable. We have winsorized the final (Shuto & Iwasaki, 2015) at the first (1st) and penultimate (99th) percentiles before the estimation to control the effects of the outliers. The non-financial service constitutes 3,328, approximately 84.55% of the full sample (Table 2).

Table 1: Breakdown of Sample

Industry	Nobs	#Firms	%Firms
Financial	608	38	15.45%
Non-financial	3,328	206	84.55%
Total	3,936	246	100.00%

Note: *Nobs = No. of firm-year. #Firms = No. of firms, %Firms = Industry percent of firms [#Firms/246].
Source: Authors` own computations

3.2. Methods

3.*2.1. Distributional Approach*

The distribution discontinuity method is well applied to detect the earnings management practices and changes. Since the bin-width controls the smooth characteristic of the baseline histogram, the precise bin-width must be determined using the optimal Bin-width (b^{ω}):

$$b^{\omega} = 2Q_{IR}(X_i)/\sqrt[3]{N} \quad (1)$$

Where, X_i is the random pooled cross-section of reported earnings ($i = 1, \dots, n$), Q_{IR} is the interquartile range Q_3(upper quartile) less Q_1(lower quartile), and N is the Nobs (Number of firm-year observations).

3.2.2. Standardized Difference Test Approach

Different statistical (standardized difference) tests have been proposed to confirm the discontinuity at the benchmark. Burgstahler and Dichev (1997) have proposed an earnings management ($EM1$) statistic that is a ratio of the difference between the actual (AQ_i) and expected (EQ_i) number of observations for the interval immediately to the right of zero over the estimated standard deviation of the difference:

$$EM1 = (AQ_i - EQ_i)/SD_i \quad (2)$$

$$SD_i = [Np_i(1-p_i) + 0.25N(p_{i-1} + p_{+1})(1 - p_{i-1} - p_{i+1})]^{1/2} \quad (3)$$

Where (3) is the standard deviation of the difference between (AQ_i) and (EQ_i) around interval i; $EQ_i = (AQ_{i-1} + AQ_{i+1})/2$; N is the total number of firm-year observations; p_i= AQ/N, is the ratio of the actual Nobs for interval i to the firm-year; AQ_{i-1}/N = p_{i-1} and $p_{+1} = AQ_{+1}/N$.

Degeorge et al. (1999) have provided an alternative test statistic ($EM2$) under the null of no earnings management (i.e., assuming that the distribution is smooth:

$$EM2 = [\Delta p_i - E(\Delta p_{-i})]/SD(\Delta p_{-i}) \quad (4)$$

Where p_i is the proportion of the actual Nobs for interval i to firm-year and change in p_i [$\Delta p_j = p_j - p_{j-1}$]. $E(\Delta p_{-i})$ is the expected (average) value of Δp, excluding p_i and $SD(\Delta p_{-i})$ is the standard deviation of (change in p_i) Δp, excluding Δp_i.

3.3. Evaluation Procedure

To verify the existence of discontinuity evidence, we have applied the following procedures. First, we have depicted the "empirical histogram" of earnings. We have shown the distributional representation of the cross-section of firms' earnings, where small earnings losses (decreases) are identified as earnings (earnings change) that fall closely below the zero interval. We have applied the default bin-width of $2 \times \mathrm{Q_{IR}(X_i)} \times \mathrm{N^{-1/3}}$ with the earnings' interquartile range $[\mathrm{Q_3} - \mathrm{Q_1}]$. Second, we have conducted the standardized difference test. We have computed the standardized difference for interval just left of zero and for the interval just right of zero. Third, we have conducted three sensitivity and robustness checks. We have verified the influence scaling/deflation (alternative earnings measure) and a sample selection (by removing the financial services sector from the sample).

We have started by examining the influence of resampling by excluding the financial firms. We have computed the differences between characteristics of earnings to the left and right of zero and have thus obtained the statistics. We have used total assets to scale the net income earnings' variables. For further analysis to verify evidence that the jump in the distribution may be due to scaling (H3), we have used an alternative deflator - market value of equity. Lastly, we have used the unscaled net-income measure. Durtschi and Easton (2005) have shown a scaler (e.g., firm size) has different discontinuity effects for small-loss (profit) earnings management. In order to circumvent this and eliminate the discontinuity effect due to scaling, we have explored the earning distributions with unscaled earnings metrics. We have followed Burgstahler and Chuk's (2015) 'quartile-partition' method to split the pooled cross-sectional earnings into four separate partitions based on both earlier deflators: lagged total assets and equity market value. We partitioned, for instance, lagged total assets (and equity market value) into quartile groups, namely into *Q1, Q2, Q3,* and *Qn*. For each Q*i* series, we have obtained the value of the unscaled income and have computed the respective small-loss and the standardized difference of profit.

4. Results

4.1. Sample Statistics

Table 2a reports the sample statistics for the earnings variable (annual assets-deflated net income). After controlling for outliers by winsorizing the earnings series, the expected value of earnings is 0.029, and the standard deviation is 2.375 (Panel A). The non-financial services (financial) industry has mean and spread of 0.103 (0.118) and 0.146 (0.146), respectively. After excluding the periods of the financial crisis (2008 and 2009) periods, the mean of the reported managed earnings with 3,444 observations was still approximate 0.103, with a spread of 0.145. The report shows that small profits (small) reported represent 85.44% (4.56%) of the sample, supposing the likelihood toward positive small earnings increase around the benchmark of zero. We have noticed that for the entire sample, the median of earnings is close to the mean, although the distribution is asymmetric (negatively skewness with -0.346). The Nobs reported for the earnings change reduced to 3,690 (Panel B). The mean and the median of the earnings change are equal and approximately 0.000, and the standard deviation is 0.180. The series is closely symmetric with a relatively low (negative) skewness, and the magnitude of peakedness neighborhood of 3, suggesting mesokurtic and likely normality. Due to the differencing, the number of positive earnings surprises (small earnings Increases) are reduced to 3,170 with a mean of 0.027 and a spread of 0.157, while the amount of negative earnings change reduces to 520 with a mean and standard deviation of -0.161 and 0.221, respectively.

Table 2b (Panel A) reveals that the financial services, despite being well-regulated (Enomoto & Yamaguchi, 2017; Pududu & De-Villiers, 2016; Gilliam et al., 2015), have the highest level of earnings management with a mean of 0.118, and a moderate spread of 0.149 relative to other industries. However, the same could not be observed for the earnings change (Panel B) in the financial services, with a mean of 0.001 and supposing a tendency toward a positive small earnings increase. Table 2c (Panels E and F) shows the statistical characteristics of earnings based on analysis by year. Positive earnings are marked for all the years, with the years 2004 and 2016, on average, having the lowest and highest earnings managed, respectively. We have observed, on average, relatively consistent small earnings decrease (increase) in the years 2009 to 2012 (in 2006, and 2013 to 2018), a relatively large earnings decrease in 2005, 2014 and 2016, and relatively large earnings increase in year 2004, 2008, 2015 and 2017.

Table 2a: Descriptive sample statistics for crisis and non-crisis periods

Category	***N***	μ	***m***	σ	$\tilde{\mu}_3$	$\tilde{\mu}_4$
Panel A: $\mathrm{Earnings_t}$						
All	3,936	0.105	0.103	0.146	-0.346	2.105
Crisis	492	0.120	0.103	0.154	0.078	1.197
Non-crisis	3,444	0.103	0.103	0.145	-0.424	2.232
Profit	3,363	0.145	0.114	0.107	1.306	1.350
Loss	573	-0.130	-0.087	0.122	-1.079	0.270
Panel B: $\Delta\mathrm{Earnings_{t-1}}$						
All	3,690	0.000	0.000	0.180	-0.178	3.348
Crisis	492	0.004	0.005	0.201	0.148	2.063
Non-crisis	3,198	0.000	-0.001	0.176	-0.253	3.596
Increase	3,170	0.027	0.007	0.157	0.751	2.716
Decrease	520	-0.161	-0.119	0.221	-0.878	0.787

Note: Table 2a shows the statistics (N, $\mu, m, \sigma, \tilde{\mu}_3, \tilde{\mu}_4$) of reported earnings and earnings-change for crisis and non-crisis periods' category. $N \equiv$ No. of observations, $\mu \equiv$ Arithmetic mean, $m \equiv$ Median, $\sigma \equiv$ Standard deviation, $\tilde{\mu}_3 \equiv$ Skewness, and $\tilde{\mu}_4 \equiv$ Kurtosis.
Source: Authors` own computations

Table 2b: Descriptive sample statistics for financial/non-financial industry

Category	***N***	μ	***m***	σ	$\tilde{\mu}_3$	$\tilde{\mu}_4$
Panel A: $\mathrm{Earnings}_t$						
Financial	3,328	0.103	0.102	0.146	-0.362	2.062
Non-financial	608	0.118	0.108	0.149	-0.276	2.314
Panel B: $\Delta\mathrm{Earnings}_{t-1}$						
Financial	3,120	0.000	0.000	0.180	-0.187	3.175
Non-financial	570	0.001	-0.002	0.181	-0.126	4.253

Note: Table 2b shows the statistics (N, $\mu, m, \sigma, \tilde{\mu}_3, \tilde{\mu}_4$) of reported earnings and earnings-change for financial/non-financial industry category. *N* ≡ No. of observations, μ ≡ Arithmetic mean, m ≡ Median, σ ≡ Standard deviation, $\tilde{\mu}_3$ ≡ Skewness, and $\tilde{\mu}_4$ ≡ Kurtosis.
Source: Authors` own computations

Table 2c: Descriptive sample statistics base on each year

Category	***N***	μ	***m***	σ	$\tilde{\mu}_3$	$\tilde{\mu}_4$
Panel A: $\mathrm{Earnings}_t$						
2003	246	0.099	0.115	0.181	-0.462	0.383
2004	246	0.137	0.117	0.178	-0.251	0.782
2005	246	0.109	0.107	0.171	-0.703	1.606
2006	246	0.110	0.111	0.187	-0.782	1.311
2007	246	0.107	0.103	0.159	-0.585	1.635
2008	246	0.125	0.105	0.165	0.051	0.611
2009	246	0.115	0.101	0.142	0.082	1.969
2010	246	0.114	0.106	0.135	-0.098	2.596
2011	246	0.105	0.104	0.130	-0.101	3.106
2012	246	0.096	0.090	0.125	0.063	1.719
2013	246	0.101	0.107	0.134	-0.301	2.555
2014	246	0.089	0.099	0.142	-0.620	2.032
2015	246	0.102	0.109	0.114	-0.298	1.917
2016	246	0.069	0.080	0.111	-1.227	5.669
2017	246	0.098	0.101	0.116	-0.581	2.581
2018	246	0.103	0.098	0.107	0.297	3.243
Panel B: $\Delta\mathrm{Earnings}_{t-1}$						
2004	246	0.038	0.005	0.248	0.080	0.435
2005	246	-0.028	-0.011	0.199	-0.319	2.108
2006	246	0.001	0.000	0.208	-0.719	3.022
2007	246	-0.002	0.002	0.217	-0.284	2.199
2008	246	0.017	0.005	0.220	0.215	1.619
2009	246	-0.010	0.004	0.179	-0.098	2.262
2010	246	-0.001	0.003	0.162	-0.546	4.308
2011	246	-0.009	-0.002	0.154	-0.013	4.209
2012	246	-0.008	-0.009	0.140	-0.285	2.573
2013	246	0.004	0.003	0.151	0.055	2.014
2014	246	-0.012	-0.003	0.165	-1.264	6.118
2015	246	0.013	0.003	0.164	-0.657	4.324
2016	246	-0.032	-0.017	0.139	-0.327	4.679
2017	246	0.029	0.014	0.148	0.353	6.088
2018	246	0.005	0.004	0.148	0.193	5.403

Note: Table 2c show distribution statistics (N, $\mu, m, \sigma, \tilde{\mu}_3, \tilde{\mu}_4$) of reported earnings [$\mathrm{Earnings}_t$] and earnings-change [$\Delta\mathrm{Earnings}_{t-1}$] based base on each year. *N* ≡ No. of observations, μ ≡ Arithmetic mean, m ≡ Median for each category indicated, σ ≡ Standard deviation, $\tilde{\mu}_3$ ≡ Skewness, and $\tilde{\mu}_4$ ≡ Kurtosis.
Source: Authors` own computations

4.2. Distributional and Statistical Evidence of Discontinuity

Figure 1A depicts the distribution of asset-scaled net income earnings for the firms. Here, we have used the entire sample of 3,936 (Table 1) firms, including both financial and non-financial services. Consistent with the optimal bin-width, the empirical histogram interval has widths of 0.021 for the earnings (level) variable. In line with literature, the distribution has a discontinuity (Enomoto & Yamaguchi, 2017; Pududu & De-Villiers, 2016; Gilliam et al., 2015; Degeorge et al., 1999).

The just left of zero exhibits remarkably too low occurrence, while the just immediate right of zero shows too remarkably high frequency. The figure, consistent with the earnings management hypothesis, shows that earnings slightly less than zero occur less frequently as theoretically expected, and the earnings slightly greater than the zero occur too much frequently. This appears to be consistent with the general earnings management hypothesis (Burgstahler and Dichev, 1997) to attain small profits (positive earnings) or, at the least, avoid small- loss (Degeorge et al., 1999; Burgstahler and Dichev, 1997) but contrary to findings by Pududu and De-Villiers (2016). To statistically ascertain that these occurrences are significant, we have obtained the standardized differences to test discontinuity at zero, the result (Table 5) shows that the (small-losses) standardized difference for interval [-0.021, 0.000] just left of zero is -16.430, and significantly negative, while the (small-profit) standardized difference for interval just right of zero [0.000, 0.021] is 5.561, and significantly positive. These results indicate discontinuity and provide compelling statistical evidence of managed earnings, supposing the rejection of the first null.

Figure 1B shows the asset-scaled net income change's earnings distribution, using the entire sample of 3,690 of the earnings-change. The distribution has interval bin widths of 0.025 and visibly, appearing less likely symmetrical at zero but with a bell shape. The just left of zero [-0.025, 0.000] appears more with unusually high frequency relative to the smoothness of the (left part) and, inconsistent with predictions. The just right of zero [0.000, 0.025] indicates earnings slightly greater than zero occurs unusually with less frequency than would be expected.

The standardised difference (Table 3) for interval just left (right) of zero is -3.015, been negative and statistically significant (5.0271, been positive and statistically significantly). In sum, the evidence supports the existence of discontinuity in the earnings distribution at zero, providing sufficient evidence, at least statistically, to refute the second null. Like previous studies, the test offers statistical significance for discontinuities at zero benchmark earnings (Burgstahler & Chuk, 2015). The finding for earnings change is similar to evidence from Pududu and De-Villiers (2016).

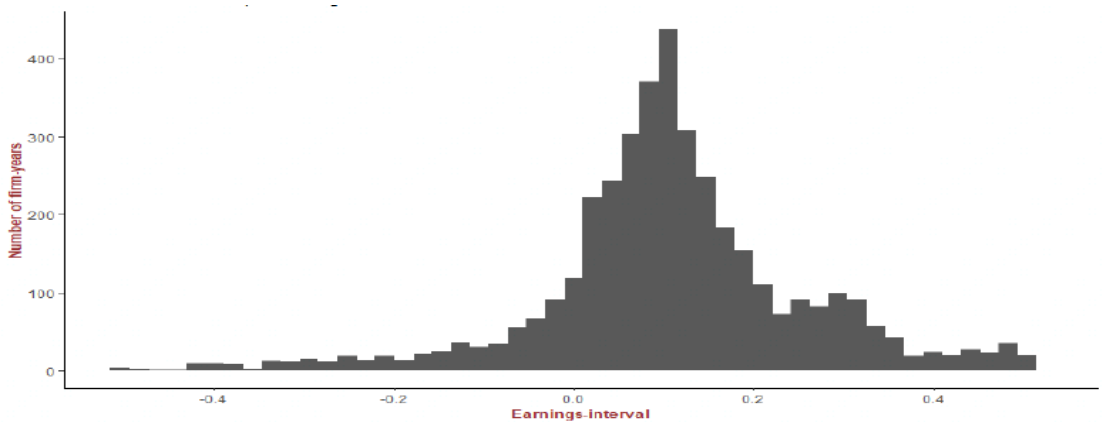

Figure 1A: Distribution of asset-scaled net income earnings
Source: Authors` plot with RStudio

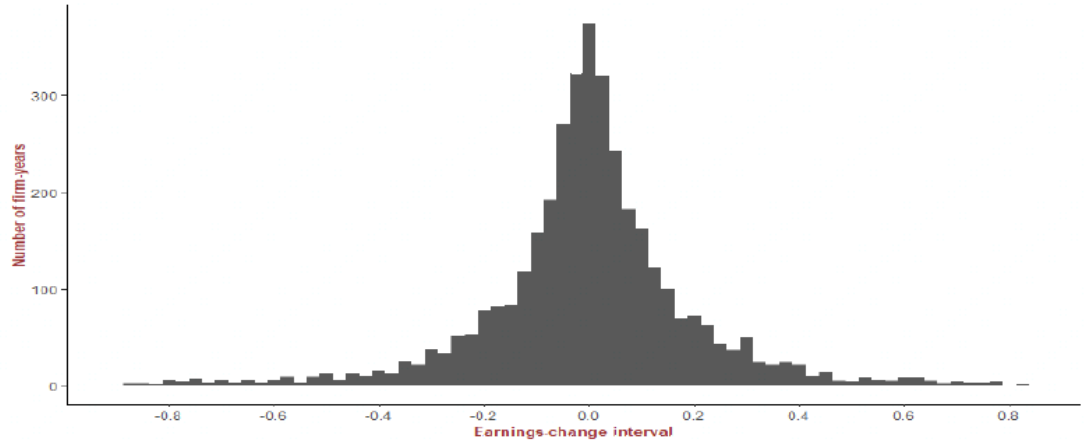

Figure 1B: Distribution of change in asset-scaled net income
Source: Authors` plot with RStudio

Table 3: Discontinuity (standardised differences) test around zero

X_i	StDiff [Loss]	StDiff [Profit]
Earnings_i	-16.430**	5.561**
	StDiff [Decrease]	StDiff [Increase]
$\Delta\text{Earnings}_i$	- 3.015**	5.0271**

Note: ** indicates that StDiff statistics is significance at 5% (one-sided test). StDiff implies Standardised differences.
Source: Authors` own computations

Table 4 reports the standardized differences (StDiff) test for small- loss and profit with the yearly subsamples of each firm's earnings (Panel A) and earnings change (Panel B). According to Gilliam et al. (2015), we have split the full 3,960 observations into separate annual sub-samples to access likely yearly deviation in the discontinuities in the distributions of earnings. The results show that for the earnings (level), all small loss standardized difference are negative and highly statistically significant, except for 2010, which is positive and still significant. The standardized differences for all the small profit (except for 2010 and 2017) are positively significantly. That of 2010 was, however, insignificant. The evidence is sufficient to believe the existence of discontinuity in the earnings distribution for each annual subsample. This explains the possible existence of the discontinuity in the overall (full) samples. For the yearly earnings change we could not admit enough evidence to support discontinuity for all the annual subsample earnings distribution. The standardized differences for the earnings decrease support are negatively significant only in 2006, 2014 and 2016–2017. For the reporting earnings increase or small positive earnings, the test is positive significant in 2005, 2006, 2009–2012 2017. Overall, the intertemporal evidence for earnings changes does support the existence of annual discontinuity.

Table 4a: Annual discontinuity (standardized differences) tests

	Years [Annual]	StDiff [Loss]	StDiff [Profit]
Panel A: Earnings_t	2003	-2.175*	1.586
	2004	-2.510**	2.171*
	2005	-8.106**	6.197**
	2006	-7.140**	8.083**
	2007	-8.407**	3.826**
	2008	-11.078**	10.429**
	2009	-4.023**	9.505**
	2010	2.114*	-1.483
	2011	-9.454**	2.251**
	2012	-8.319**	3.658**
	2013	-4.816**	4.103**
	2014	-6.35**	4.507**
	2015	-8.607**	2.171*
	2016	-6.246**	5.322**
	2017	-10.044**	-2.107*
	2018	-11.169**	2.248**

Note: ** and * indicate the standardized differences (StDiff) test-statistics is significance at 1%, and 5% for a tailed test.
Source: Authors` own computations

Table 4b: Annual discontinuity (standardized differences) tests

Panel B: $\Delta\text{Earnings}_{t-1}$	Years [Annual]	StDiff [Decrease]	StDiff [Increase]
	2004	-1.040	1.068
	2005	-1.964	3.504**
	2006	-4.322**	2.107*
	2007	-0.921	1.116
	2008	-1.236	1.307
	2009	-0.589	3.914**
	2010	-.0930	6.117**
	2011	1.281	2.313**
	2012	-1.534	2.044*
	2013	-1.453	1.698
	2014	-2.253*	-1.272
	2015	-0.379	-0.218
	2016	-2.358**	1.263
	2017	-2.049*	4.078**
	2018	-0.920	1.951

Note: ** and * indicate the standardized differences (StDiff) test-statistics is significance at 1%, and 5% for a tailed test.
Source: Authors` own computations

4.3. Robustness Evidence: Additional Analyses

4.3.1. Sample Selection: Excluding the Financial Sector

We have manage to realize a resampling by eliminating financial service firms, which are believed to be biased toward reporting losses, and may likely explain the discontinuity evidence (Pududu & De-Villiers, 2016). Figure 2A (2B) depicts a distribution of asset-scaled net income earnings (earnings change) when the financial industry is excluded. Here, the interval bin-widths of 0.028 (0.025) is obtained for earnings (earnings change). Figure 2A

shows evidence of discontinuity, collaborating findings by Pududu and De-Villiers (2016), for earnings of the non-financial sector. The regions just left (right) of zero [-0.028, 0.000] ([0.000, 0.028]) exhibit unusually too low (high) frequency. For earnings change, Figure 2B depicts a distribution with interval bin widths of 0.025. The evidence supposes the existence of discontinuity.

Although untabulated, the standardized difference statistic is -9.621 for the evidence of small losses (region just left of zero), which is negative and significant. The standardized difference statistic of 18.855 for the evidence of small profit (for region just right of zero) is positive and highly significant. The standardized difference statistics for earnings change in regions immediate left and right of zero are negative (-2.825) and positive (3.452), respectively, and are both significant, confirming the hypothesis of discontinuity. The overall results suppose discontinuity and compelling statistical evidence of earnings management for earning-level and earning-change in the non-financial services (Gilliam et al., 2015). The result is consistent with Durtschi and Easton (2009) who have found evidence that sample design does not create discontinuities.

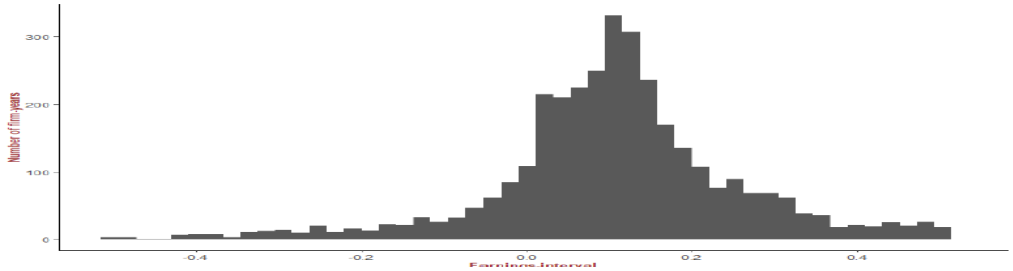

Figure 2A: Distribution of asset-scaled net income earnings for non-financial firms
Source: Authors` plot with RStudio

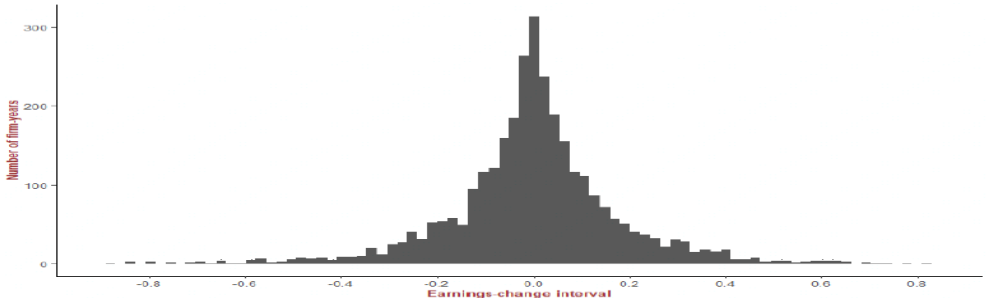

Figure 2B: Distribution of asset-scaled net income earnings change for non-financial firms
Source: Authors` plot with RStudio

4.3.2. Alternative Scaler Effects

Durtschi and Easton (2005, 2009) underline that scaling earnings may be a factor that causes discontinuity in the earnings distributions. So far, the previous earnings and earnings change distributions provide evidence of discontinuity using 'total assets' as a scaler for net income in line with Shuto and Iwasaki (2015) and Gilliam et al. (2015). In this additional analysis, we have used an alternative standard deflator – the lagged market value of equity. Figure 3A (Figure 3B) depicts the distribution of the lagged MVE-scaled net income earnings (earnings-change) for the full sample. Although untabulated, for the earnings the standardized difference statistic for interval immediately the left (right) of zero is -12.05 and significantly negative (16.56, and significantly positive). For the earnings change, the standardized difference statistic for the interval just left of zero is still negative but now insignificant (-1.30). The standardized difference statistic for interval just right of zero

remains significantly positive (21.391). The evidence supposes that the discontinuity remains despite deflating the net income with 'MVE'. Hence, the scaling effect does not preclude the existence of the discontinuity.

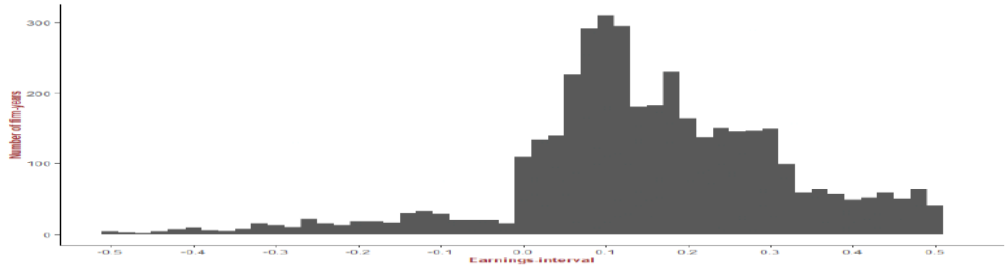

Figure 3A: Distribution of asset-scaled net income earnings based on alternative deflator
Source: Authors` plot with RStudio

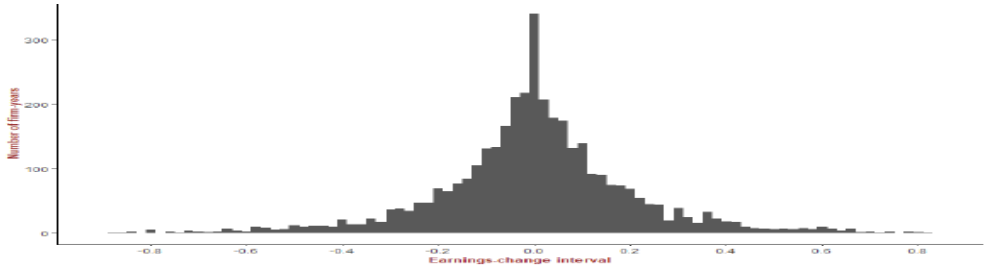

Figure 3B: Distribution of change in asset-scaled net income earnings based on alternative deflator.
Source: Authors` plot with RStudio

4.3.3. Un-scaling (Splitting into Quartiles)

We have performed the unscaling comparative analysis by separating the full samples into quartiles ($Q_i, for\ i = 1\ to\ 4$), according to Gilliam et al. (2015). The first partition is based on lagged total assets, while the second partition is based on the equity market value. Table 5 presents the result of the standardised difference test for small loss (profit) for intervals just left (right) of zero to verify discontinuity for un-scaled earnings based on the 'asset' and 'equity' quartile partition. The standardized difference tests for reporting small-loss and for loss avoidance (reporting small profit) are significant for all the quartiles partitioned except for the last partition, Q_3 (StDiff for loss) and the first partition Q_1 (StDiff for profit) of the un-scaled earnings based on equity partition. Overall, the evidence shows discontinuities in the distribution of earnings for the unscaled net income suggesting the unscaling does not preclude the existence of discontinuity. However, the result shows no evidence of discontinuity for the earnings change. Following the partitions based on both scalers, the standardised difference test for reporting small loss and reporting small profit are all insignificant for each quartiles partition. The evidence supposes that the discontinuity in the earnings-change distribution no longer remains for the unscaling net income; hence, unscaling does affect the existence of discontinuity.

Table 5: Tests of discontinuity (unscaled earnings based on assets partition)

	Q_i **Partitions**	**N**	**StDiff [Loss]**	**StDiff [Profit]**
Panel A: Earnings	Assets			
	Q_1	984	-3.231**	7.227**
	Q_2	984	-4.673*	2.105*
	Q_3	984	-2.136*	3.420**
	Q_n	984	-5.199**	3.736**
	Equity			
	Q_1	984	-3.076**	-1.132
	Q_2	984	-2.533**	5.909**
	Q_3	984	-1.078	2.115*
	Q_n	984	-6.813**	4.486**
Panel B: ΔEarnings	Q_i	N	StDiff [Decrease]	StDiff [Increase]
	Assets			
	Q_1	922	-1.273	-0.779
	Q_2	922	-1.051	1.904
	Q_3	923	-2.117*	0.447
	Q_n	923	-1.701	0.612
	Equity			
	Q_1	922	-0.065	0.086
	Q_2	922	-1.021	1.094
	Q_3	923	-1.927	0.442
	Q_n	923	-0.241	0.685

Note: The **Bold** values are StDiff statistics for 'asset' partition and the others for 'equity' partition.
**, * indicates the statistic is significance at 1%, 5% (one-sided test).
Source: Authors` own computations

5. Conclusions

Several researches confirmed that executives have incentives to manage corporate earnings, when reporting financial statements. The management of small earnings upward (to avoid loss) and the reporting of earnings increase (positive surprise) was identified as the cause of discontinuity in earnings distributions. The present paper offers compelling statistical evidence to verify the evidence of discontinuity in earnings distribution for selected JSE listed firms. The assets-scaled income was used as earnings measure to present the empirical histograms and the standardized difference test of significance was utilized to establish the existence of discontinuities at zero. Consistent with Pududu and De-Villiers (2016), we have obtained evidence of discontinuity in distributions for the earnings at a prima-facie zero-benchmarks. The evidence for the discontinuity in earnings change was in contrast with Pududu and De-Villiers (2016). We have demonstrated that the appearance of discontinuity cannot be attributed to just research design: scaling, sample selection and the unscaling. The scaling or sample selection does not eliminate, at least statistically, the evident discontinuities in earnings distributions.

There are two potential reasons for the results obtained, which offer relevance for the South African market. First, there has been an increase in the use of earnings discretion since the adoption of international accounting standards. This may be effectively connected to increased managed earnings to avoid losses, which drives the excessive discontinuities burden. Second, most firms in South Africa have relatively strong incentives to report

increased earnings to meet or slightly beat zero earnings, since such increased earnings may attract investors. Managing earnings broadly considers converting losses into profits, activating bonuses, or crossing performance benchmarks for other contractual purposes. Third, the firms considered are mostly profit oriented, and the result of the distribution of earnings is consistent with the regular pattern one would expect for profit-orientated firms. Since discontinuities imply significant earnings manipulations, we recommend measures to curb such practices, if they are to be discovered to be done with fraudulent intent to mislead corporate stakeholders.

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