The Disappearance of the Zero-Earnings Discontinuity: SOX, Dotcom Boom or Gradual Decline?

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Abstract

The zero-earnings discontinuity in the United States disappeared around the time when the Sarbanes-Oxley Act (SOX) became effective, suggesting that SOX might have had a real and lasting impact on earnings management. In this research note, we examine a potential confounding effect of the dotcom boom at the turn of the millennium. Many firms that went public in this period had no sales revenues and therefore invariably incurred losses. When the stock market valuation was high, the losses scaled by the market value of equity often fell into the smallest loss interval, reducing the discontinuity in the overall sample. However, these observations do not indicate a decline in earnings management. We find that the dotcom effect is nonnegligible. When filtering out the firms without sales, our results no longer suggest a sharp decline in the zero-earnings discontinuity after SOX. Rather, our findings are consistent with a gradual decline in earnings management over time.

Keywords: Earnings management, Zero-earnings discontinuity, SOX, Dotcom boom, Earnings distribution, Small loss avoidance

JEL: M48, G38, M41

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1. Introduction

Burgstahler and Dichev (1997) show that the frequency distribution of earnings scaled by the lagged market value of equity shows a discontinuity at zero, indicating that many firms report small profits, while few firms report small losses. This phenomenon is known as the zero-earnings (ZE) discontinuity or ZE kink. Numerous studies in several countries have confirmed the discontinuity.[1] Although different explanations for the ZE kink have been proposed, "the theory that earnings are managed to meet benchmarks provides the most simple and complete explanation for the body of evidence" (Burgstahler and Chuk, 2017, p. 744).[2]

Precisely because the kink illustrates the relevance of earnings management, its disappearance in the United States (US) as reported by Gilliam et al. (2015) is of great interest to regulators and researchers.[3] Gilliam et al. (2015, p. 188) "are able to identify a critical turning point when the zero-earnings discontinuity becomes imperceptible." This turning point is the year 2002, which "is consistent with ... a decline in loss avoidance after SOX" (p. 188). It is also "consistent with prior research suggesting SOX reduced accrual earnings management" (p. 124).[4] It therefore appears that SOX had a real and lasting impact on earnings management in line with the regulation's general objective to improve the reliability of financial reporting.

While the time of the turning point appears to be narrowly defined, Gilliam et al. (2015, p. 199) "caution that passage of SOX is not the only important event occurring during

[1] See, e.g., Degeorge et al. (1999), Dechow et al. (2003), Burgstahler and Eames (2006), Leuz et al. (2003), Burgstahler et al. (2006), Gore et al. (2007), Daske et al. (2006), and Burgstahler and Chuk (2017).

[2] For the alternative explanations, see Durtschi and Easton (2005, 2009). We do not take up this discussion.

[3] The results are different in other countries. See, e.g., Enomoto and Yamaguchi (2017) for Japan.

[4] Gilliam et al. (2015) refer to Bartov and Cohen (2009), Cohen et al. (2008), Lobo and Zhou (2006) and Lobo and Zhou (2010).

our time period of interest that may have affected the discontinuity. Examples include the collapse of Enron in 2001, the registration of US firms with the PCAOB in 2003, and the global investment settlement in 2003".

Following this line of argument, we hypothesize that the dotcom boom might have played an important role. In the second half of the 1990s, many firms with sales revenues close to zero went public and were added to financial databases. Without revenues, these firms invariably suffered losses that were often small in relation to the high market values of equity at the peak of the dotcom boom. Therefore, small losses occurred more often than small profits in this group, which apparently reduced the ZE discontinuity in the overall sample. This reduction is a direct consequence of the change in the sample composition and the high market valuation of dotcom companies rather than a sign of a decline in earnings management. As these events occurred around the turn of the millennium, their impacts might be confounded with the effect of SOX in 2002. The group of companies concerned might also have influenced the results on the ZE discontinuity in later years, depending on the stock market valuation before and after the financial crisis. Therefore, our first objective is to examine the relevance of this dotcom effect.

It is also important to filter out the dotcom effect in order to capture a temporal trend in the ZE discontinuity as accurately as possible, which is our second objective. The discontinuity did not disappear abruptly in 2002 but declined already in the 1990s. A possible explanation refers to changes in the listing requirements of the NYSE. Dechow et al. (2003, p. 379) argue that prior to 1995, positive income was an important requirement of the NYSE's continued listing standards. In 1995, losses became irrelevant for continued listing as long as certain levels of revenues, market capitalization and operating cash flows were met. Since 1999, the rule is that losses do not prevent continued listing if certain (low) thresholds of

market capitalization are met (currently, e.g., shareholders' equity of 6 million USD if net losses were reported in the last 5 fiscal years). Dechow et al. (2003, p. 379) state the following: "This shift away from an "income" focus has had a dramatic effect on the distribution of net income for NYSE firms." In this research note, we provide an updated, long-term perspective on the evolution of the kink in earnings distributions.

Our results are mainly based on data from the merged CRSP/Compustat database. We also include Worldscope data because Worldscope contains more firms that went public during the dotcom boom than Compustat. Therefore, the dotcom effect should be amplified in the Worldscope sample if our hypothesis is correct. In line with this expectation, we find that the dotcom effect is nonnegligible and even creates the appearance of an inverse discontinuity in Worldscope data. When filtering out the firms without sales, our results are consistent with a gradual decline of the zero-earnings discontinuity without a significant role of SOX. As such, our findings not only contribute to the literature investigating the zero-earnings discontinuity (over time) but are also relevant for regulators and standard setters.

The research note proceeds as follows. Section 2 describes the methodology of measuring the ZE discontinuity and our data. Section 3 presents our empirical results, and Section 4 concludes the research note.

2. Methodology and Data

2.1. Discontinuity Measures

As in most of the literature, our primary earnings measure is net income scaled by the market value of equity at the beginning of the fiscal year. As a robustness check, we use total assets as a scaling variable.

The two most commonly used discontinuity measures are based on the frequency distribution of scaled earnings for a specific interval width. Let i denote ordered intervals such that $i = 1$ is the interval of the lowest profits, $i = 2$ is the interval for the next range of profits, $i = -1$ is the interval of the lowest losses and $i = -2$ is the next loss interval. Additionally, let N_i denote the number of observations in interval i, let N denote the total number of observations in the sample and let $p_i = N_i/N$ denote the proportion of observations falling in interval i. The first measure, the standardized differences test statistic, is then defined as the standardized difference between the actual number of observations in interval i and the expected number of observations assuming no discontinuity:[5] $SD_i = [N_i - 0.5(N_{i-1} + N_{i+1})]/s_i$, where s_i is the standard error of the difference.[6] The second measure, the profit-to-loss ratio, is defined as $PL = N_1/N_{-1}$.[7] In the presence of a ZE discontinuity, SD_{-1} will be negative, SD_1 will be positive and PL will be larger than 1.

Both measures have certain weaknesses. For a given level of the discontinuity, the SD statistic increases as the sample size increases. This blending of the effect size and test power is undesirable in comparisons over time when the sample size varies. Specifically, when the sample size is small in early years, the SD statistic will underestimate the potential decline in the discontinuity. Another critical aspect is that the expected frequency is defined as the average frequency of the adjacent intervals. When these in turn are distorted, the statistic is difficult to interpret. With respect to the profit-to-loss ratio, the problem is that it is not compared with the level that would be expected without a ZE discontinuity. With a positive mean and median of scaled earnings, the "normal" profit-to-loss ratio, will be considerably

[5] See Burgstahler and Dichev (1997).
[6] The standard error is computed as $s_i = \sqrt{Np_i(1-p_i) + 0.25N(p_{i-1} + p_{i+1})(1 - p_{i-1} - p_{i+1})}$.
[7] See Dechow et al. (2003).

larger than 1. The exact value depends on the location and shape of the distribution and therefore varies.

For these reasons, we modify the two measures in the following way. We conduct a kernel density estimation inspired by Lahr (2014). Our purpose is not to estimate the complete density but only to find a smooth representation of the frequency distribution in the relevant area. Specifically, we only include scaled earnings of -0.15 to 0.15. For our interval width of 0.005, we find that the time pattern of the estimated discontinuity is almost the same for different versions of kernel estimators. This is why we apply a standard Gaussian estimator.[8] Figure 1 shows an example (Compustat/CRSP data for 1997 with a substantial ZE discontinuity). Our measure "small loss deviation" is defined as $SLD = (Actual_{-1} - Expected_{-1})/Expected_{-1}$, where $Actual_{-1}$ is the actual number of observations in the first loss interval and $Expected_{-1}$ is the expected number according to the kernel density estimation (integral over the first loss interval). The "small profit deviation" is analogously defined as $SPD = (Actual_1 - Expected_1)/Expected_1$, where subscript 1 represents the first profit interval. We also compute both measures for an interval width of 0.015. In this case, the actual observations of the first three loss and profit intervals of width 0.005 are compared to the expected value according to the kernel density over the same range.

The expected profit-to-loss ratio without discontinuity ($EPLR$) is defined as the integral of the kernel density over the first profit interval divided by the integral over the first loss interval, both with a width of 0.005. We then define our modified profit-to-loss ratio as $MPL = ln\,[N_1/N_{-1}] - ln\,(EPLR_1)$. To compute this ratio for a width of 0.015, we again

[8] The density is estimated at 512 equally spaced points. We implement the estimation in R ("density" function) with the bandwidth proposed by Scott (1992) (option bw.nrd in R).

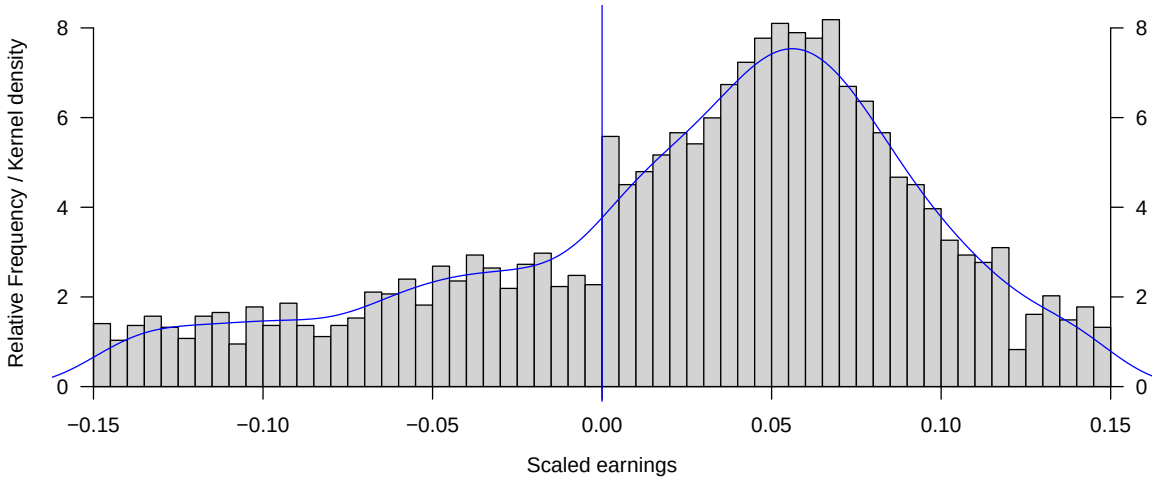

Figure 1: **Illustration of kernel density estimation.** Compustat data for 1997 (all firms). For interval width 0.005, we have: $SLD = -0.36$ and $SPD = 0.40$. This means that the number of observations in the first loss (profit) interval is 36% smaller (40% larger) than expected according to the kernel density (in blue). For interval width 0.015, we have: $SLD = -0.28$ and $SPD = 0.13$. This means that the discontinuity is smaller when the three first profit intervals and the three first loss intervals (of width 0.005 each) are taken together.

sum the observations and integrals over three intervals of width 0.005.

2.2. Data

We use merged CRSP and Compustat data of US firms and Worldscope data from Refinitiv (former Thomson Reuters) Datastream from 1987 to 2019. We exclude firms in regulated industries and financial institutions with SIC codes ranging from 4400 to 5000 and 6000 to 7000.[9] We require net income and total sales to be available. The beginning of the year market value of equity and total assets must be larger than zero. Following previous research, we remove observations with a net income of exactly zero (Compustat: 47 firm-years and

[9]See Beaver et al. (2007), Brown and Caylor (2005), Burgstahler and Dichev (1997), Chen et al. (2010), Durtschi and Easton (2005), Durtschi and Easton (2009), Gilliam et al. (2015), Haga et al. (2019), Kerstein and Rai (2007), Roychowdhury (2006), and Makarem et al. (2018).

Worldscope: 40 firm-years).[10] Net income is the bottom line position that includes operating and nonoperating income after extraordinary items (Compustat item NI; WC #1651). It is scaled by the beginning of the year market value of equity (Compustat item CSHO*PRCC_F; WC #8001). The final Compustat and Worldscope samples contain 161,072 and 126,192 firm-years, respectively. Figure 2 shows the distribution over the years.[11]

We use a threshold for total sales of 2 million USD to identify firms without substantial revenues. We do not set the limit at zero in order to also capture firms with slightly positive sales that are not economically important. The limit is arbitrary to some degree, but our results are robust with respect to the exact (threshold) choice at least in a range of 0 to 10 million USD. Overall, the percentage of firms without substantial sales is 12.7% in the Compustat sample and 16.2% in the Worldscope sample. Figure 2 shows the distribution over time (dark grey). For Compustat, the proportion rises from a low of 6.9% in 1995 to 15.7% in 2003 and a maximum of 18.4% in 2014. In Worldscope, a substantial number of firms without sales was included in 1999, reaching a proportion of 13.8% in that year. Since 2006, the proportion is above 20%, with a maximum in 2013 of 24.9%. Approximately 83% of these firms are traded in OTC markets (Non-Nasdaq OTC and OTC Bulletin Board), 13% are traded in the Nasdaq and 3% are traded in the NYSE MKT. It is important to note that not all firms can be classified as "dotcom firms" even if they went public during the dotcom boom. There is, for example, an important group of firms engaged in biotechnology and pharmaceutical research.

[10] See Burgstahler and Dichev (1997), Gilliam et al. (2015), Dechow et al. (2003), Beaver et al. (2007), Burgstahler and Eames (2006), and Lahr (2014).

[11] In the early years since 1986, the Worldscope database covered mainly large firms because it "was originally developed by fund managers who wanted to systematically store accounting information of potential investments." (Weiner et al., 2005, p. 3). The coverage was significantly expanded in the 1990s.

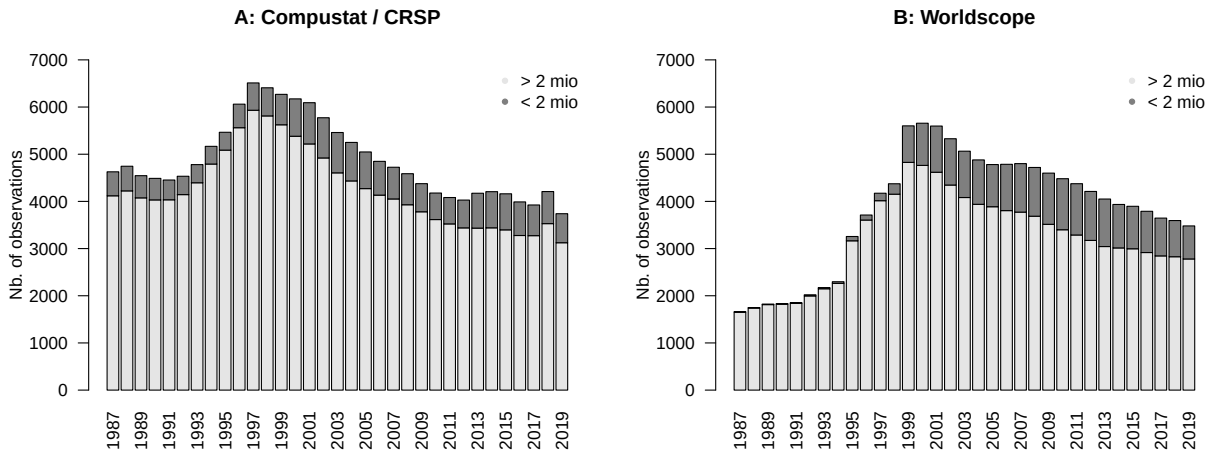

Figure 2: **Sample size by year (1987-2019) for merged Compustat-CRSP (Panel A) and Worldscope (Panel B).** The two categories are 1) Total sales greater than 2 million USD, and 2) Total sales less than 2 million USD.

3. Empirical Results: The Zero Earnings Discontinuity over Time

3.1. Compustat/CRSP Sample

Figure 3 shows the evolution of the small loss difference SLD (in blue) and the small profit difference SPD (in black) for Compustat/CRSP data. The graphs on the left and right are based on interval widths of 0.005 and 0.015, respectively. For scaling with the market value of equity (MVE), the upper panels (A1 and A2) represent the total sample and the middle panels (B1 and B2) represent the subsample of firms with sales revenues greater than 2 million USD in the respective year. The graphs in the bottom panels (C1 and C2) show results for scaling with total assets (so that scaled earnings correspond to the return on assets, ROA). The year 2001 is marked by a vertical line because it is the year before SOX was enacted (on July 30, 2002).

Before 1995, half of the expected number of cases in the narrow loss interval are "missing", indicating a pronounced discontinuity ($SLD \approx -0.5$; graph A1). From 1995 to 2006, SLD shows an upward trend, with a spike in 2000 to a level of zero. After 2006, SLD stays mainly

negative without a clear trend.

This overall pattern is reflected in the downward trend of the small profit difference SPD. The absolute values of SPD are generally smaller than those of SLD, which means that the missing small losses are not simply turned into small profits. We find the same overall pattern for the wider interval width of 0.015, but with smaller values (graph A2). Despite this similarity, the graph for interval 0.015 supports a different view: it suggests that the discontinuity declined but still remained at a high level until 2002 before it disappeared in 2003 and did not reappear afterwards. The pattern replicates the one reported by Gilliam et al. (2015).

This result is less clear in the reduced sample of firms with revenues of at least 2 million USD (B1 and B2). Based on the narrow loss interval of 0.005, SLD decreases significantly, especially in the periods from 2001 to 2002 and 2010 to 2015. The decrease is less strong for the wide loss interval of 0.015, but still considerable. Given the negative SLD values from 2008 onwards, the degree to which the kink has disappeared remains an open question.

Figure 4 shows why firms without sales revenues (right graph) affect the measured discontinuity. As expected, the frequency distribution of scaled earnings is almost fully positioned in the negative range. It tends to rise uniformly almost up to the zero threshold so that the smallest loss interval represents many more cases than the smallest profit interval.

For scaling with total assets, we only show results for the reduced sample of firms having sales revenues larger than 2 million USD (Fig. 3, C1 and C2). The graphs for the total sample are practically identical. The reason is that the losses of firms without sales are mostly substantial in relation to total assets so that few cases fall into the smallest loss interval. Based on the interval of 0.005 (C1), SPD and SLD converge until 2003. The discontinuity varies in the following years, becoming pronounced in some years (in particular

2010) and even inverse in others. The results for the interval of 0.015 (C2) are much more stable. The graph suggests that the discontinuity measures followed a declining trend over the sample period and did not experience noticeable shifts.

Appendix A reports the statistics defined in Section 2.1, including the standardized differences used to assess the statistical significance of the kink in individual years. We check whether changes in the sample composition that are not related to firms without sales have an effect. Our results prove to be robust in this respect as we find the same gradual decline for a balanced sample of stocks that were available in 2002.

3.2. Worldscope Sample

In the *Worldscope sample*, SLD shows an upward trend from -0.55 in 1995 to around zero in 2000. At this point in time, the past evolution suggests that the kink has disappeared (Fig. 5, A1). Surprisingly, SLD continues to rise after 2007 such that an inverse kink with an excess number of small losses is formed. This overall pattern is reflected in the downward trend of the small profit difference SPD. Since 2002, most of its values are negative, which contributes to the inverse kink. We find the same overall pattern with an inverse discontinuity since 2007 for the wider interval width of 0.015 (graph A2).

Excluding companies with sales revenues less than 2 million USD noticeably influences the discontinuity results in the years since 2001 (graphs B1 and B2). In the reduced sample, the SLD values are smaller, the SPD values are larger, and the inverse-kink phenomenon disappears. The "regular" kink even reappears, in particular, from 2010 to 2012 and in 2015. The modified graphs suggest that the ZE discontinuity has gradually declined since the mid-1990s but has not disappeared completely. There is no clear indication of a structural break caused by SOX in 2002.

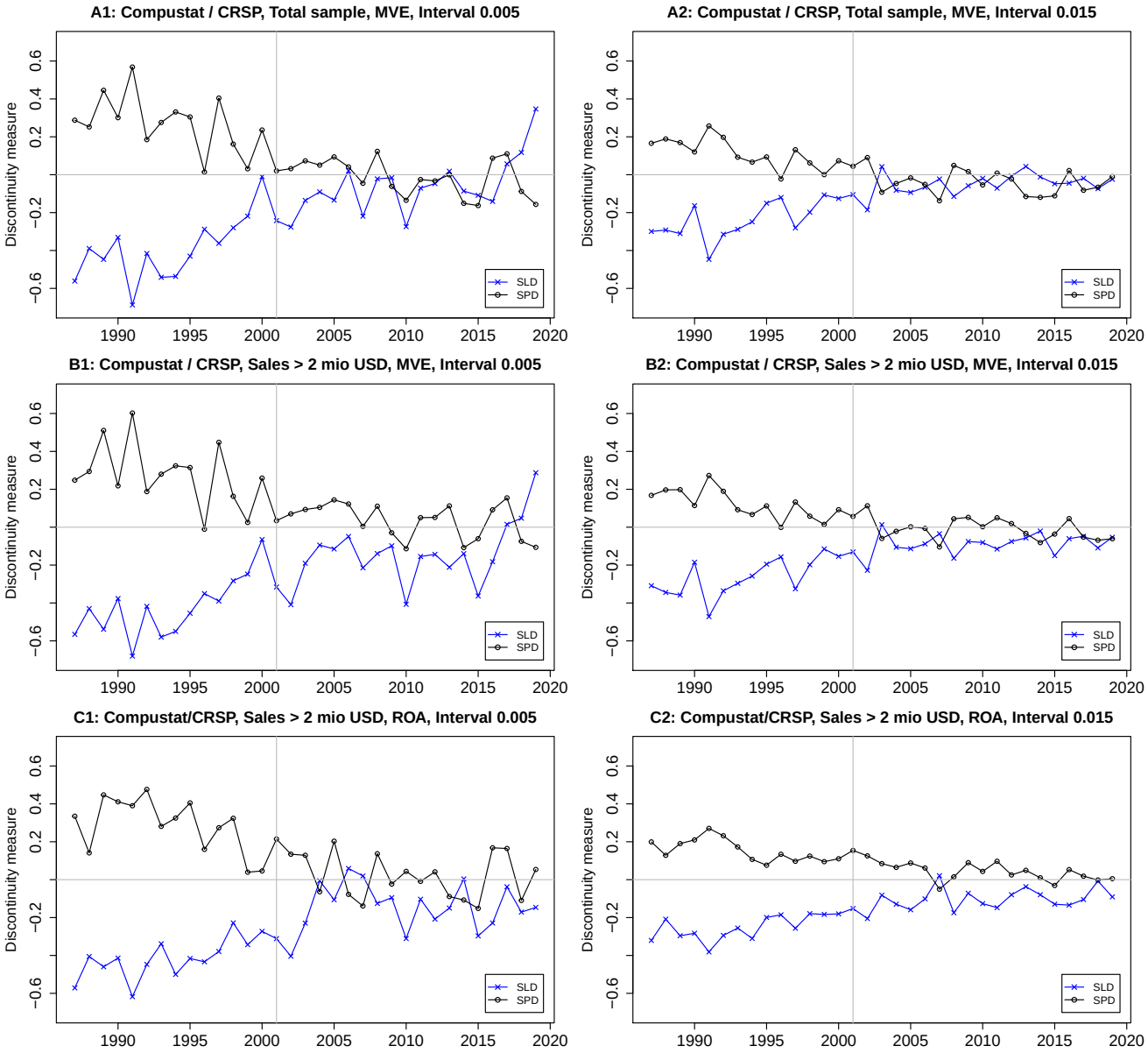

Figure 3: **Discontinuity measure for the Compustat/CRSP sample.** The discontinuity measure captures the share of excess observations (pos. sign) or missing observations (neg. sign) in the intervals of scaled earnings directly below and above the zero threshold. SLD: small loss difference, and SPD: small profit difference. The year 2001 is highlighted by a vertical line because it is the last year before SOX was enacted. MVE: scaling with the market value of equity, and ROA: scaling with total assets.

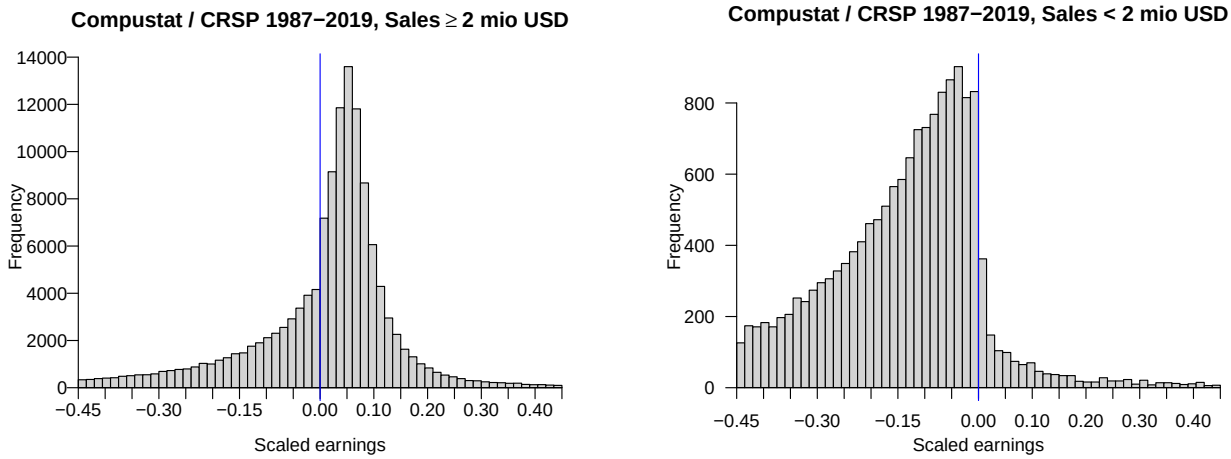

Figure 4: **Frequency distribution of scaled earnings for firms with sales revenues less than 2 million USD in the Compustat/CRSP sample.** Pooled data for two sub-periods: 1987-2001 (left graph) and 2002-2019 (right graph). The zero threshold is highlighted by a vertical line. The interval width is 0.015. Scaling with the market value of equity.

The frequency distribution of scaled earnings for firms with almost no sales (Fig. 6, right graph) reveals a large number of observations combined with a particularly large surplus of small losses over small profits. The observations are not spread evenly over the sample period. In fact, many of these firms were added to the database during the dotcom boom (see Fig. 2, Panel B), which explains why the dotcom effect is much stronger in the Worldscope sample than in the Compustat sample. In the same way as for the Compustat sample, Appendix B reports further discontinuity statistics in detail.

4. Summary and Conclusion

The disappearance of the ZE discontinuity is an important discovery in the earnings management literature. Some empirical results suggest that the kink declined in the second half of the 1990s. This is consistent with the view that firms slowly stopped avoiding small losses when the NYSE no longer considered positive earnings as a requirement for continued

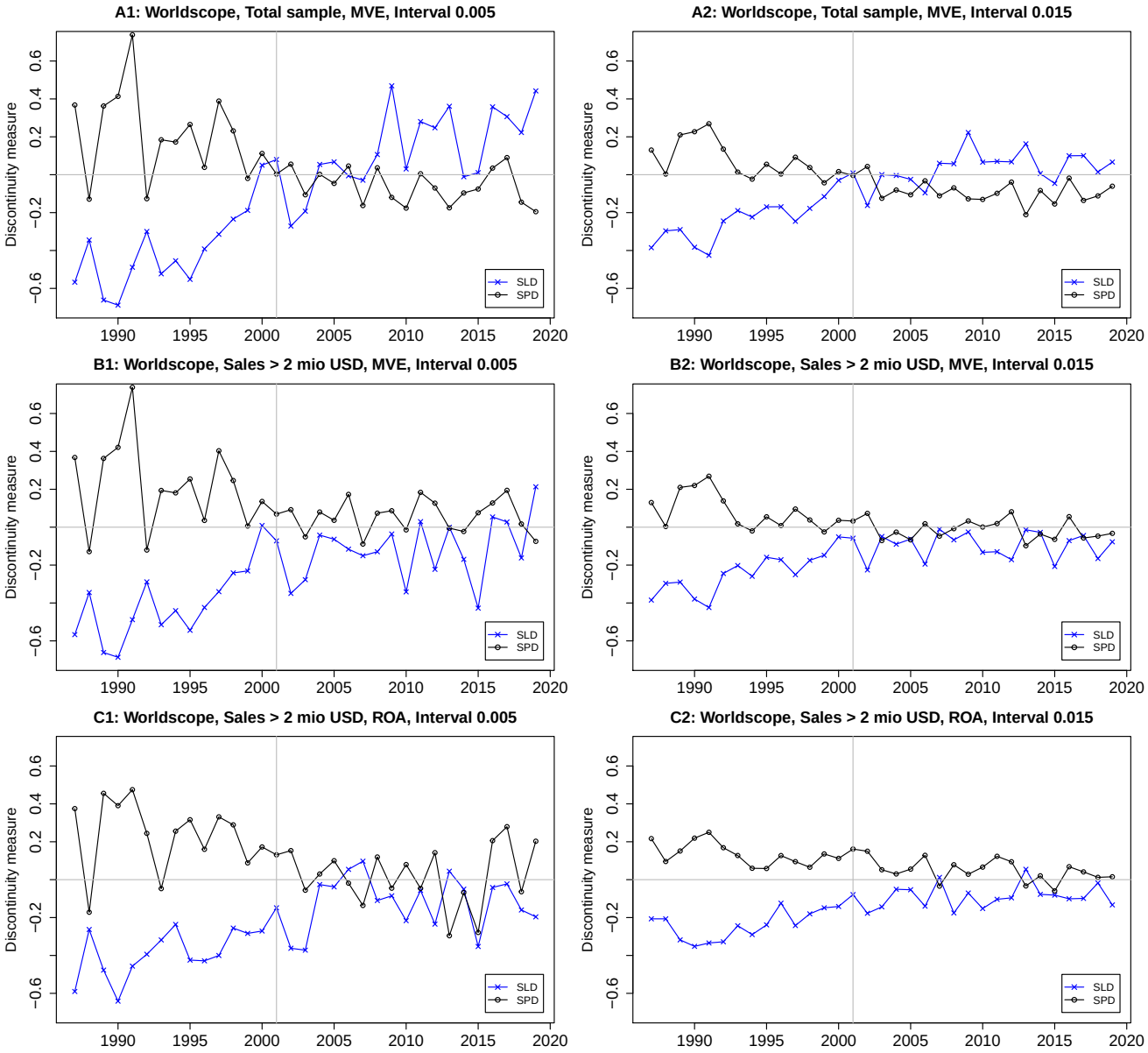

Figure 5: **Discontinuity measure for the Worldscope sample.** The discontinuity measure captures the share of excess observations (pos. sign) or missing observations (neg. sign) in the intervals of scaled earnings directly below and above the zero threshold. SLD: small loss difference, and SPD: small profit difference. The year 2001 is highlighted by a vertical line because it is the last year before SOX was enacted. MVE: scaling with the market value of equity, and ROA: scaling with total assets.

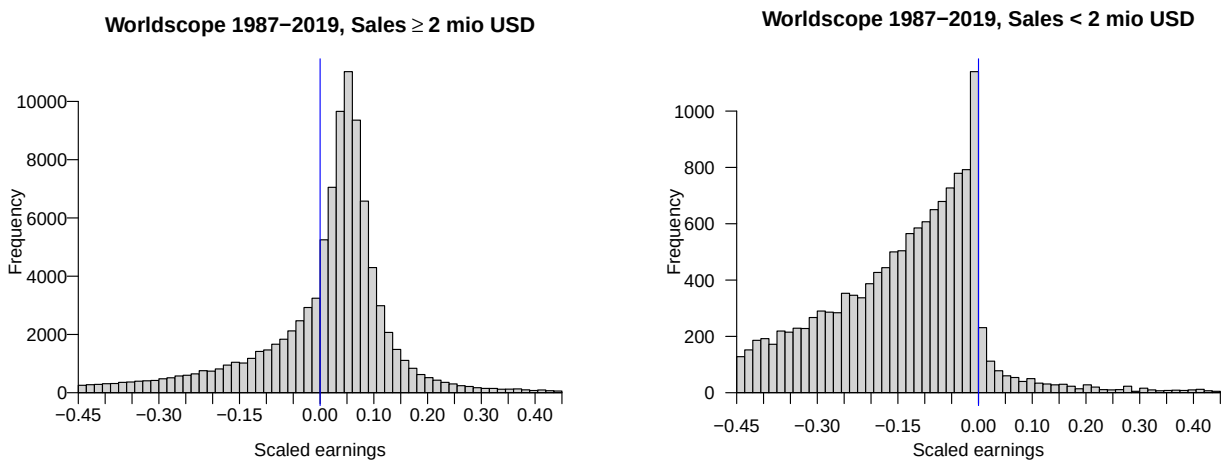

Figure 6: **Frequency distribution of scaled earnings for firms with sales revenues less than 2 million USD in the Worldscope sample.** Pooled data for two subperiods: 1987-2001 (left graph) and 2002-2019 (right graph). The zero threshold is highlighted by a vertical line. The interval width is 0.015. Scaling with the market value of equity.

listing. Other findings identify a turning point around 2002, which suggests that SOX might have been successful in decreasing earnings management activities. These explanations are not mutually exclusive. They are difficult to disentangle because in both cases, frequency distributions before 2002 will show a pronounced kink that is no longer present in distributions after 2002. Also, 2002 might appear to be a turning point not because important events happened in that year but because the gradual decline was largely completed by then. Given these difficulties, it is important to track the evolution of the ZE discontinuity as accurately as possible.

We argue that a confounding effect to be considered came from the dotcom boom at the turn of the millennium. The boom paved the way for numerous firms without sales revenues but with high-flying prospects to go public. Many of them were added to financial databases, with Compustat being more restrictive than Worldscope. When their stock market valuations were high, the scaled losses within this group often fell into the smallest loss interval. These

observations cannot be attributed to a decline in earnings management with the objective to exceed the zero earnings threshold. Therefore, they potentially confound the time series of discontinuity measures.

We find that this effect contributes to the decline in discontinuity measures and even creates the appearance of a strong inverse kink in Worldscope data. The effect is smaller but nonnegligible in the Compustat sample. It is only present in earnings scaled by the market value of equity, in contrast to earnings scaled by total assets. The reason is that losses that are substantial in relation to total assets decrease in relation to the high market capitalizations at the height of the dotcom boom and a few years after the financial crisis of 2008. Therefore, the choice of the scaling variable becomes relevant. When filtering out the effect, the results for scaling by the market value of equity become very similar to those for scaling by total assets. It is unclear that the ZE discontinuity has disappeared completely because it flares up again in later years. It is also questionable whether SOX or other events around 2002 had a causal effect. The overall patterns rather suggest a gradual decline over time that cannot be attributed to a specific regulation.

Appendix A:

Discontinuity measures in the Compustat sample of firms with sales greater than 2 million USD. Earnings are scaled by the market value of equity. N is the number of observations, SD is the standardized differences t-statistic, SLD is the small loss deviation, SPD is the small profit deviation and MPL is the modified profit-to-loss ratio. The measures are defined in Section 2.1.

		Interval 0.005					Interval 0.015				
Year	N	SD_{-1}	SD_1	SLD	SPD	MPL	SD_{-1}	SD_1	SLD	SPD	MPL
1987	4,119	-4.19	1.93	-0.57	0.25	1.06	-7.19	3.63	-0.31	0.17	0.52
1988	4,223	-2.92	1.79	-0.43	0.29	0.82	-7.94	4.48	-0.34	0.20	0.60
1989	4,075	-4.26	2.81	-0.54	0.51	1.19	-7.13	3.85	-0.36	0.20	0.62
1990	4,032	-2.59	2.29	-0.38	0.22	0.67	-3.69	2.36	-0.19	0.11	0.31
1991	4,034	-5.61	3.57	-0.68	0.60	1.61	-11.67	5.68	-0.47	0.27	0.88
1992	4,144	-2.74	1.08	-0.42	0.19	0.71	-9.38	5.08	-0.34	0.19	0.58
1993	4,395	-4.97	2.77	-0.58	0.28	1.11	-7.65	2.68	-0.30	0.09	0.44
1994	4,792	-5.16	3.39	-0.55	0.32	1.08	-6.26	1.24	-0.26	0.07	0.36
1995	5,087	-4.58	3.24	-0.45	0.31	0.88	-5.26	2.60	-0.20	0.11	0.32
1996	5,562	-2.87	0.39	-0.35	-0.01	0.42	-4.30	-0.61	-0.16	-0.001	0.17
1997	5,932	-4.49	4.32	-0.39	0.45	0.86	-10.18	4.46	-0.33	0.13	0.52
1998	5,812	-2.85	1.74	-0.28	0.16	0.48	-6.25	2.38	-0.20	0.06	0.28
1999	5,624	-1.45	0.57	-0.25	0.02	0.31	-3.11	0	-0.11	0.01	0.14
2000	5,381	-0.70	2.15	-0.07	0.26	0.30	-4.38	2.77	-0.15	0.09	0.26
2001	5,218	-2.20	0.96	-0.32	0.03	0.41	-2.88	1.13	-0.13	0.06	0.20
2002	4,921	-3.18	1.04	-0.41	0.07	0.59	-5.73	2.98	-0.23	0.11	0.37
2003	4,605	-2.21	1.18	-0.19	0.09	0.30	0.79	-1.93	0.01	-0.06	-0.07
2004	4,434	-0.76	1.47	-0.09	0.10	0.20	-2.52	-0.68	-0.11	-0.02	0.09
2005	4,271	-0.97	1.37	-0.11	0.14	0.26	-2.78	-0.43	-0.11	0.002	0.12
2006	4,133	-0.23	0.55	-0.05	0.12	0.17	-1.91	-0.21	-0.09	-0.01	0.09
2007	4,052	-2.06	0.92	-0.21	0.004	0.25	-0.42	-3.49	-0.03	-0.10	-0.07
2008	3,929	-0.96	1.19	-0.14	0.11	0.25	-3.84	1.80	-0.16	0.04	0.22
2009	3,780	-0.45	-0.18	-0.10	-0.03	0.07	-1.49	1.55	-0.08	0.05	0.13
2010	3,615	-3.02	0.20	-0.41	-0.11	0.40	-1.78	0.04	-0.08	0.002	0.09
2011	3,523	-1.28	0.40	-0.15	0.05	0.22	-2.92	1.25	-0.12	0.05	0.17
2012	3,439	-1.07	0.54	-0.14	0.05	0.21	-1.46	0.49	-0.08	0.02	0.10
2013	3,434	-1.77	1.54	-0.21	0.11	0.34	-0.75	-1.33	-0.06	-0.03	0.03
2014	3,440	-0.36	-0.50	-0.14	-0.11	0.04	-0.59	-2.87	-0.02	-0.08	-0.06
2015	3,397	-2.00	0.23	-0.36	-0.06	0.39	-3.38	-0.78	-0.15	-0.04	0.13
2016	3,277	-1.01	1.21	-0.18	0.09	0.29	-1.38	1.00	-0.06	0.05	0.11
2017	3,274	-0.50	1.41	0.01	0.15	0.13	-0.87	-1.64	-0.05	-0.05	-0.01
2018	3,529	1.12	-0.27	0.05	-0.07	-0.12	-2.61	-2.57	-0.11	-0.07	0.04
2019	3,124	2.87	-1.46	0.29	-0.11	-0.37	-1.15	-1.57	-0.05	-0.06	-0.01

Appendix B:

Discontinuity measures in the Worldscope sample of firms with sales greater than 2 million USD. Earnings are scaled by the market value of equity. N is the number of observations, SD is the standardized differences t-statistic, SLD is the small loss deviation, SPD is the small profit deviation and MPL is the modified profit-to-loss ratio. The measures are defined in Section 2.1.

		Interval 0.005					Interval 0.015				
Year	N	SD_{-1}	SD_1	SLD	SPD	MPL	SD_{-1}	SD_1	SLD	SPD	MPL
1987	1,655	-2.69	1.36	-0.57	0.37	1.15	-5.90	2.20	-0.38	0.13	0.61
1988	1,740	-0.73	0	-0.34	-0.13	0.28	-3.49	0.15	-0.30	0.004	0.35
1989	1,812	-3.50	1.08	-0.66	0.36	1.39	-3.30	2.74	-0.29	0.21	0.53
1990	1,820	-3.50	2.48	-0.69	0.42	1.51	-6.24	3.17	-0.38	0.22	0.68
1991	1,839	-2.75	2.21	-0.49	0.74	1.22	-6.71	3.70	-0.42	0.27	0.79
1992	1,996	-0.30	-0.97	-0.29	-0.12	0.21	-5.26	2.15	-0.24	0.14	0.41
1993	2,148	-2.73	1.35	-0.51	0.19	0.90	-3.91	-0.15	-0.20	0.02	0.24
1994	2,262	-2.47	1.24	-0.44	0.18	0.75	-4.52	-0.26	-0.26	-0.02	0.28
1995	3,165	-4.24	2.26	-0.54	0.25	1.01	-2.93	1.04	-0.16	0.05	0.23
1996	3,605	-3.18	1.12	-0.42	0.04	0.59	-4.17	-0.23	-0.17	0.01	0.20
1997	4,015	-3.15	2.71	-0.34	0.40	0.75	-6.05	2.83	-0.25	0.10	0.38
1998	4,153	-1.84	2.33	-0.24	0.25	0.50	-4.87	1.31	-0.17	0.04	0.23
1999	4,827	-1.45	0.56	-0.23	0.01	0.27	-3.28	-0.79	-0.15	-0.02	0.14
2000	4,763	-0.14	0.84	0.01	0.14	0.12	-1.31	0.64	-0.05	0.04	0.09
2001	4,618	-0.26	0.92	-0.07	0.07	0.14	-1.02	0.30	-0.06	0.03	0.09
2002	4,347	-2.44	1.20	-0.35	0.09	0.52	-5.34	1.95	-0.23	0.07	0.33
2003	4,082	-2.05	0.45	-0.28	-0.05	0.27	-0.40	-1.91	-0.05	-0.07	-0.02
2004	3,938	-0.22	0.72	-0.04	0.08	0.12	-2.14	-0.54	-0.09	-0.03	0.07
2005	3,887	-0.82	0.36	-0.06	0.04	0.10	-1.23	-2.62	-0.06	-0.07	-0.004
2006	3,805	-0.67	0.82	-0.12	0.17	0.28	-4.24	0.47	-0.19	0.02	0.23
2007	3,773	-1.36	-0.17	-0.15	-0.09	0.07	-0.51	-1.85	-0.01	-0.05	-0.04
2008	3,686	-0.89	0.80	-0.13	0.07	0.21	-1.28	0.44	-0.07	-0.01	0.06
2009	3,514	-0.41	0.57	-0.04	0.09	0.12	-0.60	0.67	-0.03	0.03	0.06
2010	3,399	-2.18	0.72	-0.34	-0.01	0.40	-2.38	0.43	-0.13	0.001	0.14
2011	3,288	-0.19	0.96	0.03	0.18	0.14	-2.68	0.56	-0.13	0.02	0.16
2012	3,173	-1.65	0.86	-0.22	0.13	0.37	-3.34	1.97	-0.17	0.08	0.27
2013	3,043	-0.46	0.46	-0.0004	-0.01	-0.005	-0.19	-2.13	-0.01	-0.10	-0.09
2014	3,014	-1.05	0.39	-0.17	-0.02	0.16	-0.84	-1.21	-0.03	-0.04	-0.01
2015	2,996	-2.95	2.02	-0.43	0.08	0.63	-4.28	-1.25	-0.21	-0.06	0.17
2016	2,916	0.79	0.66	0.05	0.13	0.07	-1.45	1.34	-0.07	0.06	0.13
2017	2,845	-0.63	1.84	0.03	0.19	0.15	-0.64	-1.63	-0.04	-0.06	-0.01
2018	2,827	-0.84	0.81	-0.16	0.02	0.19	-3.65	-1.62	-0.17	-0.05	0.13
2019	2,780	2.30	-0.93	0.21	-0.07	-0.27	-1.34	-0.60	-0.08	-0.03	0.05

References

Bartov, E., Cohen, D.A., 2009. The "Numbers Game" in the Pre- and Post-Sarbanes-Oxley Eras. Journal of Accounting, Auditing & Finance 24, 505–534.

Beaver, W.H., McNichols, M.F., Nelson, K.K., 2007. An alternative interpretation of the discontinuity in earnings distributions. Review of Accounting Studies 12, 525–556.

Brown, L.D., Caylor, M.L., 2005. A Temporal Analysis of Quarterly Earnings Thresholds: Propensities and Valuation Consequences. The Accounting Review 80, 423–440.

Burgstahler, D.C., Chuk, E., 2017. What Have We Learned About Earnings Management? Integrating Discontinuity Evidence. Contemporary Accounting Research 34, 726–749.

Burgstahler, D.C., Dichev, I., 1997. Earnings Managment to avoid earnings decreases and losses. Journal of Accounting and Economics 24, 99–126.

Burgstahler, D.C., Eames, M.J., 2006. Management of earnings and analysts' forecasts to achieve zero and small positive earnings surprises. Journal of Business Finance and Accounting 33, 633–652.

Burgstahler, D.C., Hail, L., Leuz, C., 2006. Importance of reporting incentives: Earnings management in European firms. The Accounting Review 81, 983–1016.

Chen, S.K., Lin, B.X., Wang, Y., Wu, L., 2010. The frequency and magnitude of earnings management: Time-series and multi-threshold comparisons. International Review of Economics and Finance 19, 671–685.

Cohen, D.A., Dey, A., Lys, T.Z., 2008. Real and Accrual-Based Earnings Management in the Pre- and Post-Sarbanes-Oxley Periods. The Accounting Review 83, 757–788.

Daske, H., Gebhardt, G., McLeay, S., 2006. The distribution of earnings relative to targets in the European Union. Accounting and Business Research 36, 137–167.

Dechow, P.M., Richardson, S.A., Tuna, I., 2003. Why are earnings kinky? An examination of the earnings management explanation. Review of Accounting Studies 8, 355–384.

Degeorge, F., Patel, J., Zeckhauser, R., 1999. Earnings Management to Exceed Thresholds. The Journal of Business 72, 1–33.

Durtschi, C., Easton, P., 2005. Earnings management? The shapes of the frequency distributions of earnings metrics are not evidence ipso facto. Journal of Accounting Research 43, 557–592.

Durtschi, C., Easton, P., 2009. Earnings management? Erroneous inferences based on earnings frequency distributions. Journal of Accounting Research 47, 1249–1281.

Enomoto, M., Yamaguchi, T., 2017. Discontinuities in earnings and earnings change distributions after J-SOX implementation: Empirical evidence from Japan. Journal of Accounting and Public Policy 36, 82–98.

Gilliam, T.A., Heflin, F., Paterson, J.S., 2015. Evidence that the zero-earnings discontinuity has disappeared. Journal of Accounting and Economics 60, 117–132.

Gore, P., Pope, P.F., Singh, A.K., 2007. Earnings management and the distribution of earnings relative to targets: UK evidence. Accounting and Business Research 37, 123–149.

Haga, J., Huhtamäki, F., Sundvik, D., 2019. Long-term orientation and earnings management strategies. Journal of International Accounting Research 18, 97–119.

Kerstein, J., Rai, A., 2007. Intra-year shifts in the earnings distribution and their implications for earnings management. Journal of Accounting and Economics 44, 399–419.

Lahr, H., 2014. An Improved Test for Earnings Management Using Kernel Density Estimation. European Accounting Review 23, 559–591.

Leuz, C., Nanda, D., Wysocki, P.D., 2003. Earnings management and investor protection: An international comparison. Journal of Financial Economics 69, 505–527.

Lobo, G.J., Zhou, J., 2006. Did conservatism in financial reporting increase after the Sarbanes-Oxley Act? Initial evidence. Accounting Horizons 20, 57–73.

Lobo, G.J., Zhou, J., 2010. Changes in discretionary financial reporting behavior following the Sarbanes-Oxley Act. Journal of Accounting, Auditing and Finance 25, 1–26.

Makarem, N., Hussainey, K., Zalata, A., 2018. Earnings management in the aftermath of the zero-earnings discontinuity disappearance. Journal of Applied Accounting Research 19, 401–422.

Roychowdhury, S., 2006. Earnings management through real activities manipulation. Journal of Accounting and Economics 42, 335–370.

Scott, D., 1992. Multivariate Density Estimation: Theory, Practice, and Visualization.

Weiner, C., Ulbricht, N., et al., 2005. Worldscope meets Compustat: A Comparison of Financial Databases. Technical Report. Sonderforschungsbereich 649, Humboldt University, Berlin, Germany.