

Detecting Earnings Management via Financial Ratios in U.S. Small-Cap Corporations

Cecilia Wagner Ricci

Abstract

This study is intended to increase the body of knowledge on earnings management (EM) in small cap companies. Though the literature suggests that firm size and the propensity to engage in EM are negatively correlated, only one study concentrates exclusively on small cap companies. The current study more than doubles the number of financial ratios tested in that study as well as the sample size. Using a paired sample matched on GIC Economic Sector and market value, Wilcoxon Signed Rank Tests are employed to ascertain whether the ratios identified in the literature as effective in detecting EM in larger companies can perform the same function in smaller companies. The sample is examined overall, by GIC Economic Sector, and for the three years preceding the beginning of the EM. The results suggest that the efficacy of large cap indicators of EM in the small cap space varies by economic sector and year.

I. Introduction

The purpose of this study is to extend the previous research on EM in small cap companies. To date, the only such study to focus on small-cap firms exclusively was that of Ricci and O’Sullivan-Gavin (2017). The current study differs from theirs in three important ways. First, Ricci and O’Sullivan-Gavin (2017) examined account levels and ratios, and focused on five ratios, whereas the current study focuses on thirteen ratios identified in the previous literature. Second, there has been an increase in the number of enforcement actions by the SEC, resulting in a larger population from which to draw. Consequently, the sample size used in the current study is more than twice as large as the one used by Ricci and O’Sullivan-Gavin (2017). Third, Ricci and O’Sullivan-Gavin (2017) made no attempt to determine whether the data were normally distributed, and thus, t-tests were used to analyze the data. In the current study, tests for normality indicated that the data are not normally distributed and thus non-parametric tests are used.

The study is organized as follows: the next section summarizes the literature, and is followed by the presentation of the sample, the methodology, and the results of the empirical tests. The final section presents the study’s conclusions, limitations, and areas of future research.

II. Literature review

The purpose of this section is to examine the previous literature on EM to identify ratios used to detect it. First, the research on EM in small cap companies is examined. This is followed by a review of the research concerning EM in large cap companies. The end result is a group of ratios whose efficacy is tested to determine their usefulness in identifying EM in small cap companies. The research by Ricci and O’Sullivan-Gavin (2017) finds that small cap firms engaging in EM have statistically significant higher NPM, ROA, and accounts receivable/sales (AR/S) compared to non-EM firms.

Cuong and Ha (2018) report that the ROA, asset growth, total asset turnover (TATO), current ratio, and cash flow from operations are statistically significant indicators of EM in companies

listed on the Vietnamese stock exchange. More precisely, they find that the TATO and long-term debt/total asset ratios (LTD/TA) tend to be negatively correlated with EM, and the ROA, return on equity, net profit margin (NPM), and inventory turnover (INV/S) ratios tend to be positively correlated with EM (Cuong and Ha, 2018).

Zainudin and Hashim (2016) examine Malaysian firms and find that firms engaging in EM tend to have greater leverage (TL/TE and TL/TA), lower profitability (NPM), lower liquidity (AR/S, inventory/total assets (INV/TA), working capital/total assets (WC/TA), and asset efficiency ratios (TATO), and that these differences are statistically significant.

Kanapickiene and Grundiene (2015) examine EM in companies in Lithuania and report that the INV/S, long-term debt/equity (LTD/TE), long-term debt/total assets, AR/S, receivables/total assets (AR/TA), and TL/TA ratios are significantly different (Kanapickiene and Grundiene, 2015).

Nia (2015) compares 134 fraudulent and non-fraudulent firms on the Tehran stock exchange between 2008 and 2014, and discovers that there are statistically significant differences in the current assets/total assets, INV/TA, and TATO ratios. In addition, he finds that the INV/TA ratios tend to be higher in firms engaging in EM. Though not statistically significant, Nia's results also suggest that firms engaging in EM tend to have higher TL/TA and TL/TE ratios, and lower TATOs.

Dalnial *et al.* (2014) also investigate publicly listed firms in Malaysia via a matched sample of 65 firms, and find that the TL/TA, TL/TE, INV/TA, and AR/S ratios are statistically significantly higher in EM companies versus non-EM companies.

Dani *et al.* (2013) also investigate EM in Malaysia, and find that the TATO, INV/TA, and gross profit/total assets (GP/TA) ratios are statistically significant indicators of EM; the TATO and GP/TA ratios tend to be lower and the INV/TA ratio tends to be higher in companies engaging in EM.

Using logistic regression and a set of 143 companies, Suyanto (2009) finds several ratios that are significantly different in the financial statements of EM companies when compared to the financial statements of non-EM companies. He finds that leverage and INV/TA ratios tend to be higher in companies making errors, and the TATO and ROA ratios tend to be lower (Suyanto, 2009).

Moore (2007) tests ratios and finds that several ratios are statistically significant in predicting EM. She notes that the operating cash flow/net income ratio is lower in EM companies, and the operating cash flow/operating income, INV/S, and ROA ratios are higher in EM companies.

Kaminski *et al.* (2004) use a matched sample of 79 companies to evaluate usefulness of 21 financial ratios. They find that interest expense/total liabilities and fixed assets/total assets ratios were significant at the 0.01 level in the years preceding the EM year; the fixed assets/total assets was also significant at the 0.01 level in the year in which the EM occurred. In the second and third post-EM years, Kaminiski *et al.* (2004) found significance at the 0.01 level for six ratios:

ROA, operating expenses/sales, operating income/sales, retained earnings/total assets, TL/TA, and WC/TA.

Using a matched sample of manufacturing firms in Greece, Spathis (2002) finds that the WC/TA, GP/TA, ROA, and the NPM ratios are lower for EM firms compared to non-EM firms. He also finds that the TL/TE and TL/TA tend to be higher in EM firms (Spathis, 2002).

Beneish (1999) used a sample of 74 companies that were issued Auditing and Accounting Earnings Releases (AAERs) between 1987 and 1993 to identify variables that detect EM. He created a series of indices that include the following ratios: AR/S, GPM, sales growth, and total accruals/total assets.

Using a sample of 51 companies taken from the *Wall Street Journal Index*, Summers and Sweeney (1998) report that EM firms have higher INV/S, growth, and ROA in the year directly before the year in which the EM was committed.

Fanning and Cogger (1998) use a set of 102 pairs of companies (matching companies identified by the SEC as having committed EM with non-EM companies) to conclude that the AR/S, INV/S, and LTD/TE are statistically significant ($\alpha = 0.01$) and tend to be elevated for EM companies.

DeChow *et al.* (1996) find that the quest to decrease external financing costs and avoid triggering debt covenant violations are significant motivations for EM. Relevant to this study is that in examining what they term the “debt motivation,” they use the TL/TA ratio, which they determine is statistically significant.

Persons (1995) studies the usefulness of financial statement data as predictors of EM. She identifies companies’ involvement in EM via SEC data, and matches them with companies not engaged in EM. Using step-wise logistic models, she concludes that firm size, asset composition, financial leverage, and TATO are statistically significant factors in determining the likelihood of financial fraud. She finds that TL/TA, AR/TA, and INV/TA are higher for EM firms, and ROA and TATO are lower.

Based on the literature review, thirteen ratios in three categories were found to be significant in more than one study. The related hypotheses are:

ASSET COMPOSITION

$$H_1: AR/TA_{EM} > AR/TA_{Matching}$$

$$H_2: INV/TA_{EM} > INV/TA_{Matching}$$

$$H_3: WC/TA_{EM} < WC/TA_{Matching}$$

DEBT

$$H_4: LTD/TE_{EM} > LTD/TE_{Matching}$$

$$H_5: TL/TA_{EM} > TL/TA_{Matching}$$

$$H_6: TL/TE_{EM} > TL/TE_{Matching}$$

SALES

$$H_7: AR/S_{EM} > AR/S_{Matching}$$

$$H_8: GPM_{EM} < GPM_{Matching}$$

$$H_9: GP/TA_{EM} < GP/TA_{Matching}$$

$$H_{10}: INV/S_{EM} > INV/S_{Matching}$$

$$H_{11}: NPM_{EM} < NPM_{Matching}$$

$$H_{12}: ROA_{EM} < ROA_{Matching}$$

$$H_{13}: TATO_{EM} < TATO_{Matching}$$

III. Sample

The “Issuer Reporting and Disclosure” sections of the 2004 to 2018 *SEC Select and Market Data Reports* were used to identify EM companies (www.sec.gov), and the small cap space was defined as containing firms whose end-of-fiscal-year market value was below \$2 billion.

The EM companies were matched on market caps in the year preceding the start of the EM behavior as identified by the SEC, and GIC Sectors. The final sample consisted of sixty-eight pairs of companies, which may be seen in Appendix A.

Regarding the time frame studied, Kaminski *et al.* (2004) found that EM started approximately thirty-six months before it was discovered, and Ricci and O’Sullivan-Gavin (2017) found that statistically significant differences in ratios could be observed up to three years before the EM started. Accordingly, data were collected and tested for the three years preceding the beginning of the EM behavior (Year -1, Year -2, and Year -3).

IV. Descriptives

The sample classified by GIC Economic Sector may be seen in Table I. Sectors 40 Financials, 50 Communications Services, and 60 Real Estate were not represented in the sample. GIC 40 Financials was excluded from the sample because companies in this sector do not have all of the variables necessary for inclusion in the study.

As indicated, the sample is weighted with companies in the GIC 20 Industrials, GIC 25 Consumer Discretionary, GIC 35 Health Care, and GIC 45 Information Technology.

Table I. Sample Distribution by GIC Economic Sector.

	Frequency	% Sample
10 Energy	4	5.9%
15 Materials	5	7.4%
20 Industrials	16	23.5%
25 Consumer Discretionary	12	17.6%
30 Consumer Staples	4	5.9%
35 Health Care	10	14.7%
45 Information Technology	16	23.5%
55 Utilities	1	1.5%

Table II presents the number and percentage of cases based on the year in which the SEC reported the EM began. The highest number of cases is found in 2006 - 2008, followed by 2009 - 2011, then 2003 - 2005. 61.8% of the sample began the EM behavior between 2006 and 2011.

Table II. Sample by Year EM Began.

Period	Frequency	% Sample
2000 - 2002	4	5.9%
2003 - 2005	13	19.1%
2006 - 2008	22	32.4%
2009 - 2011	20	29.4%
2012 - 2014	9	13.2%

Table III contains the descriptives (means, medians, and standard deviations) of each type of company. In the asset composition group, EM firms have higher median AR/TA, INV/TA and WC/TA ratios than non-EM firms do. As indicated in the debt-related ratios, EM firms have lower median TL/TE ratios, and higher median LTD/TE and TL/TA ratios. In the sales category, EM companies have lower median GPM, GP/TA, NPM and ROA, and higher AR/S and TATO.

Table III. Descriptives by Type of Firm.

	Type 1: EM Firms			Type 2: Matching Firms		
	Mean	Median	Std Dev	Mean	Median	Std Dev
ASSET COMPOSITION						
Accounts receivable/total assets	0.15	0.14	0.11	0.14	0.11	0.12
Inventory/total assets	0.11	0.08	0.14	0.09	0.06	0.12
Working capital/total assets	0.14	0.24	1.07	0.22	0.21	0.42
DEBT						
Long-term debt/total equity	0.38	0.15	0.94	0.78	0.13	2.58
Total liabilities/total equity	0.94	0.52	1.59	1.32	0.59	3.49
Total liabilities/total assets	0.68	0.51	1.30	0.55	0.50	0.44
SALES						
Accounts receivable/sales	0.27	0.16	1.45	0.17	0.14	0.15
Gross profit margin	-0.89	0.29	16.37	0.08	0.36	3.27
Gross profit/total assets	0.31	0.29	0.27	0.33	0.33	0.26
Inventory/sales	0.13	0.09	0.30	0.11	0.09	0.19
Net profit margin	-2.97	0.02	26.11	-0.75	0.04	6.70
Return on assets	-0.22	0.02	1.25	-0.04	0.04	0.43
Total asset turnover	1.08	0.94	0.75	1.00	0.88	0.86

V. Test Results

Initial tests on the sample found that it was non-normally distributed. Accordingly, the Wilcoxon Signed Ranks test was used. This test reports the significance of the differences between the pairs in a matched sample. It also identifies which of the paired variables in greater or less than the other variable. The Wilcoxon test was used to test the entire sample, the sample by GIC Economic Sector, and by Years -1 (one year before the SEC says the EM began), -2 and -3.

A. Wilcoxon Signed Ranks Test

Table IV contains the results of the Wilcoxon test on the entire sample. As indicated, five of the ratios are statistically significant. The GPM is significant at the 0.01 level, and the NPM is significant at the 0.05 level, indicating that the EM companies have lower ratios than the matching companies do. These results affirm the previous research, and H_8 and H_{11} are accepted. The INV/S results suggest that the EM firms have higher ratios than the matching firms, and that this difference is significant at the 0.05. This validates the work of Ricci and O’Sullivan-Gavin (2018), as well as Moore (2007) and Summers and Sweeney (1998), and H_{10} is accepted. The TL/TE is significant yet EM companies have lower ratios than their matches. This is not supported by the previous literature, and consequently, H_6 is rejected.

The TATO ratio is statistically significant, but the results indicate that that it is higher for the EM companies. This refutes the results of Dani et al. (2013), Persons (1995), and Suyanto (2009), and thus H_{13} is rejected. The remaining ratios do not exhibit statistically significant differences.

Table V, which contains the test results by GIC Economic Sector, indicates that the usefulness of the ratios tested varies widely. Ten of thirteen ratios are statistically significant in GIC 20 Industrials, and five are significant in GIC 25 Consumer Discretionary. One ratio is significant in GIC 45 Information Technology, and none are significant in GIC 35 Health Care.

Table IV. Wilcoxon Test Results, Full Sample.		
	Z	(sig)
ASSET COMPOSITION		
AR/TA	-0.42	(0.3364)
INV/TA	-1.64	(0.0504)
WC/TA	-0.51	(0.3044)
DEBT		
LTD/TE	-1.59	(0.0565)
TL/TA	-0.49	(0.3119)
TL/TE	-2.27†	(0.0116)*
SALES		
AR/S	-0.55	(0.2900)
GPM	-2.70†	(0.0035)**
GP/TA	-0.86	(0.1937)
INV/S	-2.28‡	(0.0112)*
NPM	-2.30†	(0.0107)*
ROA	-1.55	(0.0601)
TATO	-2.27‡	(0.0116)*
** sig 0.01 * sig 0.05 † EM < M ‡ EM > M		

In GIC 20 Industrials, two of the asset composition ratios (AR/TA, WC/TA), all of the debt ratios, and five of the sales ratios (AR/S, GPM, NPM, ROA, and TATO) are statistically significant. In the asset composition category, AR/TA signals that it is higher in the EM companies, and H_1 is accepted. However, the H_3 hypothesis states that the WC/TA ratio should be lower for EM companies, and thus H_3 is rejected. The result for WC/TA is confirmed in GIC 25 Consumer Discretionary and GIC 45 Information Technology, providing further evidence of the ratio's usefulness, albeit not in the direction expected.

As stated previously, all three debt ratios are significant. The TL/TA ratio suggests that it is higher for the EM firms, confirming the results of Persons (1995) and Spathis (2002), and indicating acceptance of H_5 . However, the LTD/TE and TL/TE ratios indicate that they are lower in the EM companies, rejecting the results found by Dalnial et al. (2014), Zainudin and Hashim (2016), and Spathis (2002), as well as H_4 and H_6 .

Four of the sales category ratios are statistically significant at the 0.01 level (AR/S, GPM, NPM, and TATO), and one (ROA) is significant at the 0.05 level. The results indicate that the EM companies tend to have lower profitability ratios (GPM, NPM, and ROA), which validates the previous research and suggests acceptance of H_8 , H_{11} and H_{12} . The significance of the NPM and ROA are also seen in GIC 25 Consumer Discretionary sector. The AR/S outcome suggests that the ratio tends to be higher in EM companies, which indicates the acceptance of H_7 , which is confirmed by GIC 25 Consumer Discretionary. The results of the tests of the TATO ratio indicate that it is higher in the EM companies, which results in the rejection of H_{13} .

Table V. Wilcoxon Test Results by GIC Economic Sector.

	20 Industrials		25 Consumer Discret.		35 Health Care		45 Info. Technology	
	Z	(sig.)	Z	(sig.)	Z	(sig.)	Z	(sig.)
ASSET COMPOSITION								
AR/TA	-2.93‡	(0.0017)**	-1.07	(0.1427)	-1.20	(0.1151)	-1.56	(0.0595)
INV/TA	-1.01	(0.1561)	-0.66	(0.2547)	-1.29	(0.0993)	-0.84	(0.2012)
WC/TA	-1.81‡	(0.0355)*	-3.47‡	(0.0003)**	-0.36	(0.3594)	-2.40‡	(0.0082)**
DEBT								
LTD/TE	-2.10†	(0.0177)*	-1.60	(0.0550)	-1.34	(0.0897)	-1.61	(0.0541)
TL/TA	-2.37‡	(0.0089)**	-1.12	(0.1323)	-1.55	(0.0602)	-1.63	(0.0515)
TL/TE	-3.43†	(0.0003)**	-2.22†	(0.0134)*	-0.32	(0.3749)	-0.89	(0.1861)
SALES								
AR/S	-2.42‡	(0.0078)**	-2.36‡	(0.0092)**	-0.01	(0.4946)	-1.33	(0.0912)
GPM	-4.26†	(0.0000)**	-0.63	(0.2649)	-0.96	(0.1697)	-0.07	(0.4714)
GP/TA	-0.11	(0.4579)	-1.08	(0.1392)	-0.58	(0.2815)	-0.23	(0.4107)
INV/S	-0.98	(0.1644)	-1.38	(0.0834)	-0.70	(0.2426)	-1.12	(0.1321)
NPM	-3.70†	(0.0001)**	-1.98†	(0.0239)*	-0.74	(0.2297)	-1.12	(0.1318)
ROA	-2.23†	(0.0130)*	-1.67†	(0.0479)*	-0.90	(0.1855)	-1.08	(0.1408)
TATO	-3.97‡	(0.0000)**	-1.62	(0.0528)	-0.75	(0.2282)	-0.34	(0.3675)

** sig 0.01 * sig 0.05 † EM < Match ‡ EM > Match

Table VI presents the results of the Wilcoxon tests by year. Recall that Year -1 is the year before the EM according to the SEC, Year -2 is two years before, etc. None of the ratios is statistically significant one year (Year -1) prior to the beginning of the EM as identified by the SEC, dealing a significant blow to the usefulness of the ratios in identifying potential EM. Moreover, none of the asset composition ratios are significant in any year. Two of the debt ratios, LTD/TE and TL/TA, are significant in Year -3. However, unlike the prior research, the results show that the EM companies have lower ratios than the matching companies do, resulting in the rejection of H_4 and H_6 . Regarding the sales ratios, the GPM, NPM, and ROA are statistically significant in Years -2 and -3, and indicate that the EM firms have lower ratios than the matching firms do. These results affirm the results from the overall and GIC sectors tests.

Table VI. Wilcoxon Test Results by Year.

	Year -1		Year -2		Year -3	
	Z	(sig.)	Z	(sig.)	Z	(sig.)
ASSET COMPOSITION						
AR/TA	-0.21	(0.4159)	-0.22	(0.4106)	-0.75	(0.2280)
INV/TA	-0.64	(0.2629)	-1.08	(0.1394)	-1.13	(0.1300)
WC/TA	-0.17	(0.4321)	-0.53	(0.2996)	-0.18	(0.4297)
DEBT						
LTD/TE	-0.73	(0.2319)	-0.16	(0.4347)	-1.87†	(0.0306)*
TL/TA	-0.81	(0.2084)	-1.43	(0.0764)	-1.70†	(0.0447)*
TL/TE	-0.04	(0.4854)	-0.54	(0.2933)	-0.17	(0.4345)
SALES						
AR/S	-0.86	(0.1943)	-0.11	(0.4545)	-0.03	(0.4893)
GPM	-1.19	(0.1164)	-1.73†	(0.0420)*	-1.73†	(0.0416)*
GP/TA	-0.51	(0.3064)	-0.07	(0.4726)	-1.18	(0.1191)
INV/S	-1.17	(0.1201)	-1.38	(0.0843)	-1.36	(0.0871)
NPM	-1.07	(0.1427)	-2.20†	(0.0139)*	-2.46†	(0.0069)**
ROA	-0.02	(0.4927)	-2.07†	(0.0194)*	-1.86†	(0.0312)*
TATO	-0.82	(0.2066)	-1.12	(0.1311)	-0.73	(0.2323)

** sig 0.01 * sig 0.05 † EM < Match ‡ EM > Match

In summary, the most useful results were those for the GPM (H_8), and the NPM (H_{11}). The hypotheses stated that these ratios would be lower for the EM companies, and this were confirmed by the results, displaying a significant relationship in the overall test, at least one of the GIC sectors, and Years -2 and -3. The least useful ratios were INV/TA and GP/TA, neither of which was significant in any of the tests.

V. Conclusions and Suggestions for Future Research

The overall conclusion is that the ratios that are used that indicate or identify EM in large cap companies may not do so effectively in small cap companies. Among the asset composition ratios, the INV/TA ratio was not significant in any of the tests. The AR/TA was significant in GIC 20 Industrials only, and though the WC/TA ratio was significant, the results indicated that the ratio was higher while the hypothesis indicated the opposite.

There were also issues with the debt-related ratios. The LTD/TE and the TL/TA ratios were significant in one GIC sector and one year. The third, the TL/TE ratio, was predicted to be higher based on the previous literature, but it was consistently lower.

Among the sales related ratios tests, the GPM, NPM and ROA were statistically significant and lower for the EM companies as predicted. The TATO was statistically significant in the overall test as well as the GIC tests. However, in both cases, the significance was based on the TATO for the EM firms being higher than it was for the matching firms, which is the opposite of what the hypothesis stated. The GP/TA ratio was not significant in any of the tests.

Several areas of research arise from these results. First, the identification of ratios that can detect EM in small cap companies is needed. This is especially important given the previous research indicating that small companies engage in EM more than large companies do (Hoang, 2007; Beasley *et al.*, 1999; Feroz *et al.*, 1991; Persons, 1995; Kreutzfeldt and Wallace, 1986; Kinney and McDaniel, 1989).

Research concerning the usefulness of ratios across GIC Economic Sectors is also necessary. Are there ratios that can be used across sectors, or are there different sets of ratios for each sector?

In addition, the ratios used in this study do not serve as early warning indicators of EM. While some of ratios are significant in Years -2 and -3, none are significant in Year -1. Consequently, additional research is needed to identify ratios, if any, that can be used to detect the propensity for EM.

References

- Beasley, Mark, Joseph Carcello, and Dana Hermanson, 1999, Fraudulent Financial Reporting: 1987-1997, An Analysis of U.S. Public Companies Committee of Sponsoring Organizations of the Treadway Commission (COSO) http://coso.org/publications/FFR_1987_1997.PDF.
- Beneish, Messod, 1999, The Detection of Earnings Manipulation, Financial Analysts Journal 55(5), 24-36.

- Cuong, Nguyen, and Nguyen Ha, 2018, Influence of Financial Ratios on Earnings Management: Evidence from Vietnam Stock Exchange Market, *Journal of Insurance and Financial Management*, 4(1) 57-77.
- Dalnial, Hawariah, Amrizah Kamaluddin, Zuraidah Mohd Sanusi, and Khairun Syafiza Khairuddin, 2014, Accountability in Financial Reporting: Detecting Fraudulent Firms, *Procedia – Social and Behavioral Sciences*, 145, 61-69.
- Dani, Radziah M., Politeknik Dickson, Nrgeri Sembilan, Wan Ismail, and Khirul Kamarudin, 2013, Can Financial Ratios Explain The Occurrence Of Fraudulent Financial Statements?, *Global Trends in Financial Crimes in the New Economies, The Fifth International Conference on Financial Criminology (ICFC)*, 345-354.
- DeChow, Patricia, Richard Sloan, and Amy Sweeney, 1996, Causes and Consequences of Earnings Manipulation: An Analysis of Firms Subject to Enforcement Actions by the SEC, *Contemporary Accounting Research*, 13(1), 1-37.
- Fanning, Kurt, and Kenneth Cogger, 1998, Neural network detection of management EM using published financial data, *International Journal of Intelligent Systems in Accounting Finance & Management*, 7(1), 21-41.
- Feroz, Eshan, Kyung Joo Park, and Victor Pastina, 1991, The Financial and Market Effects of the SEC's Accounting and Auditing Enforcement Releases, *Journal of Accounting Research (Supp)*, 29, 107-148.
- Hoang, Quyen, 2007, Management Ownership, Firm Size, and Earnings Management, *Dissertation Abstracts International Section A: Humanities and Social Sciences*, 68 (4-A).
- Kaminski, Kathleen, Wetzal, T. Sterling, and Liming Guan, 2004, Can financial ratios detect fraudulent financial reporting? *Managerial Auditing Journal* 15, 9(1) 15-28.
- Kanapickene, Rasa., and Zivile Grundiene, 2015, The Model for EM Protection in Financial Statements by Means of Financial Ratios, *Procedia - Social and Behavioral Sciences* 213, 321-327.
- Kinney, William R., and Linda S. McDaniel, 1989, Characteristics of Firms Correcting Previously Reported Quarterly Earnings, *Journal of Accounting & Economics*, 11(1), 71-93.
- Kreutzfeldt, Richard W., and Wanda A.Wallace, 1986, Characteristics in Audit Populations: Their Profile and Relationship to Environmental Factors, *Auditing: A Journal of Practice and Theory*, 6 (2), 59-73.
- Moore, Debra, *Forecasting EM: Evidence from GAO Restatement Data (Thesis, Touro University International (2007))*.
- Nia, Somayyeh, 2015, Financial ratios between fraudulent and non-fraudulent firms: evidence from the Tehran Stock Exchange, *Journal of Accounting and Taxation*, Vol 7 Iss 3, pp 38-44.
- Persons, Obeua S., 1995, Using financial statement data to identify factors associated with fraudulent financial reporting, *Journal of Applied Business Research*, 11(3), 38-46.
- Ricci, Cecilia Wagner, and Susan O'Sullivan-Gavin, 2017, Identifying Earnings Management: The Case of Small-Cap Corporations in the United States, *International Research Journal of Applied Finance*, 8 (4), 1-16.
- Ricci, Cecilia Wagner, and Susan O'Sullivan-Gavin, 2018, The Detection of Earnings Management in American Micro-Cap Companies, *Journal of Applied Financial Research*, 1 pp. 49-62.

- Spathis, Charalambos, 2002, Detecting false financial statements using published data: some evidence from Greece, *Managerial Auditing Journal*, Vol. 17 Iss. 4, pp. 179-189.
- Summers, Scott L., and John T. Sweeney, 1998, Fraudulently Misstated Financial Statements and Insider Trading: An Empirical Analysis, *Accounting Review* 73(1), 131-147.
- Suyanto. Suyanto, 2009, Fraudulent Financial Statement: Evidence from Statement on Auditing Standard no. 99, *Gadjah Mada International Journal of Business*. 11(1), 117-144.
- Zainudin, E.F.; and Hashim, H.A., 2016, Detecting fraudulent financial reporting using financial ratio, *Journal of Financial Reporting and Accounting*, Vol. 14 No. 2, pp. 266-277.

Appendix A. Sample companies

EM Company

Advanced Emissions Solutions
Apogee Technology Inc
Aspen Technology Inc
Atlas Air Worldwide Hldg Inc
Bally Technologies Inc
Black Box Corp
Bristow Group Inc
Canadian Solar Inc
Charter Communications Inc
China Valves Technology Inc
Comverse Technology Inc
Con-Way Inc
Cumulus Media Inc
Dana Inc
DGSE Companies Inc
Diamond Foods Inc
Eco2 Plastics Inc
Excel Technology Inc
Ferro Corp
Fuqi International Inc
Genesco Inc
Great Lakes Dredge & Dock Cp
Hain Celestial Group Inc
Hansen Medical Inc
Huron Consulting Group Inc
Hyperdynamics Corp
I2 Technologies Inc
IEC Electronics Corp
Ingles Markets Inc -Cl A
JDA Software Group Inc
Lattice Semiconductor Corp
LSB Industries Inc
Medquist Inc
Merge Healthcare Inc
Miller Energy Resources Inc

Matching Company

Santa Fe Gold Corp
Retractable Technologies Inc
Midway Games Inc
Advisory Board Co
Linamar Corp
Advanced Energy Inds Inc
Lufkin Industries Inc
Hollysys Automation Tech Ltd
Kerzner International Ltd
Acacia Research Corp
Zebra Technologies Cp
Teledyne Technologies Inc
Journal Communications Inc
Flexsteel Industries Inc
Emerging Vision Inc
Andersons Inc
Montague Intl Holding Ltd
Audiocodes Ltd
Arch Chemicals Inc
Finishmaster Inc
Centerplate Inc
Golden Ocean Group
Darling Ingredients Inc
Conmed Corp
Matthews Intl Corp
U S Energy Corp
Formfactor Inc
Crexendo Inc
Alico Inc
Epiq Systems Inc
Cirrus Logic Inc
Quaker Chemical Corp
Metropolitan Hlth Ntwrks Inc
Lumenis Ltd
Atlas Energy Group Llc

NCI Building Systems Inc	Gibraltar Industries Inc
Northwestern Corp	Avista Corp
Ocata Therapeutics Inc	Taro Pharmaceutical Inds Ltd
OM Group Inc	Grace (W R) & Co
Orthofix Medical Inc	Computer Programs & Systems
Overseas Shipholding Group	Gulferra Energy Partners-LP
Performance Food Group Co	Church & Dwight Inc
Saba Software Inc	Convera Corp
Safenet Holding Corp	Landmark System Corp
Schnitzer Steel Inds	Headwaters Inc
Stein Mart Inc	Biglari Holdings Inc
Stewart Enterprises -Cl A	Steiner Leisure Ltd
Sycamore Networks Inc	Pulse Electronics Corp
Symmetry Medical Inc	Ista Pharmaceuticals Inc
Take-Two Interactive Sftwr	Advanced Fibre Comm Inc
Terex Corp	Hussmann International Inc
Titan International Inc	CompX International Inc
United Industrial Corp	Spar Aerospace Ltd
United Rentals Inc	Genco Shipping & Trading
Universal Travel Group	Marinemax Inc
Volt Info Sciences Inc	G&K Services Inc -Cl A
Wabtec Corp	Actuant Corp -Cl A
Warnaco Group Inc	Carter's Inc
Wellcare Health Plans Inc	Phase Forward Inc
West Marine Inc	Build-A-Bear Workshop Inc
Willbros Group Inc	Danaos Corp

Author

Cecilia Wagner Ricci, Ph.D.

Professor of Finance, The Feliciano School of Business, Montclair State University, Montclair,
NJ 07043, riccic@montclair.edu