Università degli Studi del Molise

Department of Economics

Doctorate of Research in Public Resource Management and Innovation

Cycle XXXVI

On the Quality of Financial Statements in Municipally Owned Entities: Empirical Evidence from Benford's Law

Disciplinary Scientific Sector: SECS-P/07

Coordinator:

Prof. **Francesca Di Virgilio**

Candidate:

Luca Galati

Student No. 174758

Supervisors:

Prof. **Francesco Caralbo**

Prof. **Claudio Lupi**

Academic Years 2020/2023

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Dedica

Alla cara memoria di mio nonno,
a cui nel bene e nel male sarò sempre legato e riconoscente.

Sinossi

La presente dissertazione è articolata in due saggi che esaminano la problematica della gestione degli utili nelle società a prevalente partecipazione comunale (MOEs). La ricerca fornisce evidenze empiriche su temi di crescente rilevanza per l'informativa finanziaria aziendale, in particolare per gli enti del settore pubblico. Lo fa utilizzando la legge di Benford, un modello matematico raramente utilizzato nella letteratura contabile, per valutare la qualità e l'affidabilità dei dati finanziari. Ciascun saggio si confronta con i risultati divergenti emersi dalle ricerche pregresse, fornendo nuove prospettive e intuizioni utili a ricercatori, professionisti del settore e regolatori interessati a comprendere le dinamiche e gli incentivi alla base della manipolazione dei dati contabili nelle società a prevalente partecipazione comunale.

Il primo saggio esamina l'impatto delle elezioni locali sulla qualità dell'informativa finanziaria negli enti controllati dai comuni, utilizzando un approccio di data science. Applicando la legge di Benford ai rendiconti finanziari pubblicati da enti

partecipati dai comunali italiani, che operano nel settore dei servizi di pubblica utilità, la ricerca rileva anomalie diffuse nei dati contabili durante le stagioni elettorali. Questo non implica necessariamente che l'esistenza di frodi o manipolazioni illecite fosse diffusa in quei periodi, ma implica che (i) i revisori contabili dovrebbero esercitare un'attenzione particolare alla qualità dei dati in tali periodi critici e contesti specifici; e che (ii) gli elettori e i media dovrebbero adottare un approccio critico nell'interpretare gli indicatori di performance finanziaria degli enti di proprietà dei comuni come riflessi dell'efficienza gestionale dei politici in carica. Il saggio amplia la portata delle ricerche precedenti attraverso l'uso di un metodo matematico alternativo e raramente utilizzato, corroborando le evidenze empiriche esistenti con un nuovo approccio teorico.

Il secondo saggio si propone di esaminare come i sistemi di accantonamento proporzionale influenzino la qualità dell'informativa finanziaria negli enti controllati dai governi locali. Si esamina tale questione utilizzando il contesto degli enti a partecipazione comunale italiani a seguito dell'attuazione di una nuova normativa contabile che limita il potere di spesa del comune partecipante quando l'ente posseduto registra perdite. La ricerca applica la legge di Benford sui dati dell'utile netto utilizzando i test Chi-quadrato e Z sulla versione corretta del criterio MAD (Mean Absolute Deviation) per individuare qualsiasi segno di bassa qualità dei dati finanziari. Anomalie dif-

fuse nei dati sono state rilevate in seguito all'introduzione della nuova regolamentazione per le MOEs controllate dai governi locali. L'evidenza è più forte per gli enti partecipati interamente (100%) dai comuni. I risultati suggeriscono che l'entità della manipolazione dei dati cresce all'aumentare della quota di partecipazione del comune nell'ente, in linea con l'ipotesi che una diminuzione del potere di spesa attraverso l'accantonamento di risorse finanziarie influisca sulle pratiche di gestione degli utili negli enti controllati dai comuni. Questo saggio fa luce sulle politiche contabili del governo documentando prove empiriche di risposte alquanto inefficienti da parte di coloro che sono responsabili della preparazione dei bilanci per conto di enti di proprietà comunale e, di conseguenza, vengono forniti approfondimenti per aiutare a rivedere queste politiche in modo da prevenire ricadute anche indirettamente dannose sui servizi pubblici. Questo saggio estende la ricerca precedente sulla gestione degli utili del settore pubblico essendo il primo a verificare se gli enti a prevalente partecipazione comunale manipolano i loro redditi come conseguenza della ridotta capacità di spesa dei comuni partecipanti. Comprendere i fattori che influenzano le pratiche di gestione degli utili guidate dai governi, diversi dagli incentivi politici, rimane una questione aperta.

Abstract

This dissertation consists of two essays examining the issue of earnings management in municipally owned entities (MOEs). The research provides empirical evidence on issues of increasing relevance for corporate financial reporting, especially for public sector entities. It does so by using Benford's Law, a rarely used mathematical model in the accounting literature, to assess data quality and reliability. Each essay addresses mixed results produced by previous research, offering insights for researchers, practitioners, and regulators aiming to comprehend the incentives driving accounting data manipulation in entities controlled by local governments.

The first essay examines the impact of local elections on financial reporting quality in entities controlled by local governments using a data science approach. By applying Benford's Law to financial statements published by Italian municipally owned entities operating in utility industries, the research finds diffuse data anomalies around election seasons. This does not automatically mean that illegal manipulation or

fraud was widespread in those periods, but it implies that (i) auditors need to pay particular attention to the quality of accounting data in those crucial periods and specific environments; and that (ii) voters and media have to be critical in assuming municipally owned entities' indicators of financial performance as proxies of the administrative efficiency of incumbent politicians. This essay extends the sample size, breadth, and depth of prior studies by using an alternative, rarely used mathematical method and corroborates earlier empirical evidence by using a different theoretical reasoning.

The second essay aims to examine how proportional appropriation systems affect the quality of financial reporting in entities controlled by local governments. It examines this issue using the setting of Italian municipally owned entities following the implementation of a new accounting regulation that limits the spending power of the participating municipality when the owned entity reports losses. The research applies Benford's law on net income figures using the Chi-square and Z-tests on the adjusted version of the Mean Absolute Deviation (MAD) criterion to spot any sign of low data quality. The sample, which consists of 2,120 MOEs, covers the years 2010–2019 and is evenly divided into the periods pre- and post-policy introduction. Widespread data anomalies were detected following the introduction of the new regulation for MOEs controlled by local governments. Evidence is stronger for en-

ties owned entirely by municipalities. The results suggest that the extent of data manipulation grows as the municipality's ownership stake increases, consistent with the hypothesis that a decrease in spending power through the appropriation of financial resources affects earnings management practices in municipally controlled entities. This essay sheds light on government-based accounting policies by documenting empirical evidence of somewhat inefficient responses by those responsible for the preparation of financial statements on behalf of municipally owned entities, and, accordingly, insights are provided to help review these policies so as to forestall even indirectly detrimental repercussions on public services. This essay extends prior research in public-sector earnings management by being the first to test whether MOEs manipulate their earnings as a consequence of participating municipalities' reduced spending capability. Understanding factors influencing earnings management practices driven by governments, other than political incentives, is still an open issue.

Acknowledgments

I extend my sincere gratitude to the individuals who have contributed to this journey. While my dedication and perseverance have played a significant role in this achievement, I acknowledge the invaluable support and guidance I have received throughout this journey.

At the University of Molise (UNIMOL), I would like to thank Professor Francesco Capalbo who introduced me to the world of Forensic Accounting and provided continuous support throughout and beyond my candidature. I am grateful for his guidance and for opening up opportunities for my personal and professional development overseas. Professor Claudio Lupi, my co-supervisor at UNIMOL, deserves special mention for his patience and support. His attention to detail and statistical expertise greatly benefited my research, as well as his guidance in R coding. I would also like to acknowledge Professor Alberto Franco Pozzolo from Roma Tre University for his valuable advice and discussions related to research and career development. I thank Professor Michele Modina and

the 110 Laude team, instead, for giving me the opportunity to co-found and run a FinTech startup, the University of Molise spin-off, during my PhD studies.

Several chapters within this dissertation have also been enhanced through valuable feedback provided by Professor Roy Cerqueti, Francesco Mazzi, Massimiliano Bonacchi, Alberto Quagli, Odd J. Stalebrink, Sandra Cohen, and Pierre Donatella.

I am thankful for the stimulating discussions and support from my colleagues and peers at UNIMOL. The list is long, but I would like to mention a few: Dr. Margherita Smarra, Associate Professor Filomena Pietrovito, Emanuele Santangelo, and Associate Professor Giuliano Resce. Your support, insights, and camaraderie have enriched this academic journey and made this achievement possible. I hence thank the University of Molise, which I will always refer to as my *Alma Mater*.

Last, but not least, I must extend my heartfelt gratitude to my wife, Alessandra, for her unwavering support and patience throughout this journey. I solemnly promise her that this will be my last venture of this magnitude. Her strength and encouragement have been my anchor, and for that, I am eternally grateful.

List of Publications

The following papers are included as part of this dissertation, which have been published as joint works in refereed journals and have been presented at several academic conferences.

Chapter 3 has been published as and presented at:

1. Capalbo, F., Galati, L., Lupi, C., and Smarra, M., 2023, 'Local Elections and the Quality of Financial Statements in Municipally Owned Entities: A Benford Analysis', *Chaos, Solitons & Fractals*, vol. 173, 113752. `https://doi.org/10.1016/j.chaos.2023.113752`

    - 2022. AFAANZ Annual Conference: Accounting and Finance Association of Australia and New Zealand, Melbourne, Australia.
    - 2022. 2nd IRSPM Annual General Meeting: International Research Society for Public Management, online workshop.
    - 2021. 11th International Public Sector Conference: Eu-

ropean Institute for Advanced Studies in Management, online conference.

- 2021. 18th Biennial CIGAR Conference: Cooperative International Governmental Accounting Research, online conference.
- 2021. 31st Audit & Assurance Conference: British Accounting & Finance Association, online workshop.
- 2021. 2nd Workshop on Fraud and Accounting Scandals: European Institute for Advanced Studies in Management, online workshop.

Chapter 4 has been published as and presented at:

2. Capalbo, F., Galati, L., Lupi, C., and Smarra, M., 2024, 'Proportional Appropriation Systems and Financial Statement Quality in Municipally Owned Entities: Empirical Evidence from Italy', *Journal of Public Budgeting, Accounting & Financial Management*, ahead-of-print. `https://doi.org/10.1108/JPBAFM-01-2023-0015`

- 2023. VI Accounting Summer Camp: University of Padua, University of Lausanne, & Free University of Bolzano, Padua, Italy.
- 2023. 9th Workshop on Accounting and Regulation: European Institute for Advanced Studies in Manage-

ment & University of Siena, Siena, Italy.

- 2023. Lunch Seminar Series: University of Molise, Campobasso, Italy.
- 2022. Earnings Management in Public Sector, Hybrid and Non-Profit Organisations Conference: University of Gothenburg, online workshop.

Dissertation Style

The format of this PhD dissertation has been chosen as a compilation of essays for several compelling reasons. Nowadays, this format is widely recognised as the norm in contemporary academia due to its potential to provide added value to both the academic institution and the candidate's future career path. It aligns with the changing dynamics of research dissemination and underscores the adaptability of academic institutions to innovative approaches in graduate education.

Moreover, my choice to include these specific papers in the dissertation is not solely due to their individual merits but also because they naturally reflect the research journey I undertook during these years. While these essays represent the core of this dissertation, it is important to acknowledge that I have also made meaningful contributions to other research projects during my candidature, both published and unpublished, which will be presented in my second PhD thesis and in the PhD theses of my fellow colleagues. This also reflects the meticulous choice of the selected essays of this dissertation,

those to which I contributed the most and greatly reflecting my academic journey.

This format not only respects the individual contributions of each research project but also underscores the interplay and synergies that can emerge when disparate fields of study are brought together. In doing so, this dissertation format aims to offer a comprehensive and insightful contribution to the field of accounting and finance, while exemplifying the collaborative and interdisciplinary nature of contemporary academic research. Additionally, it reaches a broader community of scholars, practitioners, and interested readers, maximizing the impact of the research and exemplifying the fundamental goal of advancing knowledge and sharing it with as many people as possible.

Finally, when it comes to the underlying philosophical approach of this dissertation, it can arguably be seen as "positivist" due to the experimental nature of the research presented. However, I do not want to confine myself to any particular philosophical perspective and I would like to have the freedom to explore different areas and follow my inspiration in the future. Hence, I do not belong to any inflexible viewpoint, but I assure consistency in this manuscript. I have also taken an open approach in the use of first- and third-person singular in writing. While I ensure consistency throughout the dissertation, there might be sections where I use both depending on

what is more appropriate. I believe that modern theses should prioritize conveying research objectively, and this can be more easily achieved by using a writing style that provides this flexibility, rather than adhering strictly to old-fashioned writing rules.

Statement of Contributions

In the context of collaborative research efforts reflected in the co-authored papers of this dissertation, I would like to provide a comprehensive statement of contributions to elucidate the specific roles and responsibilities of each co-author:

Paper 1: 'Local Elections and the Quality of Financial Statements in Municipally Owned Entities: A Benford Analysis'

In this paper, I, Luca Galati, played a substantial role in various aspects of the research endeavour, methodology, formal analysis, data curation, investigation, and validation. Additionally, I took the lead in drafting the majority of the manuscript. Professor Francesco Capalbo made significant contributions by shaping the initial idea and contributing to the development of the introduction. Professor Claudio Lupi played a crucial role in formal analysis and visualisation, utilizing statistical software, and contributed significantly to the method section, manuscript revision, and overall quality improvement. Dr. Margherita Smarra's vital contribution was the provision

of essential data, its curation, investigation, and overall quality improvement. This collaborative effort ensured the successful completion of this research paper.

Paper 2: 'Proportional Appropriation Systems and Financial Statement Quality in Municipally Owned Entities: Empirical Evidence from Italy'

In the second paper, my contributions encompassed aspects such as partial conceptualization, methodology, software, formal analysis, data curation, investigation, and visualisation, and I took the lead in drafting the original manuscript, revisions, and edits. Professor Francesco Capalbo contributed to the development of the initial idea and assisted in revising part of the introduction. Professor Claudio Lupi provided valuable guidance by overseeing data cleaning and analysis, and by validating the results. Dr. Margherita Smarra's indispensable role involved providing essential data and overall quality improvement. This collective effort resulted in the successful completion of this article.

These contributions adhere to the established customary roles and responsibilities typically associated with co-authorship in academic research, covering a wide range of responsibilities. Within the disciplines of Accounting, the prevalent convention is to sequence authorship alphabetically, based on the initials of the surnames. The collaborative efforts of the co-authorship teams have been integral to the successful comple-

tion of these journal articles, allowing me to contribute meaningfully to all aspects of the research reported in this dissertation.

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Chapter 1

Introduction

The realm of accounting, specifically financial statement analysis, is a critical frontier for investigating the economic performance and transparency of companies. This dissertation delves into the domain of earnings management within municipally owned entities (MOEs), thereby bridging an imperative gap in accounting research concerning the influence of political and regulatory frameworks on financial reporting quality. This introductory chapter lays down the foundation of the dissertation, elucidates the theoretical underpinnings, and delineates the structure of the ensuing chapters.

Accounting data forms the bedrock of stakeholders' decision-making processes, hence its integrity is of paramount importance. However, the interplay of political and regulatory factors can substantially impact the financial reporting quality, especially in entities that are under local government control.

This dissertation encompasses two rigorous essays, each addressing critical yet distinct facets of earnings management within the realm of municipally owned entities against the backdrop of local electoral dynamics and regulatory appropriation systems. The subsequent sub-sections 1.1 and 1.2 delve into these themes in-depth, introducing the research questions, theoretical frameworks, and methodologies pertinent to each essay. The summary section 1.3 revisits the core premises and outlines the chapter framework of the dissertation.

1.1 Local Elections & Earnings Quality

The nexus between local electoral cycles and financial reporting quality in MOEs forms the crux of the first essay titled "Local Elections and the Quality of Financial Statements in Municipally Owned Entities: A Benford Analysis." This inquiry is predicated on the theoretical postulation that electoral incentives may drive incumbent politicians to influence financial reporting practices within MOEs to cast a favourable light on their governance acumen. Benford's Law, a robust data science tool traditionally employed in auditing and fraud detection, serves as the methodological linchpin for this essay. This analysis traverses a ten-year spectrum (2010-2019) within the Italian utility sector, targeting MOEs that are essentially involved in the provision of critical public utilities. The essay hypothesizes a positive association between accounting manipulations

in MOEs and impending local elections, with the empirical evidence shedding light on the manifestation of misleading financial reports, particularly in pre-electoral seasons.

1.2 Appropriation Systems & Earnings Quality

The second essay, titled "Proportional Appropriation System and Financial Statement Quality in Municipally Owned Entities: Empirical Evidence from Italy," broadens the earnings management discourse by exploring the repercussions of a novel regulatory framework on financial statement quality in MOEs. This regulatory framework, instantiated in 2016, intertwines the financial outcomes of MOEs with the budgeting capability (or spending power) of the controlling local governments, thereby potentially altering the incentives for earnings management. Employing a blend of Burgstahler and Dichev's (1997) approach alongside Benford's Law, this essay traverses a decade-long sample period of MOEs operating in all industries, bifurcated into pre and post-regulatory periods. The analysis provides empirical evidence of a significant degradation in financial statement quality post the regulatory shift, especially in MOEs where local governments hold substantial ownership stakes, hence underscoring the pivotal role of regulatory frameworks in shaping earnings management practices.

1.3 Summary

This introductory chapter has set the stage for an in-depth examination of earnings management within municipally owned entities, a subject of burgeoning relevance amidst evolving political and regulatory landscapes. The subsequent chapters will delve into a meticulous review of pertinent literature in Chapter 2, unravel the methodologies and empirical investigations germane to each essay, provide the first and second essay in Chapter 3 and 4 respectively, and finally converge on a discussion and conclusion that encapsulates the findings, implications, and avenues for future research. This dissertation, through its empirical scrutiny, aims to enrich the understanding of financial reporting quality in MOEs, offering invaluable insights to researchers, practitioners, and policymakers navigating the intricate interplay of political, regulatory, and accounting realms.

Chapter 2

Review of the Related Literature

This chapter provides an overview of the literature related to the background of the research and its methodology. First, Section 2.1 introduces the broader topic and the specific literature dealing with it in the context of public sector accounting. Second, Section 2.2 reviews the main theoretical cornerstones on which research hypotheses are drawn, specifically for each of the two essays in Section 2.2.1 and 2.2.2, respectively. Later, Section 2.3 highlights the different mainstream approaches used in the literature to empirically measure earnings management activities. The chapter concludes with a comprehensive background on the non-mainstream analytical procedure used in this dissertation: Benford's law.

2.1 Earnings Management in Public Sector

One of the issues of greatest concern in accounting literature is certainly the all-too-common practice of earnings management. Earnings management is generally referred to as the use of accounting discretion to intentionally influence the reported level of earnings (underlying economic performance) to meet specific financial objectives and obtain some private gain by misleading certain stakeholders or influencing contractual outcomes (Healy and Wahlen, 1999, Shipper, 1989). While this has been exhaustively investigated in privately-owned companies, a comprehensive literature review (Bisogno and Donatella, 2021) suggests that, more recently, this topic has become increasingly relevant within the public sector.[1]

A small but rich body of literature has examined the existence of earnings management practices in the context of public sector accounting; this includes studies investigating national governments (von Hagen and Wolff, 2006), sub-national governments (Clémenceau and Soguel, 2017), local governments (Beck, 2018, Cohen et al., 2019, Cohen and Malkogianni, 2021, Ferreira et al., 2013, Stalebrink, 2007), healthcare and non-profit organisations (Anagnostopoulou and Stavropoulou, 2021, Nguyen

[1] Instead of reviewing the same literature, this section provides the context for the research and opens to the theoretical background used to develop the hypotheses. For more information about the studies on earnings management in the public sector, see Bisogno and Donatella (2021).

and Soobaroyen, 2019); hybrid entities (Capalbo et al., 2021, 2023, Ruggiero et al., 2022), and the difference between private and state-owned enterprises (Capalbo et al., 2014, Ding et al., 2007, Wang and Yung, 2011). These studies all document, albeit to varying degrees, that earnings management is also a common practice in public sector entities, hybrid, and non-profit organisations.

Given that earnings management practices in those entities represent a serious threat to transparency in the public sector, it is important to advance our understanding to bear on this issue. This, however, cannot be done without grounding on a solid theoretical foundation or, said by Massaro et al. (2016) words, "on the shoulders of giants". I, therefore, present a theoretical background to my research in the next section on which I base the development of the research hypotheses.

2.2 Theory and Hypotheses Development

2.2.1 Local Elections & Earnings Quality

In the first essay, it is inferred that there is a direct positive relationship between elections and earnings management activities in MOEs. The hypothesis that incumbent politicians might employ accounting information for self-beneficial purposes, particularly in influencing public perception of their governance abilities, is a widely accepted notion. This concept

draws upon Lukes (2005) one-dimensional view of power as authority, distinguishing between vertical and horizontal forms of fraud. Cooper et al. (2013) note that higher-ranking individuals can enforce their will on subordinates, who often comply regardless of the legality or ethics of the commands, a phenomenon echoed in the study by Milgram (1965) on obedience. Additionally, the two-dimensional power perspective of Lukes (2005) is instrumental in understanding the role of resource control in shaping organizational dynamics. Mechanic (1962) suggests that control over resources like personnel, information, and tools enhances an individual's power, a view supported by Pfeffer and Salancik (1978) assertion that resources gain added value when they mitigate uncertainty. Hence, subordinates often adhere to unethical directives not only due to the formal power of their superiors but also because of their dependency on resources (Palmer, 2012). In the context of Italian MOEs, while directors are not direct subordinates of politicians, the latter wield significant influence through both formal authority and control over resources. This control manifests in several ways: firstly, in their ability to allocate abundant or limited resources to these entities; secondly, through the power to alter regulations that significantly affect MOEs; and thirdly, in their capacity to decide on managerial appointments, given that a manager's tenure often expires before the term of a newly-elected mayor.

The attraction of public attention to the performance of MOEs is elucidated through Public Choice Theory (PCT). PCT posits that voters generally favor capable politicians, yet often lack comprehensive information about their competence. Consequently, they rely on recent economic indicators as proxies for political adeptness (Rogoff, 1990). This concept is reinforced by literature suggesting that favorable financial results from public entities are commonly perceived as indicators of incumbent politicians' effectiveness and efficiency (Chen et al., 2008), influencing voter perceptions, particularly during periods leading up to elections (Besley and Case, 1995, Brender and Drazen, 2005). This is substantiated by findings that voters actively seek out such financial information online during pre-election times (Drago et al., 2014, Repetto, 2018).

Aligned with PCT, which holds that politicians primarily craft policies to secure votes (Arrow, 1951, Buchanan and Tullock, 1965, Downs, 1957, Black et al., 1998), there is an incentive for pre-electoral economic data manipulation to bolster perceptions of their fiscal acumen. Research indicates that politicians employ various strategies to enhance their electoral prospects, including influencing the management of state-owned entities to yield favorable financial outcomes. This manipulation extends to macro-economic variables like inflation and unemployment rates (Nordhaus, 1975, Rogoff, 1990), and budgetary elements such as taxes and public investments. Par-

ticularly at sub-national levels, there is documented evidence of pre-electoral budget manipulation, establishing a direct link between fiscal reporting and re-election odds (Alesina et al., 1997, Persson and Tabellini, 2003, Akhmedov and Zhuravskaya, 2004, Brender and Drazen, 2005, Shi and Svensson, 2006). These findings resonate with the viewpoint that public sector accounting serves as a medium to reflect the economic impact of incumbents' policy decisions (Ingram and Copeland, 1981) and that financial reporting plays a crucial role in aiding stakeholders in assessing government operational results (Brusca and Montesinos, 2006).

State-owned entities (SOEs), and their subsidiaries, MOEs, which are significantly controlled by State, regional governments, or cities, typically administer public services (Kowalski et al., 2013). These entities are often viewed as direct representations of the efficiency and effectiveness of the controlling public administration. Given this perception, it is plausible to hypothesize that politicians anticipate that voters will evaluate their governance based partly on the performance of these MOEs. In this context, incumbent politicians may be motivated to exercise their influence over MOEs' managers, utilizing accounting discretion to present financial outcomes that favorably reflect on themselves and potentially increase the success chances of their political party (Boycko et al., 1996, Stalebrink, 2007, Gaffikin, 2005, Ferreira et al., 2013). This strate-

gic manipulation of financial information in MOEs can thus be seen as a tool for enhancing political reputation and electoral prospects.

While the general public typically focuses more on the quality of services provided by MOEs rather than their financial outcomes, the short-term capacity of incumbent politicians to alter public perception of this quality is somewhat limited. However, they are often able to mitigate the negative media attention that could arise from reports indicating financial mismanagement or underperformance within these entities (Brender and Drazen, 2005). Such negative publicity could potentially be exploited by the political opposition as leverage (Luke, 2010).

Support for these observations is found in existing literature. For instance, in China, Chen et al. (2008) observed that obtaining an IPO quota is often seen as a testament to a politician's influence and competence, whereas being delisted can significantly tarnish a politician's reputation. Similarly, in New Zealand, Luke (2010) identified a perception among CEOs of SOEs that any form of business underperformance or potential failure could be capitalized upon by opposing political factions. These examples underscore the political implications associated with the financial and operational performance of MOEs and their potential use in political strategies.

Additional factors motivating politicians to prevent the

disclosure of financial losses in MOEs' statements relate to the specific nature of the sectors these entities serve. SOEs, and particularly MOEs, are commonly engaged in delivering crucial public services like transportation, waste management, and water supply. The uninterrupted continuation of these services is essential. Hence, a string of adverse financial outcomes often necessitates the infusion of additional capital from the controlling authority to maintain operational viability. As a result, such negative financial disclosures are typically linked with impending reductions in available funds for the governing body, which might otherwise be allocated to other public interest areas. This potential financial strain can be a significant concern for politicians, who may be motivated to manage financial reporting in MOEs to avoid or minimize these challenges.

However, on the other hand, it is also plausible to expect instances of accounting manipulation in MOEs' financial data even in scenarios where incumbent politicians either lack the desire or the means to exert direct pressure on MOE directors to tailor accounting outcomes. According to a line of thought rooted in Positive Accounting Theory, managers in the public sector may engage in earnings management to mitigate the political repercussions arising from politicians' decisions influenced by financial statement outcomes (Watts and Zimmerman, 1986, 1978, 1990, Jones, 1991, Zimmerman, 1979, Han and

Wang, 1998). Recent studies, such as Ramanna and Roychowdhury (2010), provide evidence that politically connected entities are more likely to undertake earnings management, particularly to mask the advantageous impacts of actions like job outsourcing on their financial statements. This practice helps shield both the entities and their politically affiliated individuals from potential criticism related to outsourcing.

Moreover, the growing accessibility of accrual-based financial data in the public sector has made it easier to scrutinize the opportunistic use of accounting information in these entities. Ferreira et al. (2013) found that Portuguese Municipalities strategically manage their earnings, especially during pre-election periods, to portray a facade of high competence and efficiency. Similarly, Stalebrink (2007) investigated earnings management in Swedish local authorities, finding that financial information prepared on an accrual basis is often manipulated. These findings align with the predictions of Positive Accounting Theory, suggesting that managers might adjust reported outcomes to sidestep political costs linked to elected officials' decisions based on these financial results, with such costs potentially intensifying around election times. Consequently, even in the absence of direct political pressure, MOEs' executives might still engage in the manipulation of accounting data during pre-electoral periods, and this tendency could be observed across various industries, not limited to utilities.

Integrating insights from Public Choice Theory and power dynamics, this dissertation posits that the convergence of authority over others and the inclination towards unethical actions can foster an environment conducive to self-serving use of accounting information. This is supported by the notion that the exertion of power by higher-ups over their subordinates (or lower-level employees), combined with their own political motivations, significantly heightens the propensity for such unethical conduct. This suggests that the persistence of earnings management activities in MOEs is primarily driven by these two interrelated factors. The absence of either the power dynamic or the inclination to engage in earnings management typically weakens the likelihood of such malpractices occurring. This brings us to the following predictions to be tested:

Hypothesis 1. *The relationship between accounting data quality of MOEs' published financial statements and electoral seasons in the municipality owning the majority of the entities' share is downward sloping;*

Hypothesis 2. *The quality of MOEs' published financial statements deteriorates further in proximity to local elections for entities in which the municipality owns an increasing number of the entities' shares;*

Hypothesis 3. *Hypotheses 1 and 2 hold when empirically tested against the financial statement sample of non-electoral (tranquil) periods.*

In the context of elections, incumbent politicians may use their influence over MOEs' executives to prompt misstated financial reporting that aligns with their political goals. Conversely, managers within these entities might also participate in such deception to avoid the political ramifications that could arise from their financial disclosures. This raises an intriguing question: do both parties, politicians and MOEs' managers, mutually and knowingly engage in these deceptive practices for their respective benefits? Although this hypothesis presents a compelling area for exploration, it remains an open question and a potential direction for future research. The complexity of these interactions and the underlying motivations warrant further investigation to fully understand the dynamics at play in the occurrence of pre-electoral accounting data manipulation within MOEs.

2.2.2 Appropriation Systems & Earnings Quality

In the second essay, it is inferred that there is a direct positive relationship between politicians' spending power and earnings management activities in MOEs. The other theoretical cornerstone on which research in this area is based is the Positive Accounting Theory (PAT). The PAT paradigm, first introduced by Watts and Zimmerman (1986), posits that individuals and organisations choose accounting practices that align with their self-interest. Studies on earnings management using PAT have

shown that managers are more likely to engage in self-serving use of accounting information when they have greater discretion over accounting choices, for example, where audits are of lower quality (Becker et al., 1998) or there are rather vague accounting standards (Ewert and Wagenhofer, 2005). More importantly, previous research has found that managers are more likely to engage in earnings management when they are facing pressure to meet certain targets, such as those set by analysts or associated with stock prices (Abarbanell and Lehavy, 2003, Degeorge et al., 1999). Overall, the theory highlights the importance of considering the views and the incentives driving managers who are willing to engage in data manipulation to achieve their own goals.

In the context of entities owned by the State or local authorities, PAT suggests that managers of these entities may use accounting discretion to present a healthier financial picture to meet their own goals or to align with the goals of the government authorities.

Perhaps, however, the cornerstone that brings the theoretical framework in earnings management literature together is based on the well-known agency theory. In private companies, for example, corporate governance watches out for the potential misalignment that can arise in the agency relationship between the owners, who are intent on maximising profit and the company managers (Shleifer and Vishny, 1997). In SOEs,

though, the two actors serve a variety of additional purposes, including those related to matters of general public interest, such as ensuring services accessible to the whole community. The ultimate owner of a public entity - the community - exercises its prerogatives by delegating powers to other parties (politicians and bureaucrats); this leads to additional agency issues - between voters and politicians and between politicians and managers - compared to those that typically affect private companies (Mocetti and Roma, 2021). In this scenario, personal interests play a key role to the extent that any behaviour can be influenced by asymmetric information. Looking at the relationship between voters and politicians, and assuming that the latter pursues a private goal, the literature argues that the presence of asymmetric information between voters and elected representatives may favour the improper use of SOEs, with negative repercussions on their management (Boycko et al., 1996, Shapiro and Willig, 1991, Vickers and Yarrow, 1991). Furthermore, the distorted use of SOEs can also be facilitated by the convergence of (private) interests of politicians and administrators who enter into mutually beneficial agreements at the expense of the public interest and efficiency in the management of SOEs (Boycko et al., 1996, Shleifer and Vishny, 1994).[2]

Building on Positive Accounting Theory and Agency The-

[2]Such outcomes are more likely to occur in situations where corruption is tolerated to a greater extent.

ory, I thus conjecture that, *ceteris paribus*, both the managers of MOEs and the municipalities' incumbent officials are utility maximizers willing to exercise discretion about accounting figures to meet their personal goals, which will very probably be aligned. I assume in this essay that the question of whether local government officials promote the use of discretion by their MOEs to present a healthier financial picture will very much depend on the incentives arising from the shared goals of both incumbent politicians and managers.

The use of the accounting theories on which I draw my conjectures creates a connection between local government and MOE management, thus opening a gateway for earnings management. This close link is usually two-fold: (1) local governments provide MOEs with the financial resources they need in order to operate; (2) MOEs' managers are generally appointed by the incumbent politicians of the municipalities owning a majority share in the entity. As argued by Capalbo (2016), this is particularly true concerning the specific case of Italian MOEs. Firstly, the municipality that owns the entity is, in most cases, not just the majority shareholder but also the principal client providing a substantial part of the entity's revenue through a service contract, so any of its decisions can have a significant impact on the single MOE's financial position. Furthermore, given the labour-intensive nature of their operations, Italian MOEs' performance is perceived as a proxy for

the risk of job cuts, which in turn increases their political sensitivity and thus the political costs for MOEs' executives. Many MOE directors have a political background, so they have a direct interest in politics and are therefore extremely sensitive to the decisions made by politicians. A further important point concerns the mayor, who officially has the authority to appoint and remove the directors of MOEs during his or her term of office, and in Italy, this authority may be exercised with a very high degree of discretion when the municipality owns more than half of the entity's total shares. The local mayor, a politician elected by the citizens, has a five-year mandate which is longer than that of the directors—three years—so the latter's term is likely to expire before a new mayor is elected.

Previous research also theorises that governments may manipulate accounts to present a healthier financial picture during election years, especially when they have strict budget restrictions, giving them a stronger incentive to use a certain discretion about accounting figures (Kido et al., 2012). Thanks to their spending power, municipalities provide MOEs with the financial resources they need in order to operate; any restriction in the budget capability of municipalities would consequently limit the resources available for these same MOEs. If this restriction is caused by the performance of MOEs, then both will see their resources being diminished. Therefore, in my empirical analysis, I want to test the following prediction.

Hypothesis 4. *Earnings management in MOEs is positively associated with the introduction of strict budget regulations for the participating local governments.*

The intuition that follows from this is that the greater the restriction of spending power for municipalities, the greater the incentive for incumbent local government officials to get MOE managers to present evidence of healthier financial performance to avoid being forced to allocate the resources necessary to make up for the entity's losses. Simultaneously, the greater the restriction of spending power for municipalities, the greater the incentives for MOE managers to engage in earnings management so as to avoid creating a cycle where their negative income (which deteriorates their finances) in turn limits the financial resources the municipality can provide to MOEs, which then leads to even weaker financial results. If I also take the size of the municipality's stake in the entity into consideration, I can state that the more shares owned by the municipality, the greater the impact of the MOE's losses on the municipality's spending power, and the greater the incentive for both managers and officials to get MOEs to present a healthier financial picture. This ultimately brings me to the second prediction I want to test empirically.

Hypothesis 5. *Earnings management in MOEs' published financial statements increases as the proportional appropriation of financial resources for municipalities increases, which in turn is a function*

of the ownership quota the municipality holds in the entity.

2.3 How to Measure Earnings Management?

In accounting research, significant efforts have been made to devise methods for assessing data quality in financial statements. As Capalbo (2016) reminds, three main strategies have emerged from this exploration. The initial strategy involves gauging market reactions to the disclosure of financial outcomes, utilizing specially designed earnings response coefficients (ERC) (Ball and Brown, 1968, Beaver, 1968, Holthausen and Verrecchia, 1990, Liu and Thomas, 2000). These coefficients have further been applied in evaluating the effectiveness of distinct accounting practices (Loudder and Behn, 1995, Altamuro et al., 2005) as well as in auditing and governance systems (Teoh and Wong, 1993, Francis and Ke, 2006).

A second methodology emphasizes assessing data quality by monitoring external misstatement signals, such as auditor dissent, regulatory body interventions, internal audit complaints, and other accounting compliance breaches (Dechow et al., 1996, Beneish, 1999). These signs are particularly useful for directly pinpointing potential deficiencies in financial reports, based on autonomous evaluations, though they are also subject to the limitations inherent in control quality and the selection process for the examined entities (Dechow et al., 2010).

The third method involves analyzing specific aspects of earnings, including the consistency of dividends, promptness in loss acknowledgment, unusually large subjective elements, and actions aimed at meeting or circumventing specific accounting benchmarks. These features generally suggest the likelihood of strategic discretion in financial statement preparation, a concept commonly known as earnings management (Dechow et al., 2010).

By reviewing this literature, Capalbo (2016) argues that the third methodology is predominantly adopted for assessing the quality of financial outcomes in state-owned entities. Therefore, this section will provide a brief overview of this third method and then review, in the next section, the literature concerning the use of a mathematical model not yet extensively adopted in public sector research to provide a background for the methodology used in this dissertation.

2.3.1 Mainstream Approaches

As highlighted by Capalbo (2016), academic research has advanced numerous approaches for evaluating the manipulation of earnings. Healy (1985) pioneering approach in 1985 marked a significant development in this area. He suggests assessing the variance between the operating cash flow, as generated by the existing management, and the financial results of that period. This approach aids in identifying 'total accruals,' a con-

cept central to accrual accounting. These accruals, which are often at the discretion of management, reflect in the financial statements various events that do not cause immediate cash flow changes, such as depreciation, provisions, and revaluations. Notably, when operating cash flow is confined to variations in cash and equivalents, the calculated total accruals include changes in working capital that impact earnings but not cash flow, like variations in receivables, as noted by Healy (1985). Additionally, it's important to acknowledge that not all accruals stem from managerial discretion. Companies adhering to accrual accounting routinely record various accruals in adherence to standard accounting practices, not necessarily as part of earnings manipulation. Hence, distinguishing between discretionary and non-discretionary accruals within total accruals is crucial. This differentiation helps isolate those accruals that are abnormal or indicative of intentional alteration, as identified by Peasnell et al. (2000).

Initial strides in this field were made by DeAngelo (1986), who delineated the non-discretionary segment of accruals by analyzing their pattern in the lead-up to management buy-out events. This groundwork laid by DeAngelo (1986) was further developed by Jones (1991), who formulated a model to segregate abnormal accruals from the total accruals. Jones (1991) model utilized linear regressions, comparing the trajectory of accruals against revenue trends and fixed assets of a

company. The rationale is that by measuring these two variables, it becomes possible to ascertain the typical level of accruals, thereby identifying any abnormal, and presumably discretionary, accruals as indicators of earnings management. As Capalbo (2016) argue, it is important to highlight that this model focuses on the absolute value of these abnormal accruals, irrespective of their positive or negative nature, leading to the common reference to these as unsigned discretionary accruals. This is also discussed in studies by Warfield et al. (1995), Klein (2002), and Bergstresser and Philippon (2006). Further refinement of this model was introduced by Dechow et al. (1995), who incorporated adjustments to better align the revenue trends, taking into account the variations in receivables.

Several researchers have suggested alternative methods for assessing earnings management, focusing on specific balance sheet items. McNichols and Wilson (1988), in their 1988 study, concentrated on tracking the pattern of write-downs in receivables and identifying the abnormal variations therein. Similarly, Beatty et al. (2002) examined the provisions for technical reserves related to claims and damages, isolating unusual fluctuations. On a different note, Stubben (2010), advocated for examining the correlation between revenue trends and the movement of receivables. His approach aims to discern the portion of receivables that may be deemed discretionary or unexpectedly high, termed discretionary or unexpected receiv-

ables. This method offers a unique perspective on identifying and quantifying the elements of earnings management.

As Capalbo (2016) points out, these methodologies discussed thus far revolve around identifying specific alterations potentially orchestrated by management to alter annual financial results. However, these methods may not be effective if management employs tactics not anticipated by the model. According to Capalbo (2016), in cases of real-based earnings management, where the manipulation is achieved not by directly adjusting discretionary balance sheet items, but through structuring operations so their accurate accounting leads to the desired outcomes, these models fall short. Examples include opting for leasing over deferred purchases to minimize balance sheet debt, as highlighted by Healy and Wahlen (1999), or the strategic timing of maintenance, research, and development expenses, as discussed by Osma (2008). These strategies are designed to artificially inflate or deflate earnings in a specific year compared to others. Additionally, maneuvers like selling off assets to avoid consolidation or timing the sale of fixed assets to realize capital gains or losses in a particular year, further illustrate the limitations of traditional earnings management detection methods.

Alternative methodologies exist for detecting earnings management, focusing on frequency analysis to spot abnormal trends associated with specific events or objectives, such as the avoid-

ance of negative financial results. A prominent example is the model by Burgstahler and Dichev (1997), which is indeed used in the second essay of this dissertation. They analyze the income statement results of 4,436 companies over 19 years and observed a significantly higher incidence of results just above zero compared to those just below. This pattern led them to suggest that such a distribution might indicate a strategic use of managerial discretion to avoid reporting negative outcomes.

Further reinforcing this approach, other researchers have explored the relationship between specific financial indicators and benchmark values to infer earnings management activities. For instance, Degeorge et al. (1999) scrutinize the trends of actual quarterly EPS against analyst predictions, uncovering evidence of earnings management aimed at aligning with these forecasts. Similarly, Chen et al. (2008) identify earnings management practices in Chinese listed companies by observing how the Return on Equity (ROE) frequently aligns with the thresholds required by local regulations for specific transactions.

According to Capalbo (2016), these studies shift the focus from identifying the mechanisms of earnings management to understanding its effects. This change in perspective highlights the complexity of detecting and regulating earnings management, as it underscores the need for a broader approach

that goes beyond mere compliance and regulatory measures, delving into the subtleties of financial reporting and managerial discretion.

2.3.2 Non-Standard Approaches

As outlined in the previous section, a significant amount of research has focused on detecting earnings management by estimating normal accruals that are not publicly observable (e.g., Jones, 1991, Dechow et al., 1995). However, in the past three decades, there has been a notable shift towards examining the distribution of accounting numbers to evaluate managerial influence on reported earnings. Two parallel streams of research have emerged to address the potential noise in accruals estimation. One approach examines financial statement digit patterns to investigate managers' incentives in avoiding losses, earnings declines, or falling short of market expectations (e.g., Das and Zhang, 2003). The other approach considers the valuation (Carslaw, 1988) and contracting incentives (Thomas, 1989) perspectives, assuming that managers engage in rounding up behaviour when reported earnings are slightly below key cognitive reference points.

However, this body of literature examining 'cosmetic earnings management' with the use of Benford's (1938) law focuses mostly on privately-owned listed firms. This includes studies examining listed companies in New Zealand (Carslaw, 1988),

the USA (Thomas, 1989, Guan et al., 2006), the UK (Van Caneghem, 2002, 2004), Finland (Niskanen and Keloharju, 2000), Japan (Skousen et al., 2004), Taiwan (Lin and Wu, 2014), Korea (Lacina et al., 2018), Romania (Istrate, 2019), Germany (Lebert et al., 2021), and even in 18 different countries (Kinnunen and Koskela, 2003). Both streams, therefore, utilize the so-called Benford's law to spot any sign of low data quality in financial statement numbers. This will thus be the main approach used in the two essays of this dissertation, contributing to the literature in public sector accounting research.

In light of our objective to ascertain whether a form of earnings management was employed by politicians and managers of MOEs to amend adverse financial outcomes and avert losses, I have also opted for a conventional methodology as an initial analytical step. This approach serves as the foundation for probing Hypotheses 4 and 5 of the second essay in Chapter 4. This mainstream methodology, grounded in established academic frameworks (i.e., Burgstahler and Dichev, 1997), is instrumental in dissecting the financial maneuvers that potentially mask the true economic performance of these entities. By dissecting the financial statements of MOEs, the research aims to uncover whether there has been a strategic manipulation of accounting figures, particularly in instances where there is a motivation to present a more favorable financial position. This investigation into earnings management practices is pivotal in

understanding the dynamics between political oversight and financial reporting in public entities. The analysis, therefore, hinges on the premise that if earnings management is prevalent, it would likely manifest in the financial adjustments made to circumvent reporting losses, thereby casting a different light on the financial health of these entities. The utilization of this mainstream approach is not only methodologically sound but also aligns with the broader academic discourse on earnings management, providing a robust framework for the investigation together with the non-mainstream Benford approach.

2.4 Accounting Research on the Use of Benford's Law

2.4.1 Benford's Law: A Background

"People always find the law to be interesting because we like learning secrets and the fact that there is some underlying order to what seems like chaos is like discovering a secret code" (Nigrini, 2012, p. 313).

The concept of the first significant digit in a number, defined as the foremost digit that is not zero, demonstrates a unique distribution pattern in real-world data. Contrary to the intuitive assumption that each digit from 1 to 9 would appear as the first significant digit with equal probability (11.11%),

these digits actually show varying frequencies in naturally occurring numbers. This phenomenon was first noted by Simon Newcomb, a Scottish astronomer and mathematician, in 1881. Newcomb observed an uneven distribution of the first significant digits in natural numbers, challenging the prevailing notion of their uniform occurrence.

However, it was not until 57 years later that this observation gained widespread recognition and was formalized into a law, now known as Benford's Law, named after Frank Benford, an American electrical engineer and physicist. Benford's 1938 study expanded on Newcomb's initial discovery, providing substantial empirical evidence to support this non-intuitive distribution of first significant digits in a variety of real-world datasets. This law reveals an intriguing and counterintuitive aspect of numerical data, highlighting that the natural occurrence of numbers follows a distinct pattern that deviates from what might be expected based on equal probability distribution.

In 1881, Newcomb (pp. 39-40) initiated a line of inquiry into the frequency of occurrence of digits as the first in natural numbers. This curiosity was sparked by an observation he made during his daily activities, where he noticed a peculiar pattern: certain digits appeared more frequently as the first digit in naturally occurring numbers. This observation led Newcomb to delve deeper into the distribution of first digits,

marking the beginning of a line of inquiry that would eventually lead to the development of what is now known as Benford's Law. His initial observations and subsequent research laid the groundwork for a deeper understanding of numerical distributions in natural datasets, challenging the conventional wisdom of the time and opening a new field of study in the realm of statistics and number theory.

It is important to distinguish the mantissa, the fractional part of a logarithm, from the concept of leading digits. Unlike leading digits, the occurrence of mantissa values follows a uniform distribution. Newcomb, in his seminal 1881 paper, not only identified the peculiar behavior of leading digits but also tabulated the probability distribution of the first two significant digits. This work, groundbreaking for its time, laid the foundation for numerous applications across various fields such as statistics, economics, physics, medicine, engineering, computer science analytics, and notably, forensic accounting, although Newcomb might not had fully envisioned the extensive future implications of his discovery.

Frank Benford, in 1938, significantly advanced this concept by providing empirical evidence supporting the anomaly in the distribution of the first significant digit, often referred to as the 'anomalous number' law. Benford's research was spurred by Newcomb's observation of the wear patterns in logarithmic tables, indicative of non-uniform usage of num-

bers. Benford compiled an extensive and diverse dataset from 20 varied sources, including figures related to river lengths, mathematical operations such as $n-1$, $\sqrt{n}$, and $n!$, as well as real-world data like newspaper items, mortality rates, and population statistics. This dataset, encompassing about 20,000 first digits, enabled Benford to calculate the mean occurrence probabilities of each digit as the first significant number. He did this by deriving the expected frequency of these digits from a probability function within the framework of logarithmic relationships. His findings not only corroborated Newcomb's initial observations but also greatly expanded the understanding of this phenomenon, setting the stage for its broader application in the analysis of numerical data.

In summary, Benford's Law represents a mathematical phenomenon with significant practical applications, particularly in identifying irregularities in numerical data. It has become an invaluable tool in detecting white-collar crimes, especially in cases involving manipulated financial statements. The law operates by analyzing digit patterns to identify anomalies that deviate from expected distributions. Forensic accountants, auditors, and legal authorities tasked with maintaining the integrity of financial records have found Benford's Law to be a potent instrument in their toolkit. It aids in revealing inconsistencies that might indicate processing errors, intentional biases in data reporting, or potential fraudulent activities. The effec-

tiveness of Benford's Law in various forensic accounting and auditing scenarios underscores its importance in the realm of financial analysis and crime detection.

2.4.2 Forensic Accounting Applications of Benford's Law

The initial application of Benford's Law within the field of accounting is credited to Carslaw (1988), who introduced an innovative hypothesis centered on human psychological behavior in number processing. Carslaw postulated that individuals, particularly accountants and managers, might exhibit a propensity to round numbers up or down to the nearest significant figure, a tendency stemming from the pressures of meeting specific performance benchmarks. He argued that the driving force behind this behavior is the allure of additional rewards that come from surpassing established performance goals.

In the accounting context, Carslaw observed that those responsible for interpreting financial statements and setting budgets often round figures upwards to meet or exceed these key performance indicators. To empirically test his hypothesis, Carslaw analyzed data from 220 major companies listed on the New Zealand Stock Exchange. His study focused on the distribution of the second digit to the left in their reported ordinary and net income figures. The results of his analysis uncovered an atypical distribution pattern of these second digits, notably a reduced frequency of the digit 9 and an increased occurrence

of 0. This pattern aligned with his hypothesis, indicating a tendency among individuals to adjust income figures slightly above psychological benchmarks. Carslaw's findings not only provided empirical support for his hypothesis but also opened the door for further exploration into the psychological aspects of financial reporting and the practical applications of Benford's Law in accounting and financial analysis.

Following the trail blazed by Carslaw (1988), Thomas (1989) conducted a pivotal study a year later, which identified analogous irregular patterns in the net income data and earnings per share (EPS) figures for companies listed on U.S. stock exchanges. Thomas's research posited that the behavior of those interpreting financial statements is significantly influenced by incentive structures linked to a company's stock price performance. He suggested that even slight upward adjustments in earnings reports could disproportionately enhance a company's stock price and market valuation, which, in turn, could have a notable impact on managerial compensation and contract outcomes.

Building upon Carslaw's groundwork, Thomas (1989) expanded the scope of the investigation to include managerial contracts, budgeting practices, and compensation structures. His findings revealed a frequent rounding of income figures to whole numbers within these domains. Thomas provided compelling empirical evidence showcasing a prevalence of second-

digit 0s in reported positive earnings and an abundance of second-digit 9s in negative earnings. Additionally, he observed a significant occurrence of EPS figures ending in 5s and 0s. These patterns substantiate the hypothesis that management personnel often resort to rounding income figures due to the influence these numbers exert on stock prices, which subsequently impact their personal compensation and contractual terms. Thomas's study thus reinforced the idea that manipulative rounding practices in financial reporting are not merely random occurrences but are often driven by underlying economic incentives and personal gains, adding another dimension to the understanding of earnings management and financial statement interpretation.

The utility of Benford's Law in accounting was further endorsed by the work of Christian and Gupta in 1993. Their research delved into cross-sectional data, uncovering a pattern of secondary tax evasion among U.S. taxpayers. This form of evasion was characterized by taxpayers strategically lowering their reported incomes to just below the thresholds set by the government, which were originally intended to clarify tax calculations rather than aid in tax avoidance. Through regression analysis, Christian and Gupta linked this behavior to various tax policy variables, demonstrating its consistent occurrence across different income brackets over time.

In the same year, Nigrini (1993) made a substantial con-

tribution to the application of Benford's Law in the realm of forensic accounting and the analysis of accounting data sets. Building upon his pioneering work in 1992, Nigrini devised a novel methodology for evaluating taxpayer compliance, offering a practical tool for revenue agencies. His approach involved utilizing Benford's Law to identify discrepancies and irregularities in reported financial data, a technique that has since become a cornerstone in forensic accounting practices. Nigrini's work was instrumental in establishing Benford's Law as a formidable resource in the detection of financial anomalies, paving the way for its widespread adoption in financial audits and investigations.

Nigrini's 1996 research stands out as a landmark study applying Benford's Law within forensic accounting, particularly in the context of detecting tax evasion fraud. In this study, Nigrini utilized a large dataset for analysis, the first of its kind in this area, and developed a goodness-of-fit test based on Benford's Law. His approach differentiated between deliberate and accidental tax evasion, incorporating a distortion factor to analyze the distribution patterns of digits in the data. This methodology enabled him to determine whether tax returns had been adjusted upwards or downwards.

One of the key findings of Nigrini's study was the notable prevalence of lower digits in reported amounts of interest received, implying an understatement of these figures. Con-

versely, he observed a higher frequency of larger digits in declared interest paid, indicating an overstatement. These patterns led to the inference that individuals with lower incomes in the U.S. were more likely to overtly manipulate their taxable incomes. In contrast, those with higher incomes might resort to more complex and subtle methods to obscure tax evasion activities. Nigrini's research, thus, provided significant insights into the behavioral patterns of different income groups concerning tax reporting and highlighted the efficacy of Benford's Law as a tool for uncovering irregularities in financial data.

In 1997, Nigrini and Mittermaier expanded the application of Benford's Law into the realm of auditing. Their study explored the use of this mathematical law as a practical tool for both internal and external auditors during the crucial planning phases of an audit. They focused on how Benford's Law could be utilized to evaluate the reliability of accounting numbers presented in financial statements.

The research by Nigrini and Mittermaier introduced and elaborated on various digital and numerical tests based on Benford's algorithm. These tests proved effective in identifying a range of discrepancies in financial records, such as underreported liabilities, overvalued inventory levels, overestimated revenues, and under-accrued expenses. The methodology involved comparing the actual frequency of occurrence of each

amount against the expected distribution of significant digits as per Benford's Law.

This comparison enabled auditors to detect potential biases or anomalies within the financial data. The presence of such irregularities could suggest attempts to skew financial results in a particular direction, thereby calling into question the accuracy and integrity of the reported figures. Nigrini and Mittermaier's work thus provided auditors with a valuable analytical approach to verify the authenticity of financial data and identify areas that might require closer examination or further investigation during an audit. The incorporation of Benford's Law into audit practices marked a significant advancement in the field, offering a more rigorous and scientific method for scrutinizing financial statements.

In 1998, Busta and Weinberg significantly advanced the application of Benford's Law by integrating it with emerging technological advancements. They pioneered the use of an artificial neural network model, which they trained using a dataset of 800 sets, each containing 200 two-digit numbers. The model's objective was to forecast deviations from the expected digit distribution patterns as per Benford's Law. This innovative approach marked a notable expansion in the field of digital analysis, particularly in the 1990s, blending traditional mathematical concepts with cutting-edge computational techniques.

Benford's Law further gained widespread attention in 1999 when Nigrini published an influential article in the Journal of Accountancy. This publication brought the law into the spotlight for a broader audience, particularly among Certified Public Accountants (CPAs). Nigrini's article provided a detailed technical analysis and practical guidelines on how CPAs could employ Benford's Law to detect anomalies and inconsistencies in financial data.

This period marked the transformation of Benford's Law from a mathematical curiosity primarily of interest to researchers into a mainstream tool in the accounting and auditing professions. As detailed by Nigrini in 2020, the law has become an established and invaluable instrument for verifying the accuracy of financial data, especially in identifying error-free amounts in tabulated records. Its adoption and adaptation by professional auditors and accountants have underscored its effectiveness and utility in real-world financial analysis, solidifying its position as a cornerstone methodology in the field of forensic accounting.

The use of Benford's Law in forensic accounting was further expanded by the significant contributions of Durtshi, Hillison, and Pacini in 2004. Their work is highly regarded for proposing a more refined and effective methodology for applying Benford's Law in the auditing process. They provided insightful guidance on how to interpret the results derived from

digital analysis tests using Benford's Law and identified specific areas where auditors should exercise caution.

Durtshi and his colleagues acknowledged a prevailing tendency in academic literature to approach claims about the effectiveness of Benford's Law in fraud detection with a degree of caution. They pointed out that deviations from the expected patterns as per Benford's Law in a dataset might not necessarily indicate fraudulent activity. Instead, such discrepancies could be symptomatic of operational inefficiencies or inherent flaws in the system.

However, they also emphasized that when applied judiciously, Benford's Law could be an extremely valuable tool in the auditing arsenal. A dataset's failure to align with the expected distribution patterns under Benford's Law could flag potential areas of concern, thereby serving as a catalyst for deeper investigation into accounts that appear suspicious. The work of Durtshi, Hillison, and Pacini in this regard is instrumental in delineating the practical aspects of Benford's Law, enhancing its applicability in forensic accounting, and aiding auditors in the critical task of identifying and scrutinizing potentially fraudulent financial activities.

2.4.3 Cosmetic Earnings Management

Benford's Law has become a widely employed tool in forensic accounting, particularly effective in identifying cosmetic earn-

ings management practices. An illustrative example of its application is Van Caneghem's 2002 study, which built upon the foundational work of Carslaw (1988). Van Caneghem demonstrated a prevalent tendency among managers of U.K. listed companies to engage in "rounding-up behavior" in their pretax income reporting. Specifically, this study highlighted a pattern where managers frequently increased the first digit by one when the second-from-the-left-most digit was nine, effectively rounding up the figures to present a more favorable financial position.

Further expanding on this area of research, Das and Zhang in 2003 delved into the nuances of how reported earnings per share (EPS) figures are rounded up. Their study provided additional insights beyond the scope of Thomas's 1989 work. They analyzed the digit immediately following the decimal point in EPS figures calculated in cents, uncovering patterns of rounding that were not previously documented. Additionally, Das and Zhang identified particular earnings patterns that were more prevalent among firms with higher levels of working capital accruals. This behavior was interpreted as a strategic approach by managers to inflate profit figures subtly.

These studies collectively underscore the utility of Benford's Law in revealing subtle yet systematic manipulations in financial reporting. By shedding light on these patterns, forensic accounting research utilizing Benford's Law provides

a more nuanced understanding of how financial data can be cosmetically enhanced to meet certain managerial or corporate objectives, thereby contributing significantly to the integrity and transparency of financial reporting practices.

In 2004, Skousen, Guan, and Wetzel conducted a notable study that significantly expanded the scope of research in detecting earnings management. Their investigation addressed two critical, previously unresolved aspects of this phenomenon. Firstly, they examined the focus of financial statement users, arguing that attention is not solely on the first digit of reported earnings. This perspective broadened the traditional approach of primarily analyzing the first digit, as per Benford's Law.

Secondly, they explored how the incentives for managers are linked to the proximity of reported earnings to certain psychological or cognitive benchmarks. Skousen et al. (2004, p. 215) posited that the decision to engage in rounding practices is a cost-benefit calculation for management. They suggested that if the perceived benefits of rounding numbers to meet certain benchmarks do not outweigh the risks and costs associated with earnings manipulation, managers might opt against reporting rounded earnings figures.

Their research revealed substantial evidence that the practice of rounding earnings figures by management was aimed at reaching these key reference points. Interestingly, their findings indicated that this practice was not confined to the ma-

nipulation of the first digit. Instead, it extended to the second, third, and even fourth digits of the reported figures. This comprehensive approach provided a more nuanced understanding of the lengths to which management might go to manipulate earnings reports, thereby achieving favorable financial portrayals. The study by Skousen, Guan, and Wetzel thus marked an important contribution to the field, offering deeper insights into the complexities of earnings management and the behavioral patterns of those responsible for financial reporting.

Nigrini's 2005 study stands out as a significant case study in the field of forensic accounting, particularly in the context of earnings overstatements. His research focused on the financial activities of Enron Corporation during the lead-up to its infamous bankruptcy, a period that also encompasses the conviction of Arthur Andersen for obstruction of justice. This era, crucial in the history of corporate America, highlighted the need for stringent financial scrutiny and regulatory oversight.

Utilizing Benford's Law as a primary analytical tool, Nigrini (2005) was able to detect anomalies in Enron's financial reporting. He specifically identified irregular occurrences of second-digit 0s in the company's revenue figures. These anomalies suggested that the revenue numbers had been manipulated to mask losses, with the frequency of certain digits surpassing the expected distributions as per Benford's Law. Such

manipulations were instrumental in creating a misleadingly positive financial outlook for the company.

The period encompassing the Enron and Arthur Andersen debacle, along with the subsequent enactment of the Sarbanes-Oxley Act in 2002, became a focal point for further research in forensic accounting. Studies by Guan et al. (2006) and Johnson (2009) also examined this timeframe to evaluate its broader impact on the quality of financial reporting and earnings. These investigations underscored the role of forensic accounting techniques, such as the application of Benford's Law, in uncovering deceptive financial practices and contributed to a deeper understanding of the mechanisms behind corporate financial fraud. The insights gained from these studies have been pivotal in shaping contemporary auditing practices and financial regulatory frameworks.

Lin and Wu's 2014 study marked a significant contribution to the field of forensic accounting, particularly in the context of cosmetic earnings management. Their research encompassed an extensive analysis of 84,870 instances of positive earnings reported by publicly listed companies in both the United States and Taiwan. The primary goal of this study was to explore the prevalence of cosmetic earnings management practices not just in established markets, but also in emerging economies.

A notable discovery from Lin and Wu's investigation was that managers in emerging markets appeared to have stronger

incentives to engage in earnings manipulation. This tendency raises critical concerns, especially for smaller and unlisted companies operating in these markets, where regulatory oversight and financial scrutiny may not be as stringent as in larger, more developed markets.

In line with this research trajectory, subsequent studies have continued to reveal unusual patterns in reported earnings across various global contexts, demonstrating the widespread nature of this issue. Notable among these is the work conducted on the impact of financial reforms in Korea (Lacina, Lee, and Kim, 2018), which provided insights into how regulatory changes affect earnings reporting. Similarly, investigations into Romanian listed companies (Istrate, 2019) and German firms (Lebert et al., 2021) further indicated the persistence of such patterns in different international markets.

These studies collectively highlight that the phenomenon of cosmetic earnings management is a global issue, transcending geographical and economic boundaries. They underscore the importance of continuous monitoring and analysis of financial reporting practices worldwide, providing valuable insights for regulators, auditors, and investors in various markets. The findings from these research efforts contribute significantly to our understanding of financial reporting behaviors and the need for robust mechanisms to ensure transparency and accuracy in financial disclosures.

Chapter 3

Local Elections and the Quality of Financial Statements in Municipally Owned Entities: A Benford Analysis

3.1 Introduction

In this essay, I investigate the quality of municipally owned entities' (hereafter MOEs) financial statements in pre-electoral seasons using a data science approach based on Benford's Law. This approach has a consolidated tradition in the auditing and fraud detection literature and has the advantage of not requiring strong econometric identification or statistical modelling assumptions; furthermore, it can be used in the presence of

large datasets. In this essay, I take the view that the totality of MOEs' financial statements is a complex economic system whose behaviour depends on different incentives set at the micro level.

Previous literature has advocated that morality and fraud are neither personal nor universal but are located within specific social and historical contexts (Cooper et al., 2013). I argue that this is also the case for data manipulation and financial statement quality. A particular context could favour data manipulation and in turn, reduce financial statement quality. In particular, I believe that in contexts where there are individuals who have an interest in the publication of specific financial statement results and are in a position to exercise power over financial statement preparers, they might decide to use it to have the latter acting immorally or fraudulently, possibly engaging in data manipulation (Cooper et al., 2013).

Public choice theory has gathered sufficient evidence to suggest that incumbent politicians, to increase their own chances or the chances of the governing party of winning again, may engage in the pre-electoral manipulation of any measure of economic performance that, perceived as a sign of administrative efficiency, can alter the perception of their governing efficiency (Buchanan and Tullock, 1965, Mueller, 1976, Rogoff and Sibert, 1988, Besley and Case, 1995, Black et al., 1998, Brender and Drazen, 2005, Chen et al., 2008, Arrow, 1951). Al-

though the first studies in this field dealt typically with macroeconomic measures, I believe that MOEs' financial results are also likely to be perceived by politicians and voters as relevant measures of economic performance. This is consistent with the results of existing literature on the influence of listed State-owned entities' results on voters' opinions (Besley and Case, 1995, Brender and Drazen, 2005, Drago et al., 2014, Repetto, 2018) and with the constant increase in the amount of public resources managed by MOEs (OECD, 2015). Incumbents might be willing to manipulate those results even if they cannot do it directly. Indeed, in the Italian institutional settings, local politicians do not have direct involvement in the preparation of MOEs' financial statements. Nevertheless, they are in the position to exercise power over MOEs' executives both through their ability to decide, as representatives of the majority shareholders, on MOEs' managers' re-appointment, and through their ability to influence, as political members, the amount of resources that can be transferred to the managed entity.

Hence, around local election times, politicians might be willing to use their power to make MOEs' managers accommodate financial statement results in a way that may favour their political ambitions, with a reduction of the quality of published financial statements data. I also believe that the above scenario is likely to occur especially with respect to those MOEs

that are more socially relevant and of greater interest to the media and the public opinion. In this essay, I focus on MOEs operating in specific utility industries (e.g., public transport, provision of gas, water and electric energy, environmental hygiene). I hypothesize that accounting manipulations in MOEs operating in these industries is positively associated with the occurrence of an election in the controlling municipality, and I test this proposition in the context of the Italian utility sector.

I carry out my analysis using a large sample of Italian MOEs operating in the utility sector, spanning a 10-year period ranging from 2010 to 2019. I then examine the distribution of pre-tax income numbers, in line with, e.g., Van Caneghem (2004) and Herteliu et al. (2021). I test my conjecture using conformity tests for the first-digit Benford's Law. In order to compare results from samples of different sizes I use chi-square homogeneity tests as well as resampling techniques (Politis and Romano, 1994). I confirm that MOEs' pre-tax income numbers conform to Benford's Law in ordinary times, but I find signs of misleading financial reports concentrated in pre-electoral times, with even greater alteration in the financial statement data of utility sector MOEs entirely controlled by the local government (i.e., when the municipality owns 100% of the firm's shares).

This essay provides some important policy implications.

First, auditors and forensic accountants will need to pay close attention to the quality of financial statements near electoral periods in particular environments (i.e., MOEs operating in economically and socially relevant industries). Second, it seems necessary to isolate managers from political influences, perhaps following the indications of the OECD and making the process of appointing managers more transparent. Third, the quality of financial statements should always be at the core of new and focused international policies, following the ongoing and recent debate around accrual-based accounting adoption by governments and state-owned entities. Finally, voters and media should be critical in assuming MOEs' indicators of financial performance as proxies of the administrative efficiency of incumbent politicians.

3.2 The Institutional Setting and the Data

In Italy, a mayor and a council are elected, for each municipality, through an election process held every five years. Mayors last for five years in their role and have a limit of two consecutive terms. New municipal elections can be held before the end of the term in three cases: (i) when more than half of the councillors resign; (ii) when the mayor resigns; and (iii) when the local government is dissolved after a court verdict because of mafia infiltration. Consequently, local elections are not synchronized nationwide and Italian municipalities have

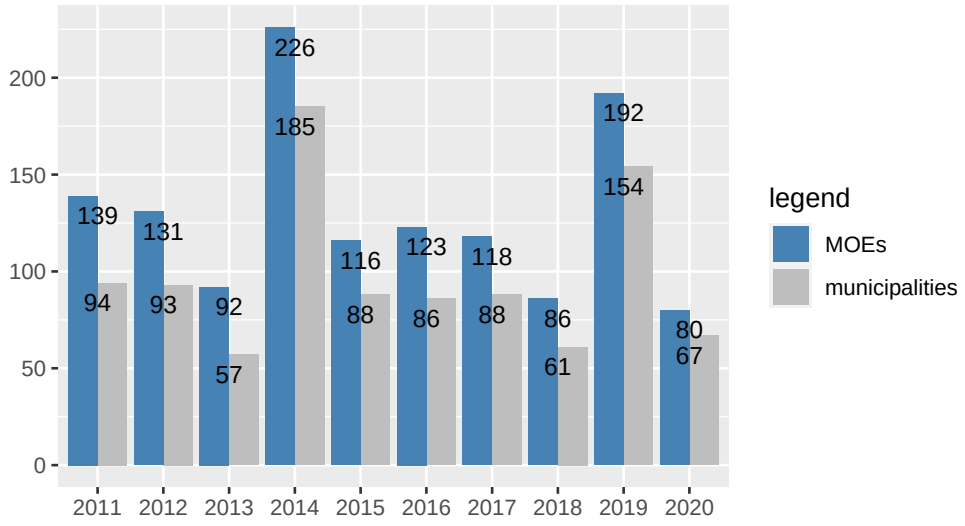

Figure 3.1: Number of utility sector MOEs and municipalities experiencing an "election-year". The blue bars represent the total number of utility sector MOEs attached to municipalities experiencing an election in each year from 2011 to 2020; the grey bars represent the number of municipalities that had elections in the same years.

different election periods over the years. Every year, a decree issued by the Minister of the Interior establishes the precise day of the municipal elections, selecting one of the Sundays in the period from 15 April to 15 June. This day is the same for all municipalities in which elections are scheduled to be held that year. Figure 3.1 reports for each year in the decade 2011–2020 the number of municipalities involved in local elections and the number of utility sector MOEs related to those municipalities.

Although Italian MOEs operate in many sectors, they are nevertheless generally responsible for the provision of local public transport, water, electricity, gas, local road maintenance,

and environmental hygiene. Most of these companies are partly or wholly owned by municipalities, which entrust these entities with most of the public services provided to their citizens (Bognetti and Robotti, 2007, Grossi and Reichard, 2008, Monteduro, 2014). The owning municipality, in most cases, is not just the majority shareholder but also the most shares of the participated entity, the mayor has full power to appoint or remove the MOE's director and can do so with an extremely high level of discretion.

The empirical investigation is based on the AIDA (Analisi Informatizzata delle Aziende Italiane) database and the Shareholdings PA (Public Administration) Open data, available through the Department of Treasury of the Italian Ministry of Economics and Finance (MEF). Created and distributed by Bureau van Dijk, the AIDA database contains the financial statements of both active and bankrupt Italian companies, including privately held and state-owned firms with Central, Regional, Local (Municipal) or any other government-level ownership, except for public bodies. In contrast, the Italian MEF database provides 262,315 observations on shareholdings and representatives in the governance bodies of companies and entities through seven editable files, which I merged and cleaned of duplicates and multiple firms' owners (by leaving only the largest). Then, I created a single dataset by merging these two databases. This merged dataset consists of several balance sheet items, along

with the reference calendar year of the same balance sheet, the name of the municipality owning the shares, the municipality in which the firm is based, and the percentage of the entity's shares owned by the municipality. All data manipulations and the empirical analysis have been carried out using R, version 4.1.2 (Team, 2022).

The dataset also includes a variable indicating the exact date of each election held in each municipality, retrieved from the election archive of the Italian Ministry of the Interior. Since data were once again open access from the same source and merged from different files, I checked for missing information and manually imputed the dates for firms experiencing one or no election in the overall period. At this stage, I found it useful to update the municipality names with their current ones, for more accurate matching between the databases. I define "pre-election data" as the financial statements related to the year prior to the local elections but published just before the elections were held. Election dates in Italy are ordinarily put towards the middle of the year and are normally known well in advance, whereas financial statements are usually approved 90 days after 31 December by the board of directors and 120 days after the end of the reference year by the shareholders' meeting. For example, a company would approve its financial statement by the end of March and publish it by the end of April at the shareholders' meeting, whereas the elections would com-

monly take place soon after in May or June. Of course, my database includes also elections held in later months, as some of them could have been postponed. This does not affect the underlying theoretical concept of manipulation incentive referred to the financial statement of the year preceding an election, as financial results could have been adjusted in view of the already announced election.

I filtered from the extrapolated 9,091 entities included in the central government database those contained in AIDA, obtaining a dataset of 6,495 observations per year. I further defined as MOEs those entities whose shares were owned by a municipality with a quota larger than 50% and selected the sample accordingly. This left me with 1,877 observations per year. I then restricted my attention to the 717 MOEs operating in the utility sector (covering five major industries, including public transport, the provision of gas, water and electric energy, and environmental hygiene), where a greater political component in terms of visibility and relevance for voters is expected. Finally, I focused on those MOEs for which I had information on their pre-tax income figures: this further reduced the sample to 6,261 observations (an average of approximately 626 entities per year).

3.3 Statistical Method

Being mostly concerned with data quality, I base my empirical analysis on the application of Benford's Law (Benford, 1938). The main statement of Benford's Law is that, contrary to what might be intuitively anticipated, the frequency of the first digit of many quantities in a number of real situations is not uniform, but rather follows a distribution such that smaller numbers are more frequent than larger ones. This behaviour has been observed in many different contexts, notably in accounting, economics, and finance (see, e.g., Herteliu et al., 2021, Nigrini and Mittermaier, 1997, Nigrini, 1999, Durtshi et al., 2004, Nigrini, 2012, Ausloos et al., 2016, 2017, Villas-Boas et al., 2017, Riccioni and Cerqueti, 2018, Shi et al., 2018, Kaiser, 2019, Miranda-Zanetti et al., 2019, Nigrini, 2020, Ausloos et al., 2021, Parnes, 2022). The theoretical reasons behind such widespread compliance of real datasets with Benford's Law have been investigated, and a number of explanations have been found (see, e.g., Raimi, 1976, Hill, 1995, Pietronero et al., 2001, Gottwald and Nicol, 2002, Fewster, 2009, Formann, 2010, Eliazar, 2013, Kossovsky, 2014, Berger and Hill, 2015, Miller, 2015, Whyman et al., 2016, Fang and Chen, 2020). In particular, Hill (1995) shows that Benford's Law naturally arises when the quantities of interest are the result of heterogeneous processes. Furthermore, Fewster (2009, p. 28) argues that "any distribution

arising in nature that is reasonably smooth and covers several orders of magnitude is almost guaranteed to obey Benford's Law".[1] Durtshi et al. (2004, p. 23) go so far as to state that "Most accounting-related data can be expected to conform to a Benford distribution, and thus will be appropriate candidates for digital analysis".

In settings where Benford's Law is the norm, significant deviations from Benford's Law are taken as manifestations of low data quality, or symptoms of possible data manipulations or even fraud.

Benford's first-digit law takes a surprisingly simple form:

$$\Pr(X = d_i) = b_i = \log_{10}\left(1 + \frac{1}{d_i}\right) \tag{3.1}$$

where X denotes the first significant digit of the item and $d_i \in 1, ..., 9$. I will denote by b_i the probability defined in Equation 3.1.

Conformity of data with Benford's distribution can be tested using different statistics (see, e.g., Nigrini, 2012, Lesperance et al., 2016, Barabesi et al., 2018, Cerqueti and Lupi, 2021). One of the most commonly used statistics is Pearson's chi-square:

[1] This claim should not be read as a necessary condition for data to follow Benford's Law. A counterexample is the random variable $X = k * 10^Y$, where Y is a standard uniform variable and $k > 0$. In this case, X is exactly Benford but does not necessarily span several orders of magnitude.

$$\chi^2 = n \sum_{i=1}^{9} \frac{(p_i - b_i)^2}{b_i} \tag{3.2}$$

where n is the number of observations and p_i represents the proportion of the first digits (1, ..., 9) in the sample. Despite its widespread use, the χ^2 has been criticized by some authors on the grounds that it has "excessive power" – i.e., it tends to reject the null of conformity with Benford's Law even in the presence of tiny unimportant deviations – when the number of observations is very large (Nigrini, 2012, Kossovsky, 2021). For this reason, Drake and Nigrini (2000) and Nigrini (2012) proposed using the Mean Absolute Deviation (MAD) criterion, a measure of the average distance between the relative frequencies of the observed digits with Benford's theoretical frequencies:

$$MAD = \frac{1}{9} \sum_{i=1}^{9} |p_i - b_i| \tag{3.3}$$

In the proponents' intentions, this criterion should be independent of the number of observations, n, and this should help overcome the "excess of power" problem. However, Cerqueti and Lupi (2021) show that when data conform with Benford's distribution, the MAD statistic depends on n and is $O_p\left(n^{-\frac{1}{2}}\right)$. These features make the MAD criterion unfit to be used as a statistical test and to be applied to compare confor-

mity with Benford's Law in samples of different sizes.

In order to take into account these issues, my empirical investigation is structured as follows. I start with a visual comparison of the empirical and theoretical frequencies. I proceed by computing the standard χ^2 test and the adjusted MAD statistic proposed in Cerqueti and Lupi (2021), a scaled version of the MAD:

$$MAD^* = \frac{\sqrt{n}}{9} \sum_{i=1}^{9} \frac{|p_i - b_i|}{\sqrt{b_i (1 - b_i)}} \tag{3.4}$$

Cerqueti and Lupi (2021) show that under the null of data conformity with Benford's Law

$$MAD^* \xrightarrow{d} \mathrm{N}\left(\sqrt{\frac{2}{\pi}}, \frac{1}{9^2} \sum_{i=1}^{9} \sum_{j=1}^{9} r_{ij} \right) \text{ as } n \to \infty \tag{3.5}$$

where

$$r_{ij} = \frac{2}{\pi} \left[\rho_{ij} \arcsin\left(\rho_{ij}\right) + \sqrt{1 - \rho_{ij}^2} \right] \tag{3.6}$$

and

$$\rho_{ij} = -\sqrt{\frac{b_i b_j}{\left(1 - b_i\right)\left(1 - b_j\right)}}. \tag{3.7}$$

Therefore, when appropriately standardized, the adjusted MAD is asymptotically distributed as N(0, 1) under the null.

The standardized adjusted MAD and Pearson's χ^2 are the first choice to detect departures from Benford's Law in many situations characterized by a random contamination of the law (Cerqueti and Lupi, 2021). Of course, comparison of the results from samples of different size remains problematic, due to the different power of the tests in the presence of few or many observations. In fact, consistent tests (such as those used in this essay) may reject the null hypothesis even for tiny and practically unimportant deviations from the null, when $n \to \infty$. Therefore, following a suggestion in Cerqueti and Lupi (2021), I use subsampling bootstrap (Politis and Romano, 1994). Subsampling bootstrap (or simply subsampling) draws samples without replacement of size m from the original sample of size n, where $m < n$. Subsampling guarantees that, provided the statistic of interest has a proper distribution, the subsampling statistics have the same distribution. Therefore, I can compare the statistics computed in the smaller sample with those consistent with the larger sample by subsampling from the larger one.

3.4 Data Analysis

In this essay, I concentrate on utility sector MOEs' pre-tax income, in line with Van Caneghem (2004) who was the first to

introduce discretionary accruals in this stream of research. I am not inferring whether entities manage reported earnings upward or downward as I am only interested in detecting whether there are diffuse signals of accounting data manipulations in certain periods, regardless of their signs. Furthermore, given that Benford's analysis can be applied only to positive quantities, and given that different incentives may hold for positive or negative values of income, I selected only positive pre-tax income values.[2]

Table 3.1: MOEs' pre-tax income descriptive statistics. Sample 1 represents the financial statements relative to ordinary periods of utility sector MOEs with the municipality owning more than half (>50%) of the total shares; Sample 2 refers to the financial statements of the same MOEs referring to the year preceding local elections; Samples 3 and 4 contain financial statement data of utility sector MOEs entirely controlled by the municipality (the latter owning 100% of the shares), respectively in ordinary periods and during election periods.

	Sample 1 ordinary-time data ownership >50%	Sample 2 pre-election data ownership >50%	Sample 3 ordinary-time data ownership =100%	Sample 4 pre-election data ownership =100%
No. Obs.	3,964	1,057	2,353	630
Min.	1	21	1	75
1st Qu.	30,751	30,890	23,386	23,756
Median	126,912	126,329	75,602	84,561
Mean	1,403,922	1,245,837	676,252	750,310
3rd Qu.	484,990	518,644	292,752	352,463
Max.	229,809,000	96,565,837	45,040,000	39,724,000
S.D.	9,398,305	6,349,160	2,562,223	2,623,179

As shown in Table 3.1, the sample is made of 5,021 observations over a decade (2011–2020), including an average of two election cycles for each entity. I noted that the data span several orders of magnitude, the minimum value being 1 and

[2]The number of negative observations is small and does not allow me to carry out the analysis using only the absolute value of the negatives.

the maximum 229,809,000. In line with Fewster (2009), this observation confirms that, in the absence of manipulations, the data are very likely to conform to Benford's distribution. The large mean-to-median ratio also suggests the same conclusion (Durtshi et al., 2004). I further split the sample into a pre-election sample (containing the observations relative to the MOEs' financial statements of the years preceding the local elections) and an ordinary-time sample (containing the observations relative to ordinary periods). The pre-election sample consists of 1,057 observations; the ordinary-time sample is nearly four times larger and contains 3,964 observations.

I apply the standard χ^2 and the adjusted and standardized MAD tests to the data in the different sub-samples to check conformity with Benford's first-digit law. I start from the case where the municipality owns the majority (> 50%) of the shares. The analysis reveals that, while in ordinary periods data conform with Benford's Law (Figure 3.2, panel B), in pre-election times the empirical distribution of the first digit decreases irregularly, with some important deviation from Benford's Law (Figure 3.2, panel A). In fact, both the adjusted MAD and the χ^2 tests reject the null hypothesis (of data conformity with Benford's Law) using a 5% significance level. Since my data include data that may deviate from Benford's Law (pre-election data) as well as a control group whose data are expected not to deviate from Benford's Law (ordinary-time data), I am in the

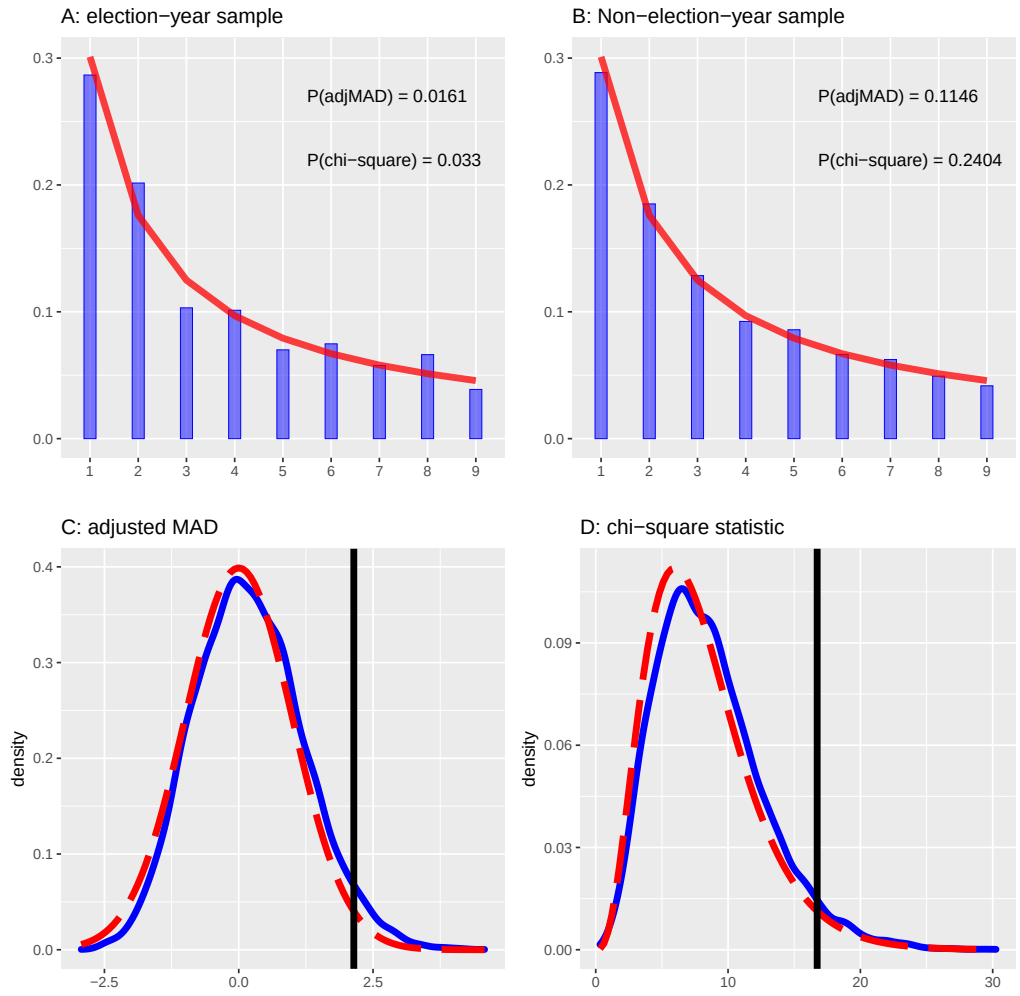

Figure 3.2: MOEs with at least 50% ownership on the part of the municipalities. Panels A and B report the empirical (blue bars) and Benford's (red curves) values of the first digit frequencies for pre-election data and ordinary-time data, respectively. P () denotes the p value of the corresponding test. Panels C and D report the densities of the relevant statistics estimated using 10,000 subsamples from the ordinary-time data (blue solid curves) and the theoretical densities under the null hypothesis that Benford's Law is valid (red dashed curves). The vertical lines indicate the value of the relevant statistics in pre-election data.

position to run also a chi-square homogeneity test, to check the null hypothesis that the differences between the empirical frequencies in the two samples can be attributed to the effect of chance alone, the underlying distribution being the same across the two population. The test, in this case, has a p-value equal to 0.064, so I can reject the homogeneity hypothesis at a significance level just above the conventional 5% level. Despite this rejection, one might still wonder whether the rejection of Benfordness in pre-election data stems from the fact that the empirical frequencies represented in panel A of Figure 3.2 are more irregular simply because they are based on fewer observations.

However, it should be observed that, despite the fact that the ordinary-time sample is significantly larger (and consequently the power of the tests is higher), both the adjusted MAD and the chi-square tests are unable to reject the null hypothesis that the observed values conform with Benford's Law in the ordinary-time data. On the contrary, the null of conformity with Benford's Law is rejected in the smaller pre-election sample where the power of the tests is lower. Therefore, rejection of the null of conformity in pre-election data cannot be an artefact created by sample size. Furthermore, by subsampling from the ordinary-time data 10,000 independent samples, each made of 1,057 observations (the same sample size as the pre-election sample), it is possible to derive the distribution of the

test statistics (Politis and Romano, 1994). If data in the larger sample conform to Benford's Law, I should expect the distribution of the test statistics to approximate their theoretical limit distribution under the null. In fact, this is what happens in panels C and D of Figure 3.2, where the subsampling distributions and the theoretical distributions of the test statistics under Benford's Law match almost perfectly. The vertical lines in panels C and D represent instead the values of the test statistics in the pre-election sample and confirm that the realized values of the test statistics are very unlikely under the distribution observed in the ordinary-time data, in samples of the same size as the pre-election data. All these results point towards the existence of significant differences in the quality of financial statements in periods approaching local elections with respect to regular periods.

I also investigate conformity with Benford's Law using a sample made exclusively of entities fully owned by the reference municipalities (i.e., when the municipality owns 100% of the shares of the entity). In this case, the sample is made of 2,983 observations. The pre-election sample is made of 630 observations; the ordinary-time sample is again nearly four times larger and contains 2,353 observations. The chi-square test of homogeneity strongly rejects (with a p-value equal to 0.008) the null hypothesis that the empirical digit distributions in the pre-election and ordinary-time samples derive from the same

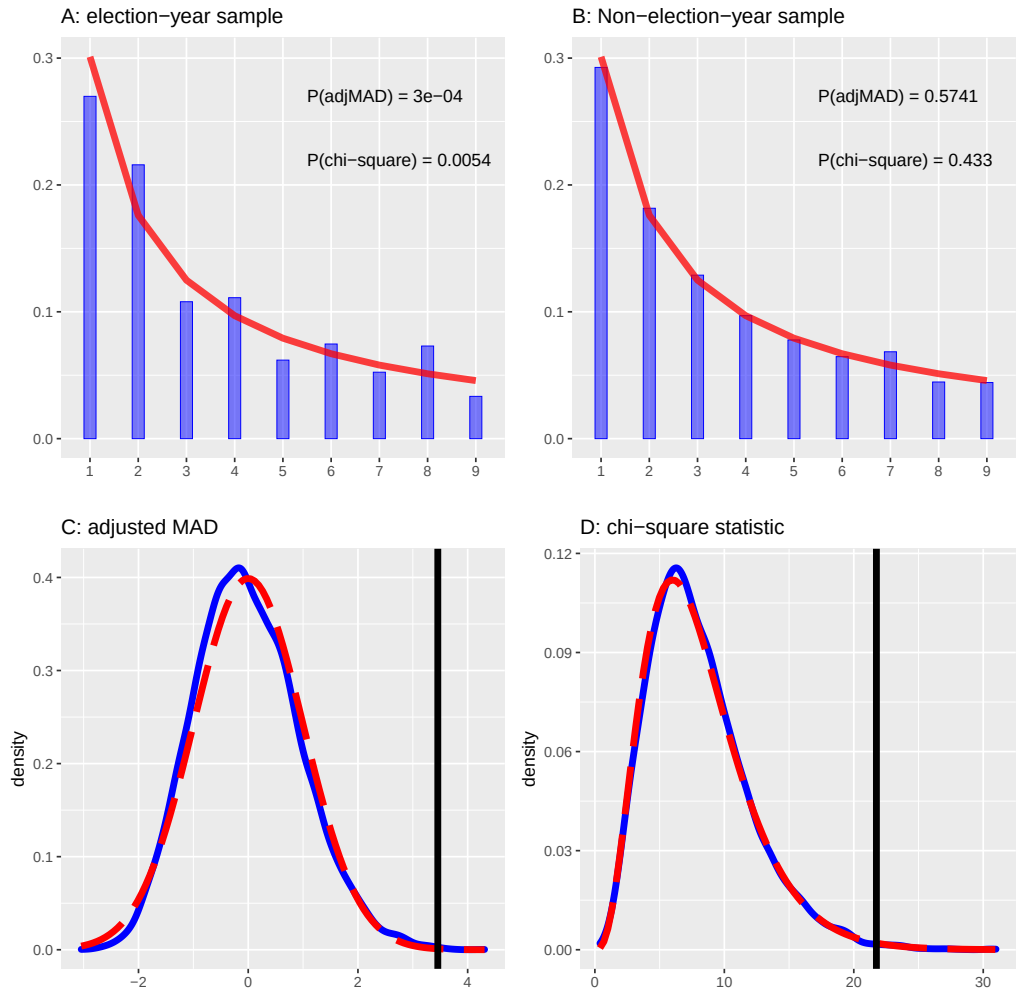

Figure 3.3: MOEs with at least 100% ownership on the part of the municipalities. Panels A and B report the empirical (blue bars) and Benford's (red curves) values of the first digit frequencies for pre-election data and ordinary-time data, respectively. P () denotes the p value of the corresponding test. Panels C and D report the densities of the relevant statistics estimated using 10,000 subsamples from the ordinary-time data (blue solid curves) and the theoretical densities under the null hypothesis that Benford's Law is valid (red dashed curves). The vertical lines indicate the value of the relevant statistics in pre-election data.

underlying distribution.[3] The empirical results point in the same direction as before, confirming data conformity in regular periods and signalling the presence of anomalies in the distribution of pre-election data (see Figure 3.3). Furthermore, despite being based on fewer observations, in this case, the evidence against Benford's distribution in pre-election data is even stronger.

3.5 Discussion and Conclusion

This essay deals with the crucial problem of the possible existence of political manipulation of microeconomic data before local elections. I use a data science approach based on Benford's Law that avoids strong modelling assumptions. Specifically, I examine the first-digit distribution of pre-tax income numbers of a sample of Italian municipal-owned entities (MOEs, with the municipality holding more than 50% of the firms' total shares) operating in the utility sector. I con- firm that pre-tax income numbers conform to Benford's Law in regular periods. However, I find signs of financial statement manipulation around election periods, especially for entities entirely controlled by the municipality (i.e., with the latter owning 100%

[3]On the other hand, the same homogeneity test applied to the empirical distributions for different ownership quota show that in pre-election data the digit empirical distributions for the two ownership levels are compatible with the same underlying distribution (p-value equal to 0.965); the same result holds also for ordinary-time data (p-value equal to 0.907).

of the total shares). Chi-square tests of homogeneity of the empirical first digit distributions in pre-election and in ordinary-time data support the same conclusion by rejecting the null hypothesis that the first digit distributions are the same across the samples, irrespective of the Benfordness of the relevant variables. Arguably, this is another symptom of a change in data quality or of the presence of data manipulations.

It should be stressed that by "manipulation" I do not necessarily mean that managers engage in illegal activities: manipulation can occur also without trespassing the boundaries of generally accepted accounting principles (GAAP) when managers, required to use their judgement to assess financial statement discretionary items, do so to achieve desired specified goals rather than to offer a faithful and fair view of the company's financial position.

The entities analyzed in this study operate in socially relevant industries, such as public transport, the provision of gas, water and electric energy, and environmental hygiene. The evidence prompts me to argue that when people have both power to exercise over third parties (e.g. politicians on MOEs' managers) and interest in engaging in misleading accounting behaviour (e.g., during pre-electoral periods in order to attract voters), the social context that arises in these given environments and specific periods can lead to a context prone to self-serving use of accounting data and a decrease in the quality of

financial statement results. Stated differently, in a pre-electoral context, incumbent politicians can exercise the power they have over MOEs' executives to make them perform accounting manipulatory activities in order to accommodate their political ambitions.

The first direct implication of this study is relevant for external/ internal auditors (and perhaps for forensic accountants, or even judicial bodies that aim to protect public finance balances), who will need to pay close attention to the quality of financial statements during pre-electoral periods, especially in particular environments (i.e., MOEs operating in economically and socially relevant industries). It also seems necessary to isolate managers from political influences by introducing a more transparent appointing procedure as advocated by the OECD Guidelines for the governance of State-owned entities. To guarantee administrators' independence, policymakers could create disincentives to incumbent politicians from exercising power over MOEs' managers. Lastly, voters and media will need to be critical in assuming MOEs' indicators of financial performance as proxies of the administrative efficiency of incumbent politicians, although those firms represent economically relevant sectors.

Obviously, I cannot exclude the possibility that executives engaging in pre-electoral accounting data manipulation do so for personal reasons and not in response to politicians' pres-

sure. The Positive Accounting Theory predicts that managers engage in earnings management activity to reduce political costs deriving from the choices that politicians make on the basis of financial statement results (Watts and Zimmerman, 1990) and definitely around election times, these costs are likely to be perceived as higher by all sorts of politically connected entities (Ramanna and Roychowdhury, 2010). Nonetheless, I leave to further research the attempt to untangle the roles that managers' personal motivations and pressure from politicians may have on detected pre-electoral accounting data manipulations.

Chapter 4

Proportional Appropriation System and Financial Statement Quality in Municipally Owned Entities: Empirical Evidence from Italy

4.1 Introduction

While the issue of earnings management has been exhaustively investigated in privately-owned companies, (Bisogno and Donatella, 2021) suggest that, more recently, this topic has become increasingly relevant within the public sector. This essay therefore aims to provide new empirical evidence on the issue of earnings management practices in State-owned entities (SOEs). This is achieved by examining the recent introduc-

tion of a new law creating a direct link between the accounting results published by municipally-owned entities (MOEs) and the spending power of the local government controlling them, in terms of the impact this law has on the quality of financial statements issued by such entities.

A recent strand of research has examined the relationship between politics and earnings management in the public sector. Kido et al. (2012) are the first to posit that governing authorities at sub-national levels may manipulate accounting numbers to present a healthier financial picture during election years, and they do find evidence consistent with their claim. Other studies examine the role of political factors in local government through elections (Cohen et al., 2019), where earnings management is found to be greater when a mayor is re-elected rather than elected for the first time. Previous research has documented the manipulation of accounting data during election cycles in MOEs too, in both Italy (Capalbo et al., 2021, 2023), focusing on utility entities, and Portugal (Serra Coelho, 2022). The studies cited all point in the same direction, focusing exclusively on election cycles as the primary context in which creative accounting practices in the public sector flourish. However, it is still an open question as to whether governments have other incentives that make them engage in, or have their owned entities engage in, earnings management practices, for example, factors that influence their spending power.

This essay therefore extends the previous studies mentioned above and enables me to test whether MOEs, regardless of the sector they operate in, manipulate their earnings as a consequence of participating municipalities' reduced spending capability.

In specific terms, I examine this issue in the framework of the introduction of a new accounting regulation regarding the appropriation of financial resources by local public administrations, introduced in 2016 (art. 21 of the Italian legislative decree of 19 August 2016, n. 175 of the Consolidated Act). Italian Municipalities use a cash-based budget that, before 2016, was not affected by any impairment of the value of their financial assets resulting from losses suffered by the entities they owned. This implied that, no matter how large the losses incurred by the entity owned, and thus the amount to be written off from the accounting value of the related financial asset, the municipality's spending power was not affected in the slightest until such time as a financial measure became necessary to deal with the insolvency that sooner or later would follow the losses. MOEs are typically used to provide services of economic and social relevance that cannot be interrupted, meaning that when these losses lead to insolvency, the municipality that owns the entity will have no choice other than to inject new capital to ensure the continuity of the entity. Under the new regulation, a direct process of appropriation of financial resources was in-

troduced, stipulating that when the municipally owned entity publishes a negative income, the participating municipality is now required to insert a pro-rata appropriation in its financial budget, which in turn implies an immediate reduction in its spending power. The amount to be appropriated depends on both the extent of the reported loss and the percentage of the equity owned. While the regulation was designed to save the financial resources that might subsequently be needed to guarantee the continuity of the entity, and therefore stability in the provision of public services, it may also have the effect of increasing the incentive to engage in the manipulation of MOEs' published earnings in order to safeguard the spending power of the incumbent politicians. This legislative change therefore provides a setting which allows me to examine the effect that a new regulation, namely the introduction of a compulsory proportional appropriation system for local governments, has on the quality of the financial statements published by MOEs.

Answering this question is important, given that earnings management practices in MOEs represent a serious threat to transparency in the public sector. Previous literature has argued that states with strict budget restrictions have stronger incentives to use discretion over accounting figures to present a healthier financial picture (Kido et al., 2012). Accordingly, I assume that the introduction of a direct link between the owned

entities' financial results and the owning municipalities' spending power might create an incentive to engage in earnings management, thereby adjusting MOEs' financial results so as to preserve the spending power of incumbent politicians. Specifically, I conjecture that the extent of self-serving accounting discretion used by MOEs to manage their earnings depends on the scale of the financial resources that local governments would be forced to appropriate in the event that owned entities report losses. It follows that the higher the total number of shares owned by the municipality (and consequently the larger the forced reduction in its spending power), the greater the incentive to engage in earnings management in order to adjust the positive or negative perception of their economic performance in the MOEs published financial results.

To test my conjecture, I use Burgstahler and Dichev's (1997) approach and Benford's (1938) law, and I examine whether there is data manipulation in the financial statements of Italian MOEs before and after the introduction of the new accounting regulation for local governments. Given the focus of local governments on the losses incurred by the entities they own, I analyse anomalies in the first digit of the net income of MOEs over a 10-year sample that is divided equally between the periods pre- and post-introduction of the new accounting regulation. I focus on municipalities with the largest ownership quota within the entity when two or more municipalities own

the same MOE. Following Cerqueti and Lupi (2021), I perform Chi-squared and Z-tests on the adjusted mean absolute deviation (MAD) of the empirical data from the Benford distribution. After examining all the entities in my sample, following the introduction of the accounting regulation I find evidence of a significant decrease in the quality of the financial statements published by controlled MOEs (total shares owned >50%). More importantly, I also find that the extent of the data manipulation amplifies as the municipality's ownership stake rises (i.e. 100% of total shares) when compared to entities over which the municipality does not have formal control. These findings are therefore consistent with the suggestion that a reduction in local governments' spending power due to the appropriation of financial resources affects earnings management practices in MOEs, at least to the extent that the latter engage in manipulation as a consequence of the stronger incentive for local governments to defend their spending power by making MOEs look financially healthier.

4.2 Institutional Framework

Municipally Owned Entities (MOEs) in Italy are typically in charge of providing socially and economically relevant services, such as local public transport, water and waste management, utilities such as electricity and gas, local road maintenance, children's education, services for the elderly, disabled and chil-

dren, the municipal police force, building planning and control, recreation services, libraries and cemeteries. Since the advent of New Public Management, municipalities have transferred control of the vast majority of the public services offered to their residents to the business enterprises they control or, at least in part, own (Grossi and Reichard, 2008). According to a recent report by Casamonti and Gottardo (2020) from the OCPI (Osservatorio dei Conti Pubblici Italiani) on "The dimensions of the Italian entrepreneurial State", from 1999 to 2019 the value of State investments in business enterprises increased over time in Italy, reaching nearly 10% of GDP. As of 2020, out of the active entities in which the State has a stake, the vast majority (nearly 67.5%) are directly owned by local governments (ISTAT, 2023). Interestingly, more than 60% of those active entities are entirely controlled by the State (over 50% of the total shares), of which 42.3% are controlled by local governments (ISTAT, 2023).

As mentioned above, actions taken by the municipality which owns the entity can have a considerable impact on the financial status of a single MOE, because the municipality is typically not only the majority shareholder but also the principal client, providing a significant portion of the entity's revenue through a service contract (Capalbo, 2016).[1] Until now,

[1]On top of that, the mayor, whose term typically lasts longer than the manager's appointment, has complete authority and considerable discretion to appoint and remove MOE directors when the municipality's ownership stake exceeds 50% of the total

however, the reverse was not true, in that the actions taken by the entity, whether or not it registered negative results and thus worsened its income over the years of its operation, could not influence the financial circumstances of the municipality which owned it unless the latter was called upon to recapitalise the entity when it was no longer able to cover its costs.

In recent years, as highlighted by the Italian lower chamber (Camera dei Deputati, 2023) in an internal communication on the "Monitoring and control of State-owned companies and recognition of the organizational structures", the regulatory environment surrounding these Italian entities has grown more complex, because the need to ensure the achievement of public finance targets has led to the establishment of strict financial containment and control measures on public enterprises. This question was most recently redefined by legislative decree no. 175 of 2016, containing the Consolidated Law on State-owned companies, which reorganised and formalised the matter within a systematic framework. In developing the reform, the aim of the Italian legislators was to ensure efficient, transparent management of State shareholdings, as well as the protection and promotion of competition across the market, while also contributing to the reduction of public expenditure through the implementation of new streamlining and review procedures designed to reduce the number of entities owned

shares

by the State (especially those owned by local governments). Essentially, the underlying objective of the reform was to avoid the distorted and excessive use of private company status by public administrations, which had previously used this structure to avoid the limitations and rules specific to the public sector such as compliance with budget constraints or rules on public recruitment and procurement.

The legislative decree also addressed the urgency to link the cash-based system of public administrations with the equity value of their controlled entities in order to overcome the existing indifference that the predominantly cash-based accounting systems of public administrations have with regard to the losses suffered by those entities (Capalbo, 2016).[2] Effective as of the 2015 financial statements, article 21 of this decree requires local and regional level governments to appropriate part of their resources every time an owned entity reports negative performance and as a result suffers a reduction in its equity, the appropriated amount is proportional to the share in the entity. The aim of the newly- introduced proportional appropriation system was essentially that of saving the financial resources needed to guarantee the continuity of the entities, but also, more importantly, to act on the spread of state-owned entities that are constantly running at a loss, which could represent a serious threat to public services nationwide. Nonethe-

[2]Capalbo (2016) also discusses other reasons which motivated the legislator to intervene.

less, the question naturally arises as to whether the new budget constraints might have had the unintended effect of increasing the incentive to report healthier financial results in SOEs' financial statements in order to defend the spending power of incumbent politicians. Taking this unique context, my research tests this proposition on entities owned by municipalities.

4.3 Description of Data and Sample

Our analysis uses yearly net income item data from the financial statements of Italian Municipally owned entities (MOEs) over a 10-year period from 2010 to 2019, sourced from the Bureau van Dijk AIDA database (Analisi Informatizzata delle Aziende Italiane). The Italian Ministry of Economics and Finance (MEF) Public Administration Shareholdings Open database, available through the Treasury Department website, provides me with 262,315 entities whose shareholdings and representatives are public bodies at any level of government. I extrapolated 9,091 sets of entities from the central government database for which an entity was owned by a municipality. The merged dataset consists of several balance sheet items, the reference calendar year, the name of the municipality owning the shares, each entity's Italian tax code and the percentage of the entity's shares owned by the municipality. As not all entities were included in AIDA, I focus on the financial statements of the remaining 6,495 MOEs on which I have complete information, resulting

in a sample of 64,950 observations.

We sample data evenly, dividing the period in pre- and post- introduction of the accounting regulation and I only select the entities that are present in both periods with five-year financial statement data, and which have net income information available for the entire sample period. This leaves me with 1,060 entities and consequently 10,600 net income observations. I further split the data to create two samples in which there are entities with a stake owned by the municipality that is respectively greater than 50% and equal to 100% and two further samples within which there are MOEs with a direct quota owned by a municipality that is less than or equal to 50% and greater than 0%, the latter comprising the whole dataset. Although the latter includes entities subject to the regulation, they still provide some sort of control to test my assumption.[3] In line with Mocetti and Roma (2021), in the event that two or more municipalities owned shares in the same entity, I selected the municipality with the largest percentage stake (i.e. the largest shareholder) as it has more formal decision-making powers than the other owners.

[3]I acknowledge control samples should include untreated entities in order to compare results in my tests properly. However, selecting private companies that might be somewhat similar in terms of sector- or size-based criteria would severely hamper my ability to carry out the analysis, as there are significant differences in the way such businesses operate, are regulated, and prepare financial statements. Italian MOEs are quite unique and any comparison with other private-sector companies would produce misleading, or at least biased, results.

Descriptive statistics for MOEs' net income are reported in Table 4.1. However, before conducting any statistical tests, I look at what happened to the published financial results of MOEs before and after the introduction of Article 21 of the regulation mentioned above. The sample considered consists of 8,350 observations of which only subsidiaries (i.e. when the total number of shares owned by the municipality is greater than 50%) are selected. Here I compare the properties of the average net income (per MOE) in the two five-year periods 2010–2014 and 2015–2019 for entities that are observed in all ten years. The samples relating to the two five-year periods consist of the same 835 entities so any possible difference cannot be traced back to a different composition of the samples.

Table 4.1: Summary statistics of MOEs' net income. The four samples are made of companies with the respective ownership quota, indicated in parentheses, of the municipality.

	Sample 1 (<=50%	Sample 2 (>50%)	Sample 3 (>0%)	Sample 4 (=100%)
No. Obs.	12,850	8,350	21,200	4,640
Min.	-11,601,111,000	-319,109,625	-11,601,111,000	-319,109,625
1st Qu.	-6,350	-638	-4116	0
Median	2,987	7,146	4,554	5,746
Mean	-347,129	141,308	-158,004	-139,520
3rd Qu.	87,348	68,777	76,967	43,407
Max.	6,235,645,000	226,579,000	6,235,645,000	49,018,690
S.D.	138,619,467	6,545,239	108,588,820	6,264,588

The average figure (expressed in thousands of Euros) for the period 2010–2014 is -45.6, while for the period 2015–2019 it is 466.4. Hence the 2015–2019 average is higher than the 2010–2014 average. However, the mean can be greatly affected

by a few values in the tails of the distribution. If I look at the median, which is a more robust position indicator than the average in the presence of anomalous data, I note that the median in the period 2010–2014 is equal to 9.9, while for the period 2015–2019, it is 28.5. Figure 4.1 illustrates a comparison of the data distribution in the two periods analysed.

The two estimated densities (red and blue curves representing the distribution of MOEs' net income during the periods pre- and post-introduction of the new accounting regulation, respectively) appear to be quite different at first glance. If those differences are driven by accounting data manipulation, however, they need to be tested in terms of statistical significance, which will be the focus of the next sections. Considering the fraction of entities that recorded a loss in the two five-year periods, it can be observed that in the period 2010–2014, 30.4% of entities recorded a loss. This becomes 22% in the period 2015–2019. It is therefore natural to question whether those differences were simply due to the efficacy of the new regulation or, more importantly, if well-intentioned government policies can backfire by in this case incentivising managers and incumbent politicians to manipulate accounting data so as to avoid budget restrictions. The introduction of the new policy provides me with an ideal setting to test this and find out whether accounting regulations impact management behaviour around reported earnings.

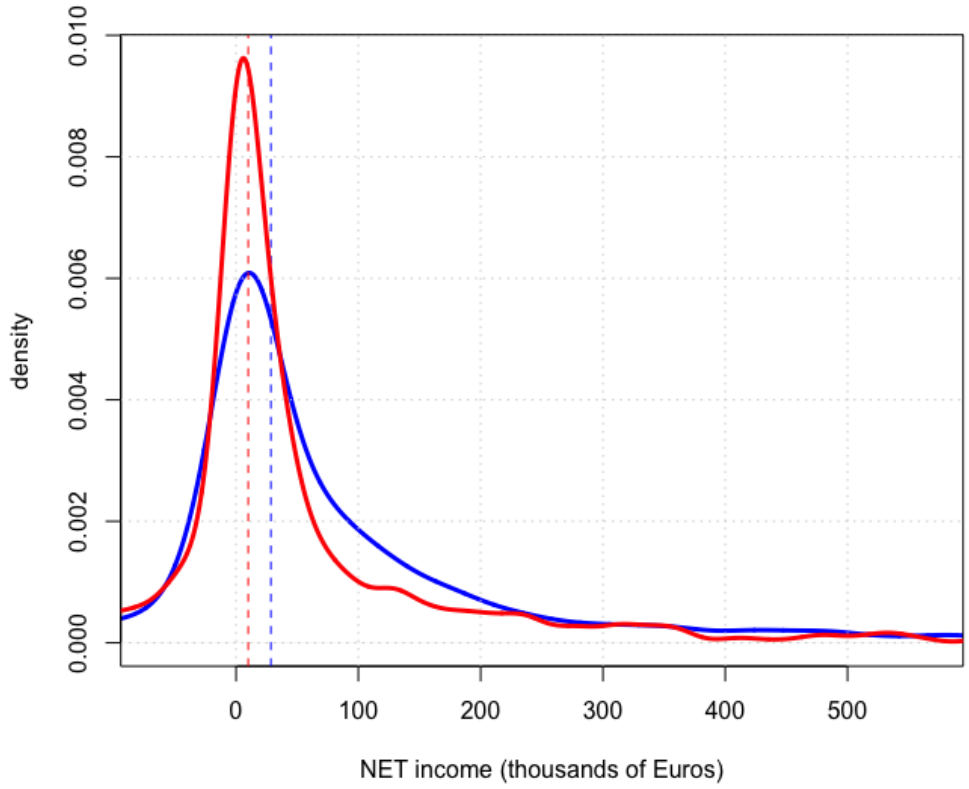

Figure 4.1: Net income distributions of MOEs (with municipality quota >50%). The red curve represents the distribution of data for the period 2010–2014, the one in blue refers to the period 2015–2019. The vertical dotted lines represent the medians in the two five-year periods. For greater detail, the density, calculated using all the observations available for each period, is shown graphically only for a limited range of observations, trimming the most extreme tails (with an overall trimming of about 20%).

4.4 Empirical Method

From a statistical point of view, the null hypothesis related to Prediction 4, which I intend to test in the empirical analysis, is that there is no earning management after the introduction of the new regulations. In the same way, the statistical null hypothesis related to Prediction 5 is that there is no effect of the ownership quota the municipalities hold in the entities on earnings management in MOEs' published financial statements.

In keeping with the mainstream literature on earnings management, I adopt the Burgstahler and Dichev (1997) approach to look for anomalies in the distribution of net earnings. This method allows me to depict the change in the losses published by Italian MOEs before the introduction of the new accounting rule, compared to the losses reported after the implementation of the above-mentioned legislative decree. The graphical representation of net income distribution changes for each sample divided by ownership quota gives me a first clue about the trend of whether increasingly fewer MOEs tended to report losses. Although this technique is mainstream within the literature on the detection of earnings management and fits well with the aim of my study, the accuracy of the results it produces can be influenced by other confounding factors, such as economic cycles, unemployment, or natural disasters. More-

over, after looking at management behaviour in the presence of small reported losses and profits, this study focuses on data quality through the examination of earnings management practices during a period in which there are incentives to avoid reporting losses. For these reasons, this study employs Benford's law methodology so as to avoid confounding factor biases, which is also in line with Capalbo et al. (2023).[4]

The underlying concept behind Benford's law is that the leading digit of many real-world numerical data follows a precise logarithmic distribution. Accounting datasets have been proven to be a setting in which Benford's law is considered the norm (Nigrini, 2012) and to be appropriate candidates for such analysis (Durtshi et al., 2004, Hill, 1995). Therefore, the distribution of the leading digits of financial statement numbers is expected to obey the law so that any significant deviations are taken as manifestations of low data quality or symptoms of possible data manipulation. To implement this approach, I see abnormal digit occurrence in net income items as number-pattern anomalies and thus use earnings data quality as a proxy for earnings management. I focus on net income numbers, consistent with the literature (see, e.g., Carslaw, 1988,

[4]To understand why Benford's analysis is not affected by the possible presence of confounding factors, let me assume that I can express the effect Y of a stochastic confounding factor (the business cycle, say) on the variable of interest X, Berger and Hill (2015, Theorem 6.3) prove that under mild regularity conditions, if X is Benford, so is XY. This allows me to test the statistical significance of accounting data manipulation over an extended period of time.

Thomas, 1989), because it is a balance sheet item which is the result of mathematical aggregation of numbers from different distributions (e.g. revenues, operating costs, taxes, etc.) and, therefore, more likely to be useful for a Benford's law-based analysis (Durtshi et al., 2004). If Prediction 4 is valid, I should observe that the data do not comply with Benford's law after the introduction of the new regulations: if Prediction 5 is valid, I should observe that the deviation of the distribution of data from Benford's law increases with the share of ownership by municipalities.

There is indeed a large body of accounting literature relative to the use of Benford's law to test cosmetic earnings management in financial statement items (see, e.g., Carslaw, 1988, Thomas, 1989, Van Caneghem, 2002, 2004), and this was also introduced in the context of public sector accounting (Rauch et al., 2011, 2014, Capalbo et al., 2023). These studies all find that bias in the occurrence of net income digits (and other items) is the consequence of management incentives to round off earnings and conclude that Benford's law is a good analytical procedure to spot such manipulative behaviours. Furthermore, the chosen approach is particularly appropriate given the high number of different, independent entities analysed across various subsamples. As Hill (1995, p. 354) argues, "If distributions are selected at random (in any "unbiased" way) and random samples are then taken from each of these distributions, the

significant digits of the combined sample will converge to the logarithmic (Benford) distribution".

Benford's first-digit law is also remarkably straightforward:

$$\Pr(X = d_i) = b_i = \log_{10}\left(1 + \frac{1}{d_i}\right) \tag{4.1}$$

where X denotes the first significant digit of the item and $d_i \in 1, ..., 9$. I will denote by b_i the probability defined in Equation 4.1. While there are different ways to test data conformity with Benford's distribution (Nigrini, 2012, Cerqueti and Lupi, 2021), I adopt the most commonly used statistics, Pearson's chi-square:

$$\chi^2 = n \sum_{i=1}^{9} \frac{(p_i - b_i)^2}{b_i} \tag{4.2}$$

where n is the number of observations and p_i represents the proportion of the first digits (1, ..., 9) in the sample.

Many studies in the accounting literature have also used the Mean Absolute Deviation (MAD) criterion, first advocated by Drake and Nigrini (2000) and Nigrini (2012) to address the "excess of power" issue of the chi-squared test when dealing with large datasets. This measures the average deviation in absolute terms of the empirical data analysed (financial statements numbers in the tested sample) and Benford's theoretical frequencies:

$$MAD = \frac{1}{9}\sum_{i=1}^{9}|p_i - b_i| \tag{4.3}$$

However, this criterion does not have a well-defined probability distribution and therefore lacks statistical foundations. To overcome this limitation, I follow Cerqueti and Lupi (2021), who propose a standard normal test of conformity based on a scaled version of the excess MAD, which in turn is defined as:[5]

$$\delta_{n,9} = MAD_{n,9} - E\left(MAD_{n,9}\right) \tag{4.4}$$

where n is the number of observations and $E\left(MAD_{n,9}\right)$ is the expected mean absolute deviation on the first digit in the presence of n observations. My approach starts with a visual comparison of the empirical and theoretical frequencies. Then I compute the χ^2 and the Z test based on the excess MADs for each subsample in my analysis to infer the impact of the introduction of the new accounting regulation for the budget of municipalities in Italy on the quality of MOEs' financial statement data.

[5]The importance of the excess MAD was already highlighted in Barney and Schulzke (2016). However, by deriving its asymptotic distribution, Cerqueti and Lupi (2021) could derive a formal test of conformity based on the excess MAD.

4.5 Results

In this essay, I focus on net income numbers (in line with Carslaw, 1988, Thomas, 1989) of MOEs with varying levels of ownership by municipalities. The newly introduced accounting rule does indeed look at the final results of those entities in order to calculate the proportional financial resource appropriation the municipality is forced to take into account the year following the owned entity's reported losses. Regardless of whether the entities' results are positive or negative, I am mostly concerned with the quality of those accounting data after the introduction of the regulation. In untabulated tests, I also extract data from the sample entities operating solely in the utility sector, which are shown to be more prone to engaging in accounting data manipulation (Capalbo et al., 2021, 2023), and find that those entities are not driving my main findings.

We apply the Burgstahler and Dichev (1997) approach to look for anomalies in the distribution of net income numbers. Figures 4.2 and 4.3 depict those distributions for each subsample analysed in this study, showing overall that Italian MOEs are very likely to report small profits. Despite this significant spike around zero, which indicates an abnormal number of entities reporting small losses and even more with small profits, the behaviour worth noting is the number of entities which, before the new accounting rule, were reporting losses. This num-

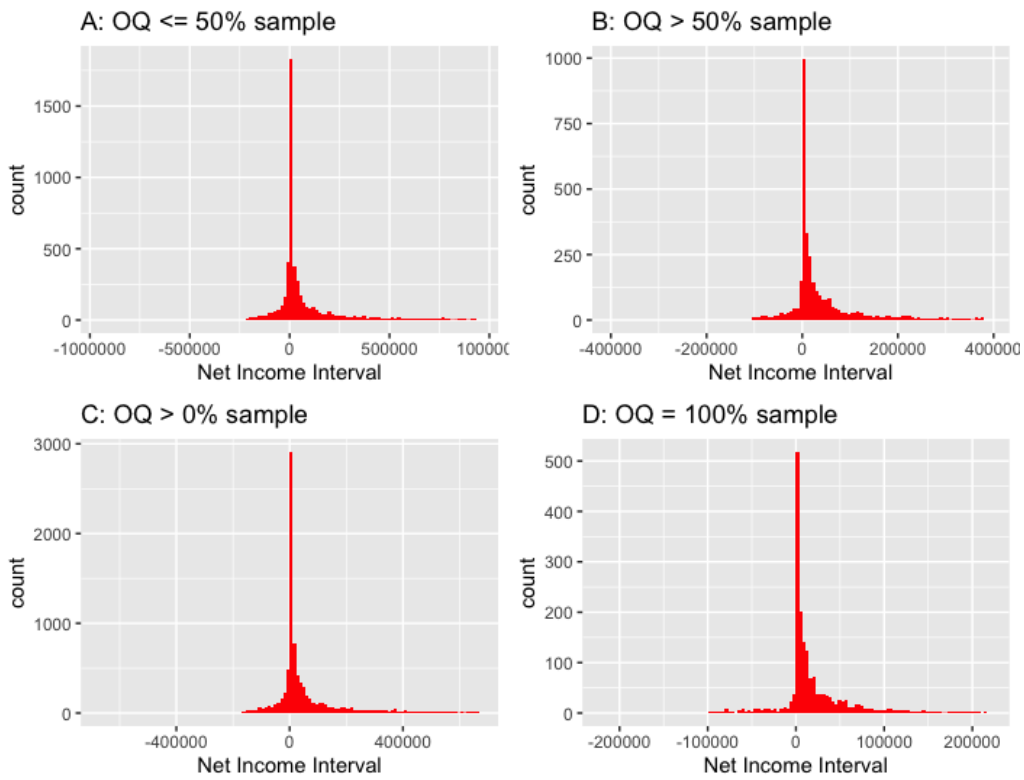

Figure 4.2: Distributions of net income during the pre- law introduction period. The figure reports the distributions of net income intervals following the approach in Burgstahler and Dichev (1997), which are divided according to the ownership quota (denoted as OQ), in each panel respectively.

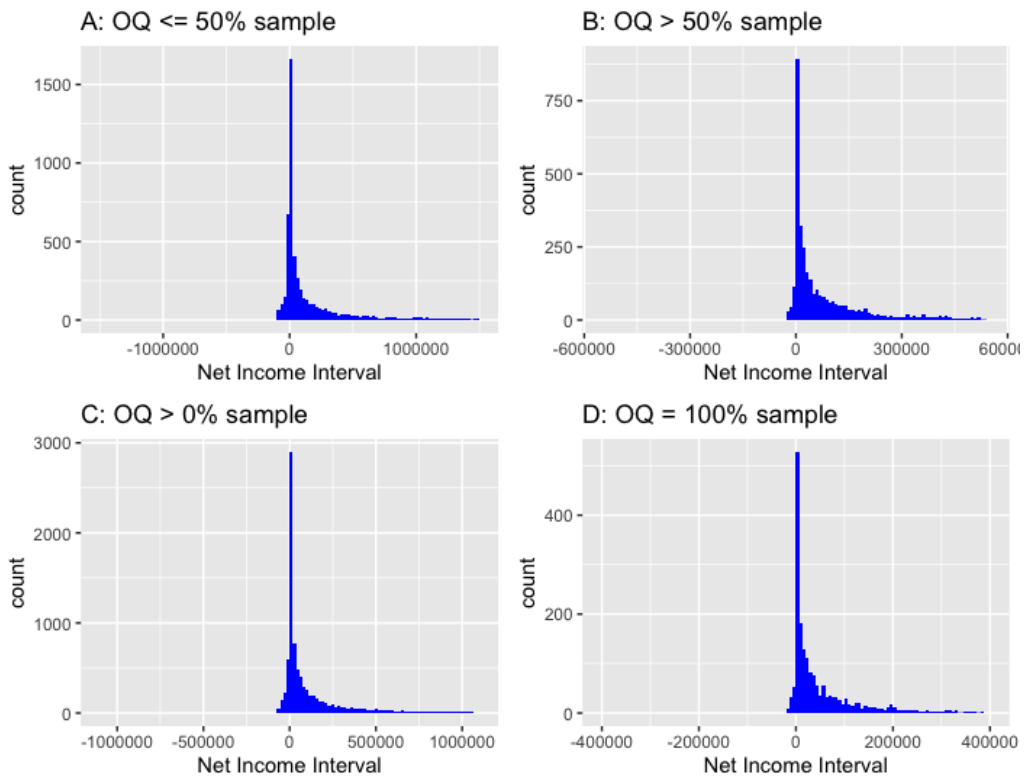

Figure 4.3: Distributions of net income during the post- law introduction period. The figure reports the distributions of net income intervals following the approach in Burgstahler and Dichev (1997), which are divided according to the ownership quota (denoted as OQ), in each panel respectively.

ber improved abruptly after the implementation of the new regulation. The distribution of negative net earnings changes sharply between the pre- and post-introduction period analysed, showing a substantial number of MOEs incongruously publishing positive earnings during the period in which the law was in force. By looking at the bars moving from the left to the right-hand side of the charts, this is even more true for entities for which the share owned by the municipality is larger (i.e. greater than 50% and equal to 100%), in these cases almost all of them change their earnings from negative to positive. Small changes can be seen in the distribution of net income for MOEs with a smaller local government ownership quota (i.e. less than 50%) or in the overall sample. However, a potential drawback of Burgstahler and Dichev's (1997) approach is that its results may be affected by changes in the macroeconomic situation that can affect company results, mainly in the same direction. Therefore, I resort to Benford's (1938) law analysis.

In applying the digit-based procedure, I start with the results illustrated in Figures 4.4 and 4.5, showing whether the distribution of the empirical data obeys Benford's law. Figure 4.4 shows the analysis carried out on the sub-sample of the period preceding the introduction of the new accounting regulation. The panels each correspond to the different subsamples divided by the municipality's ownership quota (OQ),

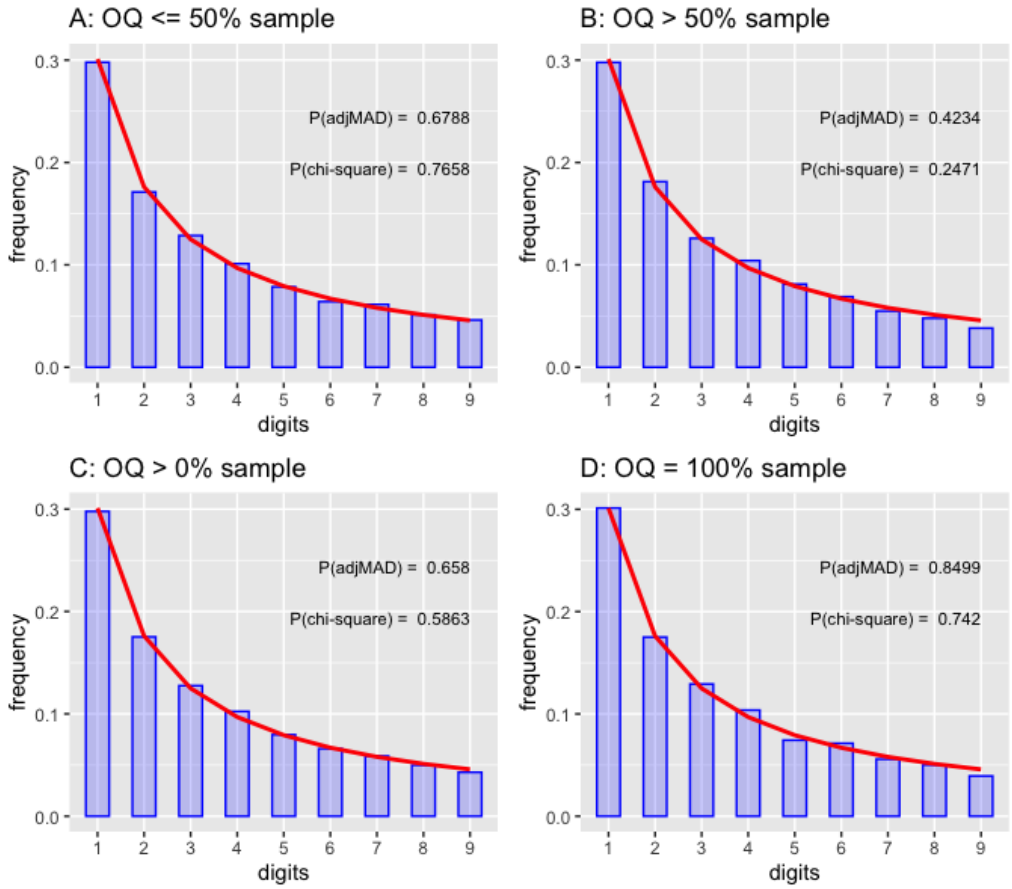

Figure 4.4: First-digit distributions of net income during the pre-law introduction period. The figure reports the empirical (blue bars) and Benford's (red curves) values of the first digit frequencies for the four samples analysed, which are divided according to the ownership quota (denoted as OQ), in each panel respectively. P(•) denotes the p-value of the corresponding test.

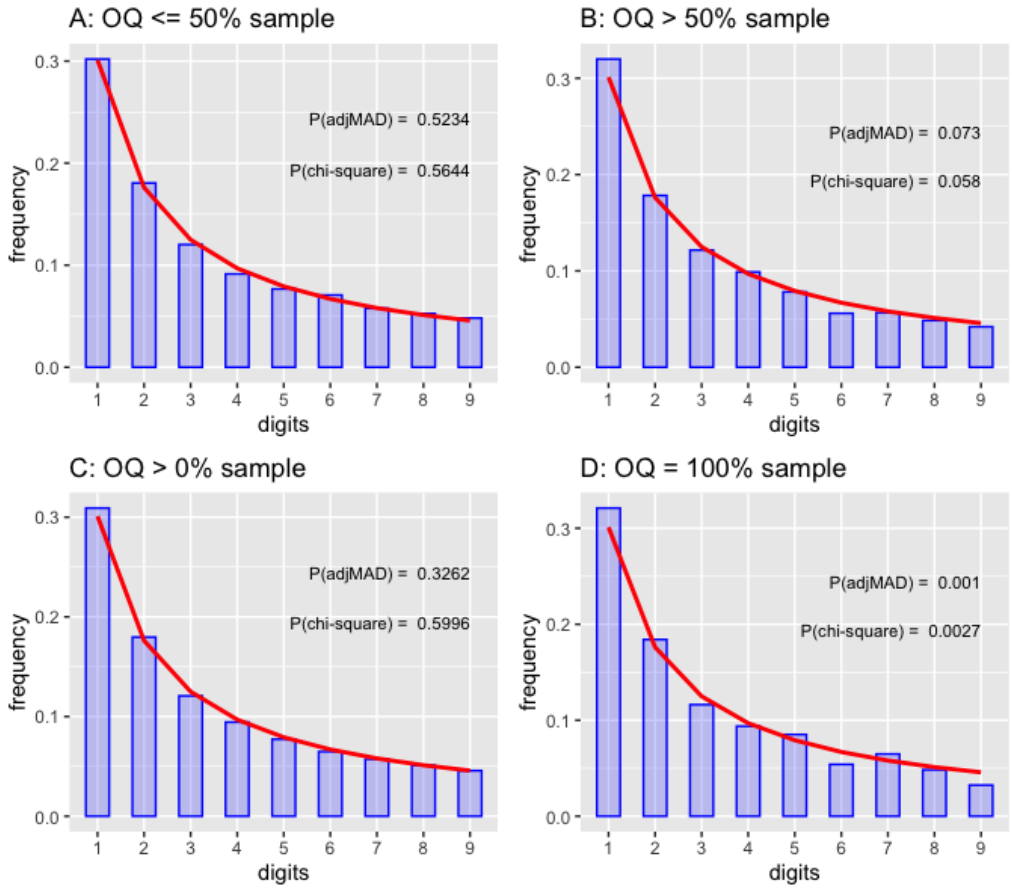

Figure 4.5: First-digit distributions of net income during the post-law introduction period. The figure reports the empirical (blue bars) and Benford's (red curves) values of the first digit frequencies for the four samples analysed, which are divided according to the ownership quota (denoted as OQ), in each panel respectively. P(•) denotes the p-value of the corresponding test.

and all show a perfect fit between the first digit distribution of MOEs' net income and Benford's distribution. This is the expected result in the absence of data manipulation. Figure 4.5, on the other hand, shows the samples relative to the period following the introduction of the new rule, with widespread irregularities in the distribution of net income figures for entities directly (OQ > 50%) or entirely (OQ 5 100%) controlled by local governments. There seems to be an overuse of the number 1 and an underuse of the number 9 as the first digit of net income. This is consistent with the tendency to round off that is hypothesised in previous accounting research using Benford's law (Carslaw, 1988, Thomas, 1989), according to which managers round earnings off to the nearest cognitive reference point (e.g. EUR 99,873 to EUR 100,000).

We then applied the standard χ^2 and the tests based on excess MAD to check conformity with Benford's first-digit law. Table 4.2 reports the results in terms of conformity of the tests carried out on net income digits with respect to each subsample in both periods, pre- and post-introduction of the accounting regulation. Both statistical tests provide consistent results across all the samples and periods. There is no significant evidence of a decrease in data quality for entities where the quota owned by the municipality is less than or equal to 50%, neither in the period before the introduction of the regulation (from 2010 to 2014) nor in the period when the regulation was in force

(from 2015 to 2019). In other words, the distribution of net income figures for MOEs within those subsamples conforms well to and obeys to Benford's law, supporting the belief that my dataset is an appropriate candidate for such analysis. This provides a control when examining entities with majority local government ownership (a share that is greater than 50%), which effectively shows a statistically significant mean deviation of 1.5% from the expected distribution (at the 10% level) after the proportional appropriation system came into being. There is no evidence of data manipulation for the period prior to the introduction of the accounting regulation, which again provides further support for the applicability of the chosen method, given its conformity with Benford's law.

Lastly, I repeated the tests for the entire sample in the pre- and post-introduction periods and no irregularities were found in the distribution of the figures for net income. This supports the findings in the subsample for entities wholly controlled by the municipality (100% share), which show that the decrease in data quality in financial statements is indeed being driven by controlled entities. A possible explanation for the results might lie in the fact that MOEs in which the municipality has a smaller share (i.e. <50%) have decreasing budget restrictions and thus incentives to make them look financially healthier, which in turn implies that as the local government ownership share increases, and consequently the budget

Table 4.2: Benford's law conformity tests on the first digit of net income numbers. The table reports the χ^2 and Z-tests for MOEs' net income numbers in each subsample divided by the ownership quota of the municipality. The chi-squared test is computed as $\chi^2 = n\sum_{i=1}^{9}\frac{(p_i - b_i)^2}{b_i}$, where n is the number of observations and p_i represents the proportion of the first digits (1, ..., 9) in the sample. Whereas the Z-test is computed on the excess MAD calculated as $\delta_{n,9} = MAD_{n,9} - E(MAD_{n,9})$, where $MAD = \frac{1}{9}\sum_{i=1}^{9}|(p_i - b_i)^2|$ and $E(MAD_{n,9})$ is the expected mean absolute deviation on the first digit in the presence of n observations. The pre period goes from 2010 to 2014, while the period goes from 2015 to 2019. P-values are reported within parentheses below the tests and n number of observations for each sample is in italics below the excess MADs. Excess MAD is expressed in percentage terms.

quota	Chi-squared		excess MAD			
	pre	post	pre	Z-test	post	Z-test
<=50	4.92 (-0.7658)	6.74 (-0.5644)	-0.0385 *6,425*	-0.46 (-0.6788)	-0.0048 *6,425*	-0.06 (-0.5234)
>50	10.26 (-0.2471)	15.06 (-0.0579)	0.0196 *4,175*	0.19 (-0.4234)	0.148 *4,175*	1.45 (-0.0729)
>0	6.55 (-0.5863)	6.43 (-0.5996)	0.0262 *10,600*	-0.41 (-0.658)	0.029 *10,600*	0.45 (-0.3262)
100	5.14 (-0.742)	23.59 (-0.0026)	-0.1411 *2,320*	-1.04 (-0.8499)	0.4195 *2,320*	3.08 (-0.001)

restriction, so the self-serving use of accounting discretion in financial statements published by MOEs also increases. Local governments with less than 50% ownership also have no formal powers over the governance of the MOE. Despite being based on fewer observations, the evidence against Benford's distribution for both the χ^2 and the Z-tests based on the excess-MAD in those MOEs is even stronger (the test p values are below any conventional significance level), suggesting that the pervasiveness of anomalies grows with the municipalities' share of ownership. This conclusion is reinforced by the fact that the number of observations, in this case, is smaller, thus reducing the power of the test.

For robustness, all the tests have been performed on different sampling procedures considering shorter time periods around the introduction of the accounting regulation (e.g. 4 and 3 years before and after) from which I obtained qualitatively similar results. To summarise, my analysis confirms both my theoretical predictions. Firstly, the introduction of strict budget regulation for local governments is shown to be positively associated with earnings management practices in participating entities, as there is evidence of low quality in accounting data for the period following the implementation of Article 21 of Legislative Decree 175/ 2016, confirming Prediction 4. Thus, the first alternative hypothesis is not rejected. Secondly, the quality of MOEs' financial statements in the post-

introduction period deteriorates even further when municipalities have to appropriate proportionally more resources to cover MOEs' losses, implying that local governments have increasing incentives to make their entity adjust published net income figures. This is consistent with Prediction 5, related to the fact that a reduction in the spending power through financial resource appropriation for local governments increases the likelihood of earnings management practices in MOEs at an increasing rate, proportional to the municipality's ownership share. A policy that reduces spending for local governments if the financial performance of their MOEs suffers, encourages accounting data manipulation in these MOEs to ensure incumbent politicians can maintain their spending power. Predictably, this effect is more pronounced in those MOEs that are fully owned by these local governments.

4.6 Conclusions

This essay examined the unexplored issue of the impact of financial resource appropriation systems in local governments on the quality of MOEs' financial reporting. I find signs of accounting data manipulation upon the introduction of a new regulation that forces Italian municipalities to appropriate resources proportionally to their share of ownership in controlled entities when these report losses. Evidence of this manipulation is stronger as the ownership share increases, implying that

as local governments face proportionally greater reductions in their spending power on the basis of their ownership share, they have greater incentives to get their entities to engage in the manipulation.

This study therefore contributes to the flourishing debate on earnings management practices in public sector accounting. It also extends the small body of literature examining political factors influencing the self-serving use of accounting techniques in public sector organisations by examining other influencing factors, such as local government spending power. More importantly, I were able to develop new theoretical insights for earnings management in entities owned by the State which extend both positive accounting and agency theories. To the best of my knowledge, these predictions have no known parallel in the literature and the uniqueness of the setting analysed is an excellent opportunity to test them. Lastly, this essay sheds light on how well-intentioned government policies can backfire by incentivising municipalities and MOE executives to manipulate accounting data so as to avoid financial penalties. It thus suggests that reviewing these policies and taking the incentives of all actors into greater account may be appropriate.

Our documented evidence of somewhat inefficient responses by those responsible for preparing the MOEs' financial statements also has major policy implications. Firstly, the activities

of auditors are directly influenced given that, in the Italian context, auditors and forensic accountants will need to pay closer attention to the quality of MOEs' financial statements. At the national level, stronger policies, both internal and external to the organisation could help. Secondly, my empirical findings have clear implications in terms of MOE managers' reappointment and bonuses. It appears vital to shield managers from political influence, perhaps by implementing OECD recommendations and making the process of hiring managers more open. As a result, a sound strategy would ensure the independence of directors and managers while discouraging incumbent politicians from wielding control over them when the circumstances might favour such conduct. Thirdly, in light of the ongoing, recent debate over the adoption of accrual-based accounting by governments and state-owned enterprises, the quality of financial statements should always be at the heart of new international policies. The results of this study ultimately suggest that other similar major European countries, those which have more widespread development of SOEs in proportion to their GDP (Casamonti and Gottardo, 2020), should see my results as red flags and learn lessons from the Italian experience on how to prevent earnings management practices.

While the empirical approach used in this study can avoid the influence of other confounding factors on the results, such

as economic cycles, the analysis can only be used to infer the quality of the accounting data itself, and not the direction (upward or downward) of the earnings management activities, or even the actual fraud. Another limitation of this study could lie in the interpretation of the empirical findings. The earnings management results are proxied by the quality of the MOEs' financial statements, which are the consequence of the anomalies and abnormal digit occurrence in net income figures. Any interpretation should remain confined to the quality of the accounting data or in symptoms of data manipulation, otherwise, it could be misleading. Possible alternative explanations can be processing inefficiency or errors, but the focus of this study remains that of accounting data quality. Further research could potentially investigate the issue examined in this study further with alternative mainstream approaches to spot any fraudulent behaviour more accurately. Moreover, the generalisability of the argumentation could be tested in other contexts with comparable institutional settings.

Given the interesting results, it would also be worth further investigating the extent to which the accounting regulation analysed has had a genuine impact on reducing the losses of those particular entities and, in turn, has allowed local governments to save the financial resources that might be needed in the future to guarantee the continuity of the entities they own. A final avenue of research in the future can consist of

verifying the active participation of incumbent politicians in earnings management activities, based on the Public Choice theory.

Chapter 5

Discussions & Conclusions

In concluding this dissertation, I revisit and synthesize the findings of my two essays, which collectively advance our understanding of earnings management in municipally owned entities, particularly in the context of local elections and proportional appropriation systems. The conclusion integrates these findings with the broader literature, reflects on their implications, acknowledges the limitations of my research, and suggests avenues for future research.

The first essay established a significant relationship between local election periods and the quality of financial statements in MOEs. By using an analytical procedure to spot data alteration named Benford's Law, it was observed that financial statement manipulation is notably prevalent in entities wholly controlled by municipalities, especially during pre-electoral periods. This manipulation often does not transgress generally

accepted accounting principles but alters data quality to fulfil specific goals.

The second essay extended this discussion to the impact of a new appropriation system in Italian municipalities, discovering that the introduction of this system led to increased manipulation of financial statements, more pronounced in entities with higher municipal ownership. This manipulation is a response to the regulation requiring municipalities to allocate resources proportionally to their share of MOEs reporting losses.

These findings contribute to the literature on public sector accounting by highlighting the interplay between political factors, regulatory frameworks, and financial reporting quality. They support theories that posit political motivations and fiscal pressures as significant drivers of earnings management, particularly in public sector contexts.

The implications of these studies are multifaceted. For auditors and regulators, there is a clear need for heightened vigilance in periods surrounding local elections and in contexts where regulatory frameworks tie municipal finances to MOE performance. For policymakers, these findings suggest the necessity of revising government policies and accounting practices to mitigate the incentives for earnings manipulation. Additionally, they highlight the importance of ensuring managerial independence in MOEs to prevent political interference

in financial reporting.

The methodology adopted, while robust, has its limitations, primarily in its ability to infer data quality rather than specify the direction of earnings management or identify fraudulent activities explicitly. Future research could explore alternative methods to more precisely detect and characterize earnings manipulation. Furthermore, the generalizability of the findings could be tested in different institutional settings and sectors.

Future research should investigate the individual motivations of managers versus external pressures in earnings manipulation and examine the broader impact of accounting regulations on the financial sustainability of MOEs. Additionally, exploring the active role of politicians in influencing accounting practices in MOEs would further enrich the literature on public choice theory.

This dissertation, by addressing previously inconclusive areas in financial statement analysis in the public sector, not only fills a crucial gap in accounting literature but also provides practical insights for auditors, policymakers, and regulators. The evidence gathered underscores the intricate relationship between political environments, regulatory systems, and financial reporting quality. It also calls for a reevaluation of current practices to enhance transparency and accountability in public sector financial reporting. Through this work, I have

endeavoured to contribute a nuanced understanding of earnings management dynamics in MOEs, offering a solid foundation for future explorations in this vital area of public sector accounting.

Appendix A

Implementation of Excess MAD Tests in R

```r
# Normal excess-MAD test as in Cerqueti and Lupi (2022)
exc.MAD.test <- function(data, type = "1",
                         plot.severity = FALSE, lower.lim = NULL
    , upper.lim = NULL,
                         plot.Benford = FALSE)
  ## data: vector of data to test
  ## type: "1" first digit; "12" first-two digits
  ## plot.severity: should severity plot be produced?
  ## lower.lim: min excess MAD to be plotted in severity plot.
    Default 0
  ## upper.lim: max excess MAD to be plotted in severity plot.
    Default empirical excess MAD
  ## plot.Benford: should a plot of estimated and Benford's
    frequencies be produced?
{
  sigdigits <- function(x, type = type)
    ## Extracts first and first-two significant digits from
    numbers
    ## x: vector of numbers
    ## type: "12", first-two; "1", first
    ## Ref. Barabesi et al. (2018)
  {
    Sx  <- round(10^(log10(abs(x)) - floor(log10(abs(x)))), 6)
    ifelse(type == "1", Dmx <- floor(Sx), Dmx <- floor(Sx * 10))
    return(Dmx)
  }
```

```
22
23  ## Prepare data for analysis
24  data <- as.matrix(data)
25  data <- abs(data[complete.cases(data)])
26  data <- data[data != 0]
27  n <- length(data)
28  ## extract significant digits from data
29  data12 <- sapply(data, function(x) sigdigits(x, type = type))
30  data <- data12
31  rm(data12)
32
33  require("ggplot2")
34  ifelse(type == "1", d <- 1:9, d <- 10:99)
35  k <- length(d)
36  b <- log10(1 + 1/d)
37  ones <- rep(1, k)
38  # covariance matrix of the e's
39  Sigma <- diag(b) - b %*% t(b)
40  D <- diag(sqrt(b*(1-b)))
41  invD <- solve(D)
42  # covariance matrix of the standardized e's (correlation)
43  C <- invD %*% Sigma %*% invD
44  diag(C) <- 1 #(avoid approximations)
45  # Cov(|X|, |Y|) [Smythe e Wellner, 2001]
46  EXY <- function(i,j) 2/pi*(C[i,j]*asin(C[i,j]) + sqrt(1 - C[i,
      j]^2))
47  # covariance matrix of |e*|
48  R <- C * 0; for(i in 1:k)for(j in 1:k) R[i,j] <- EXY(i,j) - 2/
      pi
49  n <- length(data)
50  # empirical frequencies
51  fE <- as.numeric(table(factor(data, levels = d)))/n
52  e <- fE - b  # difference between empirical and Benford
53  MAD <- mean(abs(e))
54  expected.MAD <- sqrt(2/(pi*n*k^2)) * t(ones) %*% D %*% ones
55  variance.MAD <- as.numeric(t(ones) %*% D %*% R %*% D %*% ones)
56  excess.MAD <- as.numeric(MAD - expected.MAD)
57  norm.test.stat <- k*sqrt(n) * excess.MAD / sqrt(variance.MAD)
58  fig.severity = NULL
59  fig.Benford = NULL
60  if(plot.severity == TRUE)
61  { fig.severity <- "Test statistic < 0: severity plot cannot be
      produced."
62    if(norm.test.stat > 0)
63    {
64      if(is.null(lower.lim)) lower.lim <- 0
65      if(is.null(upper.lim)) upper.lim <- excess.MAD
66      fig.severity <- ggplot() +
67        geom_function(fun = function(x) pnorm(norm.test.stat,
68                                              sqrt(n) * k * x /
      sqrt(variance.MAD),
69                                              1),
```

```
                        colour = "black", n = 512, size = 1) +
        xlim(lower.lim, upper.lim) +
        theme(legend.position="none") +
        labs(x = "excess MAD", y= "severity")
    }
  }

  if(plot.Benford == TRUE)
  {
    ifelse(max(d) == 9, brks <- seq(1, 9, 1), brks <- seq(10,
    90, 10))
    freqs <- data.frame(as.factor(d), fE, b)
    names(freqs) <- c("digits", "fE", "fB")
    fig.Benford <- ggplot(freqs) +
      geom_col(aes(x = digits, y = fE),
               width = 0.5,
               color = "blue",
               fill = "blue",
               alpha = 0.2) +
      geom_line(aes(x = digits, y = b),
                size = 1,
                color="red",
                group = 1) +
      scale_x_discrete(breaks = brks) +
      labs(x = "digits", y = "frequency")
  }

  return(list("MAD" = MAD,
              "excess.MAD" = excess.MAD,
              "test.stat" = norm.test.stat,
              "pvalue" = 1 - pnorm(norm.test.stat),
              "figure.severity" = fig.severity,
              "figure.Benford" = fig.Benford))
}
```

Listing A.1: Excess Mean Absolute Deviation Tests Algorithm

```
# Chi-square test as in Cerqueti and Lupi (2022)
chi.sq.test <- function(data, type = "1",
                        plot.severity = FALSE, lower.lim = NULL,
    upper.lim = NULL,
                        plot.Benford = FALSE)
  ## data: vector of data to test
  ## type: "1" first digit; "12" first-two digits
  ## plot.severity: should severity plot be produced?
  ## lower.lim: min excess MAD to be plotted in severity plot.
    Default 0
  ## upper.lim: max excess MAD to be plotted in severity plot.
    Default empirical excess MAD
  ## plot.Benford: should a plot of estimated and Benford's
    frequencies be produced?
```

```
{
  sigdigits <- function(x, type = type)
    ## Extracts first and first-two significant digits from
   numbers
    ## x: vector of numbers
    ## type: "12", first-two; "1", first
    ## Ref. Barabesi et al. (2018)
  {
    Sx  <- round(10^(log10(abs(x)) - floor(log10(abs(x)))), 6)
    ifelse(type == "1", Dmx <- floor(Sx), Dmx <- floor(Sx * 10))
    return(Dmx)
  }

  ## Prepare data for analysis
  data <- as.matrix(data)
  data <- abs(data[complete.cases(data)])
  data <- data[data != 0]
  n <- length(data)
  ## extract significant digits from data
  data12 <- sapply(data, function(x) sigdigits(x, type = type))
  data <- data12
  rm(data12)

  require("ggplot2")
  ifelse(type == "1", d <- 1:9, d <- 10:99)
  k <- length(d)
  b <- log10(1 + 1/d)
  ones <- rep(1, k)
  n <- length(data)
  # empirical frequencies
  fE <- as.numeric(table(factor(data, levels = d)))/n
  e <- fE - b  # difference between empirical and Benford
  ## Chi-square [chi-square with ndigit-1 df]
  chi2 <- n * sum(e^2/b)
  p.chi2 <- 1 - pchisq(chi2, k-1)

  fig.severity = NULL
  fig.Benford = NULL
  if(plot.severity == TRUE)
  {
    if(is.null(lower.lim)) lower.lim <- 0
    if(is.null(upper.lim)) upper.lim <- chi2/n
    fig.severity <- ggplot() +
      geom_function(fun = function(x) pchisq(q = chi2,
                                             df = k-1,
                                             ncp = x*n),
                    colour = "black", n = 512, size = 1) +
      xlim(lower.lim, upper.lim) +
      theme(legend.position="none") +
      labs(x = "non centrality parameter / n", y= "severity")
  }

```

```
  if(plot.Benford == TRUE)
  {
    ifelse(max(d) == 9, brks <- seq(1, 9, 1), brks <- seq(10,
   90, 10))
    freqs <- data.frame(as.factor(d), fE, b)
    names(freqs) <- c("digits", "fE", "fB")
    fig.Benford <- ggplot(freqs) +
      geom_col(aes(x = digits, y = fE),
               width = 0.5,
               color = "blue",
               fill = "blue",
               alpha = 0.2) +
      geom_line(aes(x = digits, y = b),
                size = 1,
                color="red",
                group = 1) +
      scale_x_discrete(breaks = brks) +
      labs(x = "digits", y = "frequency")
  }
  return(list("chi2" = chi2,
              "pvalue" = p.chi2,
              "figure.severity" = fig.severity,
              "figure.Benford" = fig.Benford))
}
```

Listing A.2: *Chi − Squared* Tests on the Excess MAD Algorithm

Appendix B

Additional Robustness Results

This section provides additional robustness results for the first essay of Cahpter 3. Below are the figures illustrating the alternative first-two digits tests based on Benford's law with the respective MAD criteria on different balance sheet items, namely revenues, other revenues, pre-tax income, and net income. For each test there is a corresponding figure representing the density of the bootstrap-based samples and that under the null hypothesis that Benford's law is valid at the 5% significance level.

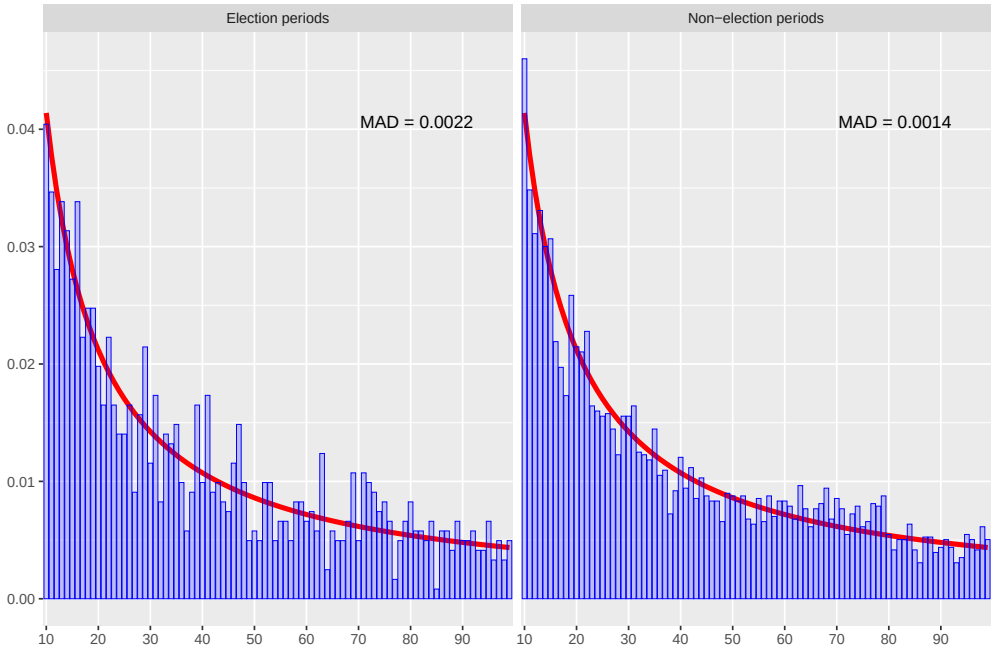

Figure B.1: Distribution of first-two digits of MOEs' revenues. The Panels on the left and right report the empirical (blue bars) and Benford's (red curves) values of the first-two digit frequencies for pre-election data and ordinary-time data, respectively.

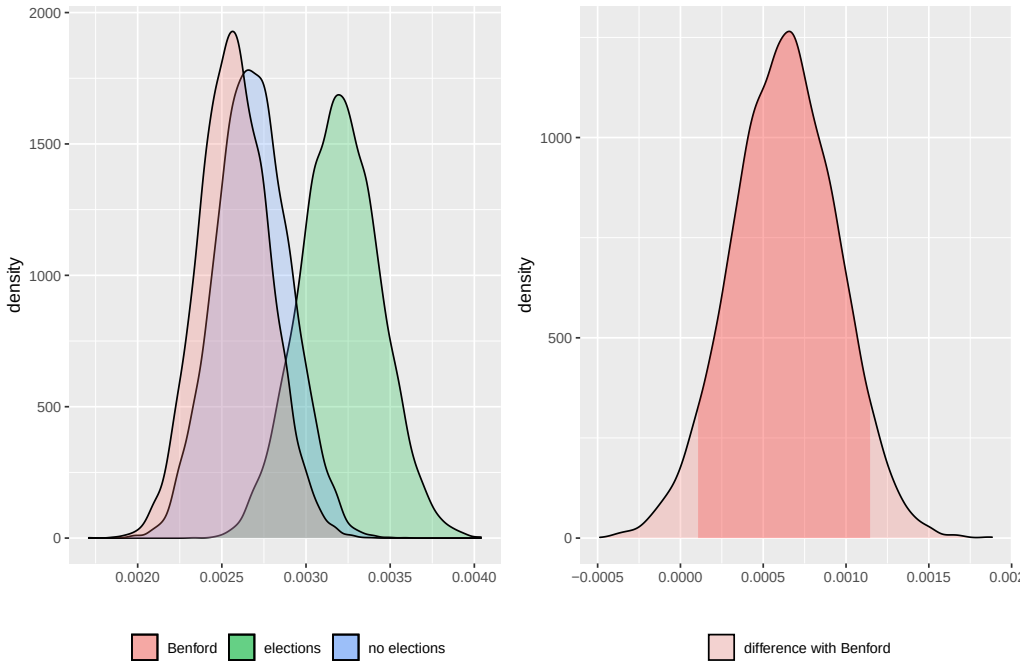

Figure B.2: Bootstrap-based densities of MAD for MOEs' revenues. The Panel on the left reports the densities of the relevant statistics estimated using 10,000 subsamples from the ordinary-time data (blue), pre-election data (green) and the theoretical densities of Benford's law (red). The panel on the right reports the density under the null hypothesis that Benford's Law is valid at the 5% significance level.

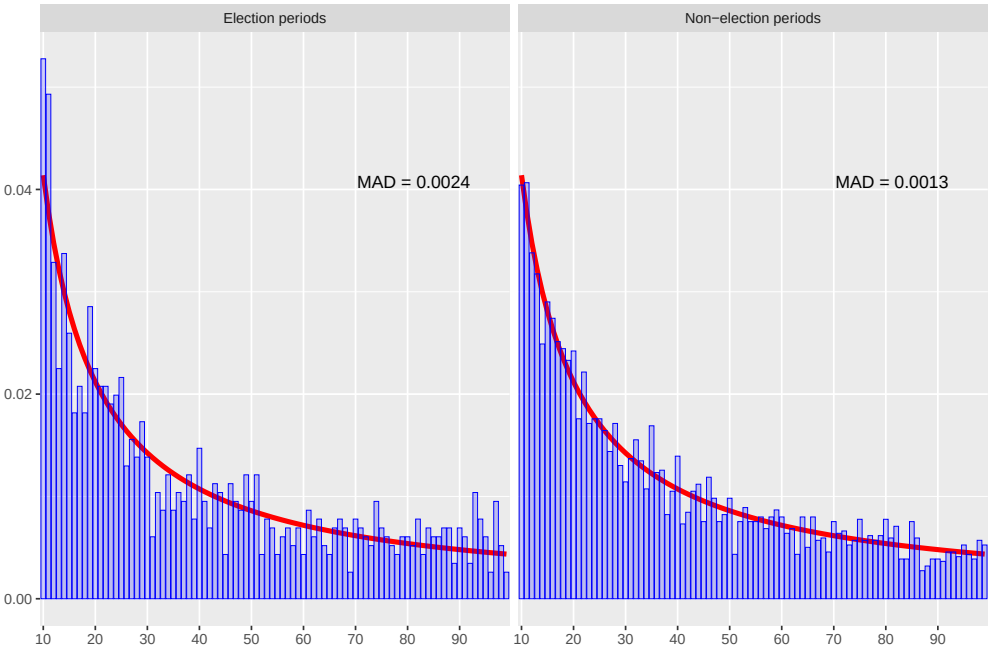

Figure B.3: Distribution of first-two digits of MOEs' other revenues. The Panels on the left and right report the empirical (blue bars) and Benford's (red curves) values of the first-two digit frequencies for pre-election data and ordinary-time data, respectively.

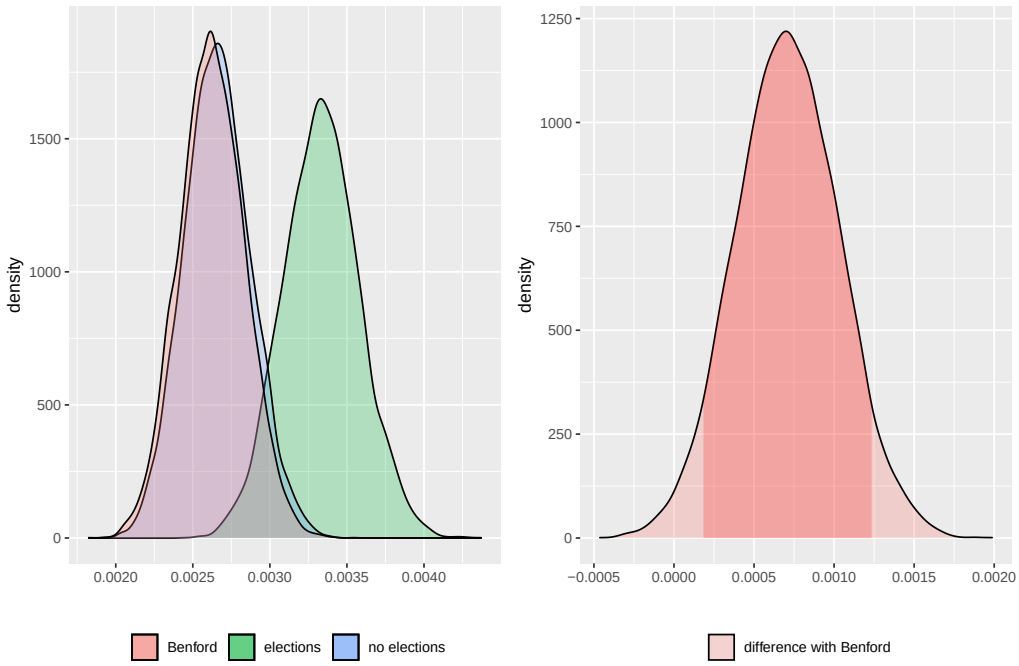

Figure B.4: Bootstrap-based densities of MAD for MOEs' other revenues. The Panel on the left reports the densities of the relevant statistics estimated using 10,000 subsamples from the ordinary-time data (blue), pre-election data (green) and the theoretical densities of Benford's law (red). The panel on the right reports the density under the null hypothesis that Benford's Law is valid at the 5% significance level.

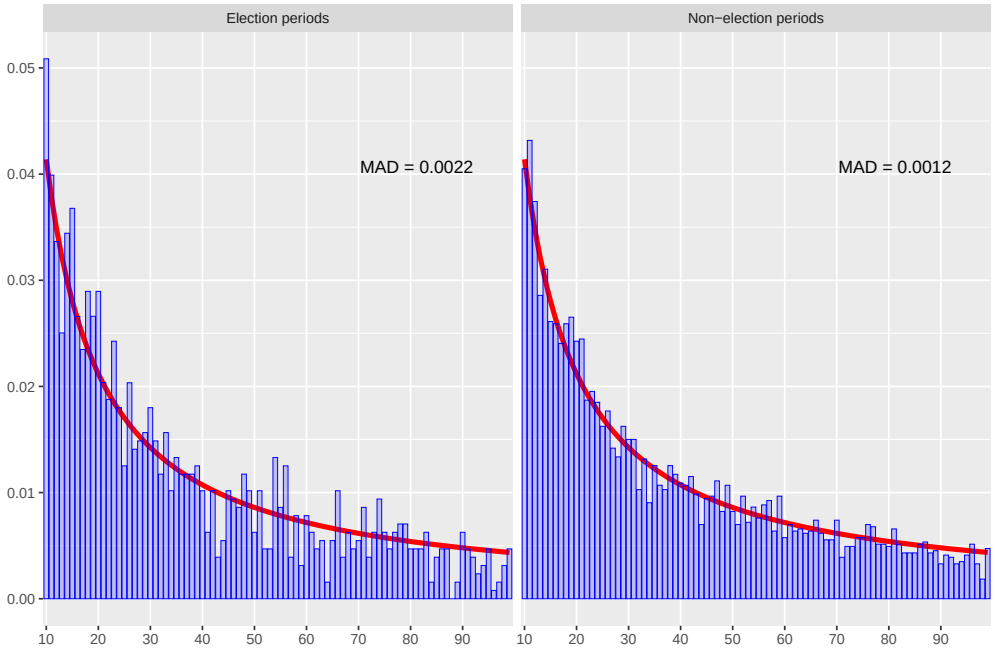

Figure B.5: Distribution of first-two digits of MOEs' net income. The Panels on the left and right report the empirical (blue bars) and Benford's (red curves) values of the first-two digit frequencies for pre-election data and ordinary-time data, respectively.

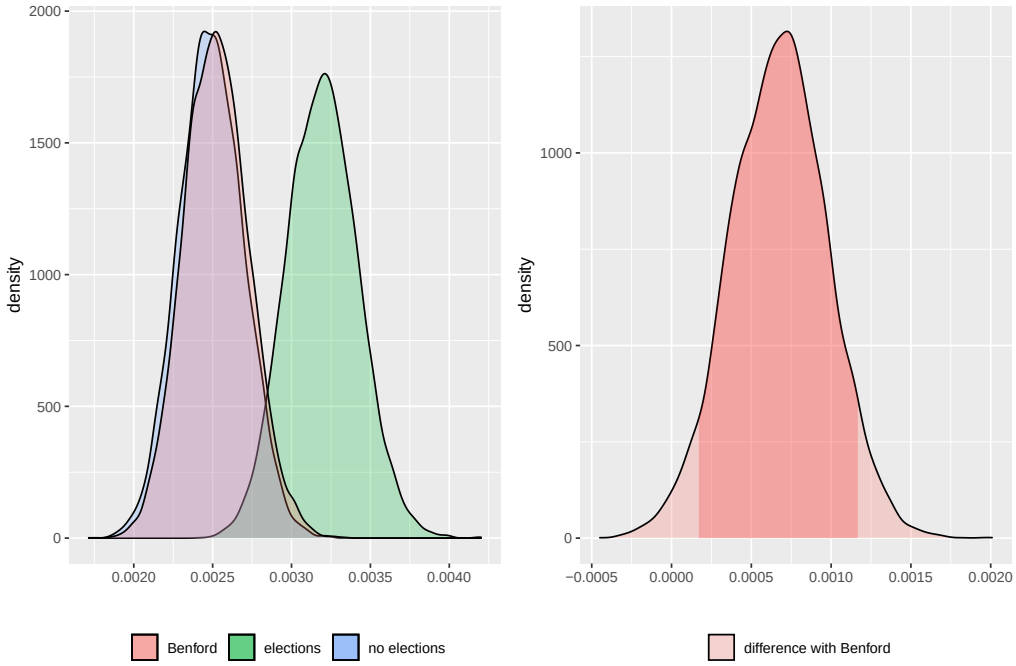

Figure B.6: Bootstrap-based densities of MAD for MOEs' net income. The Panel on the left reports the densities of the relevant statistics estimated using 10,000 subsamples from the ordinary-time data (blue), pre-election data (green) and the theoretical densities of Benford's law (red). The panel on the right reports the density under the null hypothesis that Benford's Law is valid at the 5% significance level.

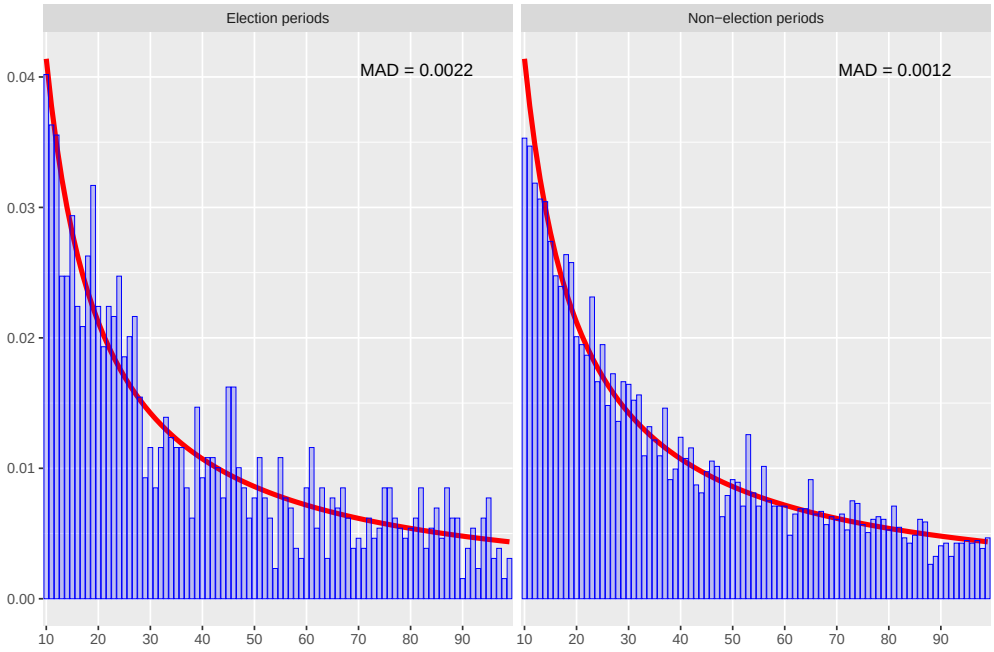

Figure B.7: Distribution of first-two digits of MOEs' pre-tax income. The Panels on the left and right report the empirical (blue bars) and Benford's (red curves) values of the first-two digit frequencies for pre-election data and ordinary-time data, respectively.

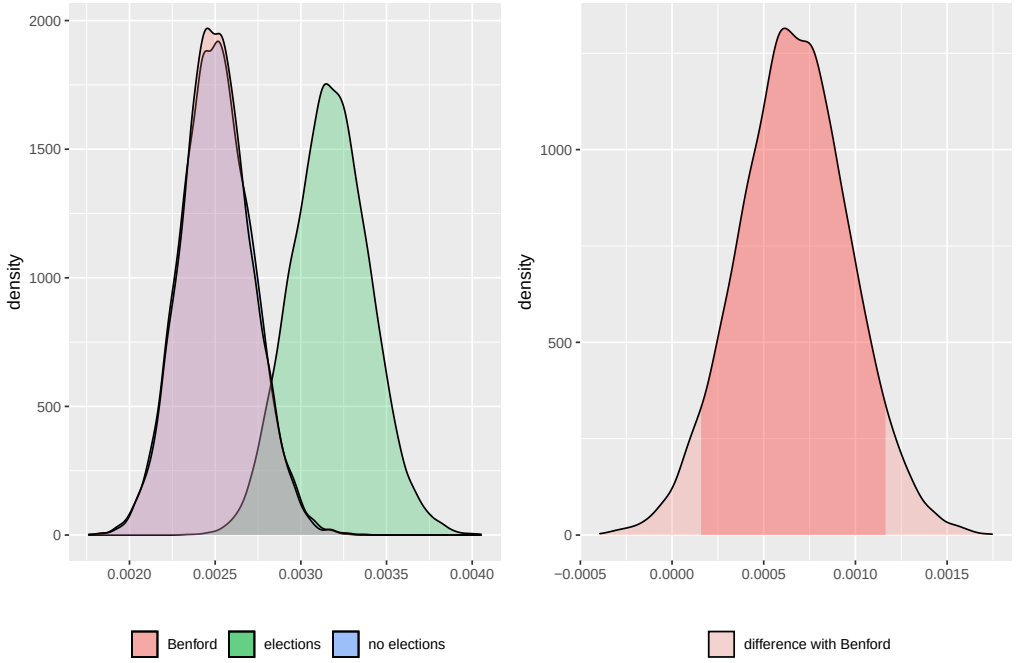

Figure B.8: Bootstrap-based densities of MAD for MOEs' pre-tax income. The Panel on the left reports the densities of the relevant statistics estimated using 10,000 subsamples from the ordinary-time data (blue), pre-election data (green) and the theoretical densities of Benford's law (red). The panel on the right reports the density under the null hypothesis that Benford's Law is valid at the 5% significance level.

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