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# Contents

## Editorial

- Bridging the Divide: Establish the *Public Finance Journal*  
*Bruce D. McDonald III and Craig S. Maher.* . . . . . 3

## Research Articles

- Establishing an Agenda for Public Budgeting and Finance Research  
*Bruce D. McDonald III, et al.* . . . . . 9
- Modeling Approach Matters, But Not as Much as Preprocessing: Comparison of Machine Learning and Traditional Revenue Forecasting Techniques  
*Sarah E. Larson and Michael Overton.* . . . . . 29
- AI as a Budgeting Tool: Panacea or Pandora's Box?  
*Michael E. M. Lee, Daniel Hayes, and Craig S. Maher.* . . . . . 49
- Adoption of Property Tax and Expenditure Limitations by U.S. States: A Multiple Events History Analysis  
*J. W. Decker.* . . . . . 66

## Book Reviews

- The Municipal Financial Crisis: A Framework for Understanding and Fixing Government Budgeting  
*Kenneth W. Hunter.* . . . . . 80
- Municipal Fiscal Stress, Bankruptcies, and Other Financial Emergencies  
*Jonathan B. Justice.* . . . . . 84
- Financial Strategy for Public Managers  
*Stephanie Leiser.* . . . . . 87



# ***Bridging the Divide: Establishing the Public Finance Journal***

Bruce D. McDonald III<sup>1</sup>, Craig S. Maher<sup>2,c</sup>


The creation of *Public Finance Journal* (PF) is the culmination of several years of discussion about how best to address the divide between practitioners' research needs and academic scholarship. PF's origin is predicated on the expectation that for a professional discipline such as public administration and the subfield of public budgeting and finance, in particular, there needs to be an easily accessible forum for the dissemination of ideas and solutions. This journal would not be possible without the support of the Government Finance Officers Association, the oversight committees, the editorial board, and those helping with the journal's management. We are excited about the inaugural edition, where we have reviews of three important books, three thought-provoking research articles, and an article that surveys current research needs in the budget and finance field as expressed by faculty and practitioners.

Keywords: Engaged Research, Public Budgeting and Finance, *Public Finance Journal*

Public administration, in general, and public budgeting and finance, in particular, is a professional discipline. While theory is core to much of the academic research, the key questions asked by scholars are primarily normative. How can we help governments be more efficient and effective? What are the implications of policy changes? How can we better insulate government programs from economic shocks? What is a sound fiscal policy? What are the impacts of certain taxes and the combination of tax systems? What does a fiscally healthy state and local government look like? These are just a sample of questions pursued by public budgeting and finance scholars.

There are excellent outlets for disseminating research by public budgeting and finance scholars, and there are great resources for practitioners provided by organizations such as the Government Finance Officers Association (GFOA). What we have learned from sessions with public budgeting and finance practitioners and researchers, however, is that there are few opportunities where research is shared across these disciplines and practitioners are actively

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engaged in the process. Furthermore, getting access to most academic journals is too costly for most government officials. This is a void we envision being filled by *Public Finance Journal (PF)*.

*PF* is an open-access, online journal developed and sustained through a collaboration of academics and practitioners. This collaboration is nurtured through all phases of the process, beginning with the journal's conception and development (see our advisory board). Another example of this collaboration is the double-blinded manuscript submission review process. The editors are intentional about soliciting reviews that consist of a combination of practitioners and academics.

Similarly, in an effort to attract research on issues germane to public budgeting and finance professionals, GFOA recently launched the GovFi Prize, where they solicited research on a set of topics and offered cash incentives to awardees. Recipients of the 2024 prize include faculty and practitioners, such as a senior economic analyst for Bellevue, WA, and a debt analyst for the Metropolitan Washington Airports Authority. The goal is for these award recipients to write articles that are timely, relevant, and publishable in *PF* (still requiring approval through the double-blind review process).

## **Establishing the Journal**

Given the unique mission of *Public Finance Journal*, we want to take this opportunity to provide some background on the formation and establishment of the journal. The creation of the journal began in the fall of 2021. After observing the limited involvement of practitioners in the annual conference of the Association for Budgeting and Financial Management, Bruce McDonald (North Carolina State University) and Shayne Kavanagh (GFOA) began discussing ideas for how to improve the academic-practitioner divide within this field. Several ideas were discussed over the next several months, including the establishment of academic tracks within the GFOA conference and the establishment of a webinar series where academic research could be presented to practitioners, among others. While McDonald and Kavanagh saw promise in each of the ideas, they kept coming back to the same challenges. Much of the research being conducted in the field does not address the questions that practitioners need to have answered. Further complicating the issue is that most research is inaccessible to the field of practice. Access to most academic research is cost-prohibitive due to the closed, subscription-based models of publishing, and the style of academic writing is often difficult for the typical person to read and understand.

Given the challenges of the relevancy of the research questions being studied and the accessibility of the research produced, any attempt to bridge the academic-practitioner divide would need to address them head-on. To encourage the academic community to engage in research relevant to the community, the work would need to count towards tenure requirements. This meant that it would need to appear in an academically managed, peer-reviewed journal. At the same time, the research would need to appear in a journal that overcomes the barriers of access by publishing on an open-access platform. A new journal was required to create a link between the two communities.

Once the decision was made to propose the establishment of an academic journal by the GFOA, the next step was in drafting the proposal. While the GFOA has a record of publishing

Table 1. Journal Formation Committee

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Shayne Kavanagh, Government Finance Officers Association
Craig S. Maher, University of Nebraska Omaha
Bruce D. McDonald III, North Carolina State University
Michael A. Pagano, University of Illinois Chicago
James L. Perry, Indiana University
Kurt Thurmaier, Northern Illinois University
Kyle Wedberg, Government Finance Officers Association
Katherine Willoughby, University of Georgia

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Table 2. Journal Oversight Committee

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John Hird, University of Massachusetts Amherst
Shayne Kavanagh, Government Finance Officers Association
Chris Morrill, Government Finance Officers Association
James L. Perry, Indiana University
Kyle Wedberg, Government Finance Officers Association

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books and a professional magazine, the proposed journal would be their first foray into academic publishing. From the fall of 2021 through the late spring of 2022, McDonald and Kavanagh drafted, revised, and polished a proposal for a new journal. The primary questions at hand in drafting the proposal were what the focus of the journal would be, how the journal would ensure accessibility to the field of practice, and what it would cost to create and produce the journal.

Kavanagh presented the proposal for the establishment of a journal to the GFOA's board of directors in June of 2022, receiving their approval to begin the formal planning process. To assist in planning, McDonald and Kavanagh recruited an eight-person formation committee. (A list of the members of the journal formation committee is provided in Table 1.) The committee was tasked with establishing a mission statement for the journal, drafting its aims and scope, choosing a name for the publication, and selecting its first editor(s)-in-chief.

Taking on this task, the committee quickly formalized the mission and direction of the journal. In September 2022, based on the recommendation of the committee, the GFOA announced Bruce D. McDonald III (North Carolina State University) and Craig S. Maher (University of Nebraska at Omaha) as the inaugural editors-in-chief of *Public Finance Journal*. While future terms of the editor-in-chief will be three years, McDonald and Maher were appointed for an initial five-year term to provide additional time to establish the journal and provide stability in production during its early years. In the months that followed, McDonald and Maher recruited Meagan M. Jordan (Old Dominion University) to serve as the book review editor, Sarah E. Larson (Miami University) to serve as the social media editor, and doctoral student Saman Afshan (North Carolina State University) to serve as the editorial assistant.

In addition to recommending the appointment of the current editors-in-chief, the journal formation committee also recommended the establishment of an oversight committee. This committee's focus was to provide oversight to the journal on behalf of the GFOA and serve as the points of contact to which the editors would report (See Table 2 for a list of membership in the journal's oversight committee).

Table 3. Editorial Board

2023 Appointees	2024 Appointees
Eugenia Gorina, University of Texas Dallas	Beverly Bunch, University of Illinois Springfield
Kenneth Hunter, Town of Rocky Mount, NC	Laure Celerier, University of Ottawa
Philip G. Joyce, University of Maryland	Dean Michael Mead, Carr, Riggs & Ingram, LLC
Onuyumbe E. Lukongo, Southern University	Samual B. Stone, California State University Fullerton
Christine Martell, University of Colorado Denver	David Swindell, Arizona State University
Charles E. Menifield, Rutgers University	Tammy R. Waymire, Governmental Accounting Standards Board
Francisco Ordaz, U.S. Department of State	Michelle L. Lofton, University of Georgia
Michael A. Pagano, University of Illinois Chicago	Brian Sigritz, National Association of State Budget Officers
Kurt Thurmaier, Northern Illinois University	Carolyn Bourdeaux, University of Georgia
Kyle Wedberg, Government Finance Officers Association	Ben Noble, City of Seattle, WA

With the journal's leadership established, the formal launch took place in January 2023 with the beginning of the editors' term and the announcement of the first members of the editorial board. According to the policies of the journal established by the formation committee, ten individuals are appointed annually to the editorial board, each serving a three-year term. Five of these members are to be appointed by the current editorial team, and the other five are to be appointed by the oversight committee. Given the journal's focus on connecting research to practice, members of the editorial board come from both the field of practice and the academic communities. An overview of the 2023 and 2024 appointees to the editorial board is provided in Table 3.

While the journal formally launched in January 2023, its first year was one primarily centered around planning and recruitment. This included the creation and launch of the journal's website ([www.PublicFinance.org](http://www.PublicFinance.org)), the recruitment of manuscripts to appear in the issue, and managing of those manuscripts through the review process. On February 19, 2024, the journal began posting accepted articles on its website each Monday in the lead-up to the release of the first issue on April 1, 2024. After the release of the first issues, articles will be posted to the journal's website on an ongoing basis as they are accepted and emerge from the production process.

### Mission, Aims, and Objectives

The mission of *Public Finance Journal* is to serve those engaged in public budgeting and finance through the publication of significant advances in the science of the discipline that conveys both theoretical importance and timely application. Timeliness, rigorous research, and applicability are key to the journal and our editorial process. We aim to process manuscripts as quickly as possible.

The journal has four guiding principles. These are:



- *Public Finance Journal* is an open-access journal that is committed to the community of practice;
- All articles published adhere to the standards of peer review and the ethical standards of the Committee on Publication Ethics;
- We encourage posting open data and methods for all published articles to our Dataverse; and,
- Both replications and manuscripts with null results are important to the scientific process.

## Journal Format

*PF* is a biannual journal publishing peer-reviewed research that examines and analyzes contemporary issues in budgeting and finance and explores the applicability of solution sets. The GFOA publishes the journal and serves as a forum for discussion on significant issues related to the advancement of our scientific understanding. Articles go through a rigorous, double-blind peer-review practice that includes three reviewers, two from the academic community and one from the community of practice and is chosen for publication based on their originality, importance, interdisciplinary interest, timeliness, and accessibility. Regarding the latter, the style of writing and language used must be accessible to a broad, non-academic audience.

We publish three types of articles: research articles, survey articles, and book reviews. This first edition is a good example of this practice as we include three book reviews, three research articles, and one survey article. Research articles are original studies whose conclusions represent a substantial advance in the understanding of an important problem and have immediate, far-reaching implications. The typical research paper published by the journal should not exceed 6,000 words in length.

Survey articles are reflections on the status of the field's understanding of a particular topic or issue. A survey article intends to help readers understand what we know about the given topic, where the gaps in the research are, and where future studies should focus. Surveys that are included in the journal are expected to be between 10,000 and 12,000 words. While survey articles are typically editor-solicited, we encourage interested authors to contact us to discuss contributing a survey to the journal.

Book reviews are short, 1,000-1,800-word evaluations of recently published books that offer a brief description of the text's key points and a short appraisal of the strengths and weaknesses of the work. These reviews aim to introduce our community of readers to public budgeting and finance books and to get an overview of their contributions in a quick and accessible format.

## Conclusion

The focus and dissemination of public finance research is at a critical stage. There are challenging questions facing public officials, from managing under greater oversight to pivots in the economy that affect revenue collections (Decker, 2023, 2024). There are pulls on expenditures driven by shifts in demographics and intergovernmental relations. There are additional questions about transparency that include processes regarding how to solicit input on

budgetary decisions, engaging citizens in resource allocations, and the degree to which diversity and equity drive these decisions (Guzman et al., 2023). On top of this, the recent explosion in AI and machine learning offers opportunities for fiscal analyses and policy generation, as demonstrated in this inaugural edition of *PF* (Larson & Overton, 2024; Lee et al., 2024).

As you consider the journal as an outlet for your research, we encourage you to engage with the work of McDonald et al. (2024), published in this issue. McDonald et al.'s (2024) article is the result of more than 200 academics and practitioners who have come together to establish a research agenda for the discipline that includes both the needs of the community of practice and the research interests of the academy. We also encourage your engagement with the "Research Needs Bulletin Board," which appears on our website. The bulletin board is an interactive way for the *PF* community to share research needs, find research questions, or share research opportunities. We hope that this board will be an asset to the field and will help provide guidance and recommendations on what to study and where we can go next.

These are exciting times, and *PF* has the attention of researchers and professionals. We at *PF* offer a unique forum for thought leaders to engage in these research questions, which is free access and includes the perspectives of researchers, academics, and practitioners. We, as editors, are excited about the opportunity to help in the formation of *PF* and sincerely appreciate the time and effort of the journal's formation and oversight committees, the editorial board, and GFOA for enabling this to become a reality.

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# ***Establishing an Agenda for Public Budgeting and Finance Research***

Bruce D. McDonald III<sup>c</sup>, *et al.*<sup>\*</sup>

Public budgeting and finance is a discipline that encompasses communities of research and practice. Too often, however, these communities fail to engage each other, instead choosing to operate independently. The result is that the research being conducted fails to address the questions of the day and our governments' challenges. In this article, we come together as a community of academics and practitioners to establish an agenda for where future research should be conducted. This agenda aims to align the research being undertaken within the academic community with the needs of those working in the community of practice. After establishing ten areas where research is needed, we followed a ranked-choice voting process to establish a prioritization for them. Based on the outcome of this process, the two primary areas where research is currently needed most are the fiscal health of our governments and the implementation of social equity budgeting.

Keywords: Public Budgeting and Finance, Public Finance, Ranked Voting, Research Agenda

Public budgeting and finance are at the heart of public administration (Kettl, 2018). When the New York Bureau of Municipal Research established its training school in 1911, budgeting and finance were central competencies of its program (see Dahlberg, 1966; McDonald, 2010). Governments need resources to provide public goods and services, and it is through the process of budgeting that we establish what streams of revenue a government will use and how the funds will be spent across competing demands (Mikesell, 2017). With this in mind, public budgeting can be viewed as a statement of a government's priorities (Jordan & McDonald, 2025; Lee et al., 2021). Not only has the importance of public budgeting led to the establishment of several field-specific journals, but budget- and finance-related research is frequently published in the generalist journals of public administration and in the journals of urban affairs, political science, economics, sociology, and criminology, among others.

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There is no shortage within the academic literature on what public budgeting and finance is and what it should become. Kioko et al. (2011), for example, argue for the importance of research on financial management, concluding that the research not only contributes to the field of public budgeting and finance but also the broader discipline of public administration. Rubin (2015) sought to establish a research agenda based on an analysis of the classics from the field, and Grossi et al. (2023) adopted a polyphonic approach to establishing a research agenda for public sector accounting research based on the authors' experiences as journal editors and what they would like to publish moving forward. Despite the richness of this debate, it is fair to say that a purely academic perspective has dominated it. Yet one of the key challenges that we face in the area of public budgeting and finance is finding topics that are both interesting and important to the academics who conduct the research and the practitioners who seek to implement it.

The field has always struggled with the academic-practitioner divide (Schwoerer et al., 2022), but the distance between these communities has only grown in recent years (Hall & McDonald, 2023). The involvement of both practitioners in academic-oriented conferences and academics in practitioner-oriented conferences has declined significantly (Posner, 2009). Further exacerbating this divide is the difficulty practitioners face in accessing the published research in the field. This has prevented the two sides from coming together for a dialogue and raises the concern that the research focus of academics no longer aligns with the research needs of practitioners.

In this paper, we seek to overcome this divergence and chart a new direction for research in public budgeting and finance. We have seen significant strides in research over the past few decades. This includes advancements in the statistical tools employed in research, the complexity of the problems being studied, and the number of academics interested in improving the state of budgeting and finance across the United States. We have also seen a new wave of challenges in practice that we struggle to overcome and balance. The Great Recession, the COVID-19 pandemic, and an increasingly politicized environment have all left their mark. In this article, the two sides of public budgeting and finance have come together to discuss the state of our research. Through this dialogue, we find windows of opportunity for research that can make an active and noticeable contribution towards the problems we face as a society and advance the capacity of our brethren in practice. By establishing a research agenda for the field that aligns the research being conducted with the needs of those in practice, we hope to encourage researchers to engage and support these areas of need moving forward.

## **Our Approach**

To establish an agenda for public budgeting and finance research, we took an inclusive approach that encouraged participation from anyone involved in the discipline. As part of an inclusive process, all respondents to the survey were invited to join the project as co-authors. In total, 232 academics and practitioners joined the process.

This process began by establishing a survey that asked participants to list what areas within public budgeting and finance needed attention and why. To gain insight and participation from those in practice, we relied upon the Government Finance Officers Association and the North Carolina Local Government Budget Association to distribute the survey to their members. To incorporate the academic perspective, the faculty directory and teaching schedules of all



NASPAA-accredited MPA programs were reviewed to capture who taught or researched government finance-related topics. An email was then sent to the resulting list inviting their participation.

After the initial survey, all responses were coded and categorized around their main theme. This produced a list of ten areas where additional research is needed. A second survey was distributed to all participants in the first round, asking them to rank the ten categories and provide a short explanation for their choices. Respondents could choose to rank as many or as few of the categories as they wanted. This provided an opportunity for the data to be analyzed using a ranked-order voting process.

Ranked order voting, also known as preferential voting or ranked-choice voting, is a voting system where voters use a rank to order candidates or options—in a sequence from first, second, third, and onwards—on their ballots. The counting of ballots follows a series of rounds such that the option with the fewest votes is distributed to the option that is ranked the next highest. If voters do not rank all options, their vote is removed from the count, and their last preferred option is eliminated from contention. Ranked-order voting intends to maximize the preferences of those voting by allowing them to be considered throughout the entirety of the voting process. In establishing this paper's research agenda, nine rounds of counting were conducted to arrive at the final prioritization of the agenda items.

## **The Research Agenda**

Our collective professional judgment identified ten key areas where research is the most needed to chart a comprehensive course for advancing public budgeting and finance scholarship. A list of these areas and the key research questions that we believe need to be addressed are provided in Table 1. By concentrating on these ten areas, we aim to establish a robust research agenda for public budgeting and finance that meets the needs of those who serve in positions of practice within the field and enriches academic understanding of the discipline.

### Budgeting Systems

One area where research is needed is in the fundamental system in which we work: the budgeting systems we use. The underlying structure of the budgeting process has changed little in the last hundred years. While the function of the budget has not changed, the nature of the governments we budget have, as has the size and complexity of budgets and the technology used to create them. We treat budgeting systems as though they are fixed, choosing to follow the processes and allocation trends that have been made in the past. Governments have several existing approaches to budgeting at their disposal. These include zero-based budgeting, performance-based budgeting, and flexible budgeting. From the standpoint of practice, many governments experiment with these different approaches, hoping to find something that works best for their community. However, research into these approaches tends to be descriptive, ignoring the need to develop further and build new approaches that better meet our needs under current conditions.

To help us understand the budgeting process better and to improve the systems our governments employ, several research questions need to be addressed. These include a more detailed understanding of how the budget process operates and how that process can be improved and/or controlled. Included within the systems category is the need for research that helps us

Table 1. Categories of Research and Their Descriptions

Category	Description
Fiscal Health	Respondents who mentioned fiscal health were interested in seeing research on how to address and improve a government's financial condition. Key issues also included the development of practical measurement systems, a better understanding of severe fiscal stress, improved forecasting of fiscal health conditions, and the impact of budget decisions and processes on fiscal health.
Social Equity Budgeting	Responses related to social equity were broad, exhibiting the widest range of research concerns. Chief among these concerns were how to measure social equity and how to incorporate social equity into the budgeting process effectively. This includes making equitable budget allocations and cuts and developing equitable tax and finance policies. While most responses focused on how to improve equity in the decision-making process, there was also a desire to better understand how past budgeting inequities have impacted communities and perpetuated racial disparities.
Budgeting Systems	Responses that are categorized under budget systems center on how the budget process operates and how that process can be improved. Included within the systems category are understandings about intergovernmental finances, budgeting for special purposes governments, comparative budgeting, and the development of budgetary theory.
Tax and Revenue	The tax and revenue category includes responses that focus on broadening the tax base and diversifying revenue. Concerns regarding the impact of tax incentives, tax competition and collaboration, tax and expenditure limits as a form of state preemption, and sales and property tax policies were included among the responses. Responses also included a need for a better understanding of tax administration.
Data and Methods	Responses categorized as data and methods center on the use of data analytics and the use of new tools or technology in the public budgeting process. This includes how data analytics can be used to improve policy analysis and decision-making, as well as the accuracy of budget and revenue forecasting. Also of interest was how to improve the financial data collected by public service organizations and make it more accessible
Community Engagement	Questions that fall within the community engagement category primarily focused on how the public engages in the budget process, how that engagement can be improved, and how to better engage with targeted communities. They also included a desire to better understand how civic engagement influences budgetary outcomes and what the public knows about the budget process and governmental finances.
Emergency Management	Emergency management and finance relates to the impact of the COVID-19 pandemic and other emergencies, such as wildfires and hurricanes, on the financial condition and budgetary demands of governments. The focus within this category is on how local governments can financially prepare for unknown emergencies and how to improve financial decision-making to help a government survive and recover from the event.
Capital Budgeting	Capital budgeting responses focused on improving the accuracy of capital forecasts and developing better funding plans for capital projects. This includes the need for capital accounting and reporting and long-term capital planning during times of uncertainty.
Education Finance	Education finance centers on developing better and more equitable funding models for K-12 schools and public universities. Concerns regarding school funding included a need for a better understanding of how schools budget and manage their debt. Responses also noted the importance of developing a better understanding of the relationship between school finance and the finance of surrounding local governments.
Managing Budget Offices	The category of staffing, training, and organizing budget offices relates to how a budget office is best managed and the use of alternative organizational structures for the office. Also included are how staff should be trained, recruited, and managed, as well as how to prepare staff for ethical decision-making in the budget process.

better understand intergovernmental finances and budgeting for special-purpose governments. In a globalizing world, there is also a need for comparative analyses across governments and governmental systems that can help us understand alternative ways of achieving successful

budget outcomes. Lastly, as we explore the underlying systems of public budgeting, a concerted effort must be undertaken to help develop modern budgetary theory.

### Community Engagement

Community engagement involves community members in the decision-making process (Young & Tanner, 2023). As a core component of a democratic and representative government, it helps to make our public institutions more transparent, accountable, effective, and equitable. When viewed through a budgeting lens, the leading mechanism of community engagement is participatory budgeting (Shybalkina, 2022). This process empowers community members to actively determine the allocation of specific portions within a government's budget (Manes-Rossi et al., 2023).

The incorporation of community engagement in the budgeting process is often challenging for members of the public, as participation is costly and susceptible to free-rider problems. Many who may want to participate are unable to do so because of the burdens they experience, such as the lack of child care at meetings or meetings held in locations and at times that are not convenient for public transportation. Even when public members overcome such limitations, there are anecdotal stories about local governments moving budget meetings or changing times at the last minute to thwart widespread community involvement.

The rise of participatory budgeting as an important solution for governments emerged from the Porto Alegre experiment in Brazil in the 1980s (Bhatnagar et al., 2003). While this experiment initially saw many successes, the use of community engagement in budgeting has declined in Brazil. Several questions come to mind as we reflect on the successes and failures of community engagement efforts. The questions that are important for research to address focus on how the public engages in the budget process and how that engagement can be sustained and improved. It is also important for research to be conducted that gives us an understanding of how we better engage with targeted communities to improve their involvement and representation. Finally, there is an urgent need to understand better how civic engagement influences budgetary outcomes and what the public knows about the budget process and governmental finances.

### Social Equity Budgeting

Theory and research are needed to incorporate social equity principles into the budgeting process. In recent years, social equity has become a key topic for both our governments and our society as a whole (Guy & McCandless, 2020; McCandless et al., 2022). While much of the discussion has centered around policy-making and service provision (see Stokan et al., 2023), the budgeting issue continues to emerge as governments struggle with how to pay for the initiatives. Traditionally, we have viewed budget staff as neutral arbiters (Johnson & Kavanagh, 2021). However, the rise of social movements such as Defund the Police and Black Lives Matter has challenged established conceptions of how public budgeting addresses social equity (Guzman et al., 2023; McDonald & McCandless, 2024). The result is that the budget staff of many governments are being called to play an active role in equity initiatives (Kavanagh & Kowalski, 2021; Kavanagh et al., 2023).

Social equity is defined in terms of fairness, due process, and justice (Guy & McCandless, 2012). In a budgeting context, the incorporation of social equity principles into the budgeting process can be reflective of changes in the budgeting process itself or in the outcomes

of that process (McDonald & McCandless, 2021). This can include consideration of how public hearings about the budget are held or how public comment is solicited, but it can also be reflective of an intentional effort that ensures the fair allocation of a government's resources throughout the entirety of the community (McDonald et al., 2024). As Rubin and Bartle (2023a, 2023b) remind us, there is no one correct way of incorporating social equity into the budgeting process. Instead, that incorporation should reflect those who live within a community and the inequities that they experience (Guzman, 2023).

As research is being conducted on social equity budgeting, several research questions emerged from our collaborative process that we would encourage scholars to prioritize. Chief among these concerns were how to measure social equity and how to incorporate social equity into the budgeting process effectively. This includes how to make equitable budget allocations and budget cuts, as well as how to develop equitable tax and finance policies. We also encourage explorations into the different ways that local governments are incorporating social equity into their budgeting process and what it would take for a government to run such an initiative effectively. Of course, we would be remiss to point out that while most responses focused on how to improve equity in the decision-making process, research is also urgently needed so that we can better understand how past budgeting inequities have impacted communities and perpetuated socioeconomic and racial disparities.

### Tax and Revenue

The tax and revenue streams available to a government are pivotal to the ability of that government to operate (Mikesell, 2007). There is an ever-growing need for public goods and services (Andres, Clifton, & Ferry, 2022). However, most governments are limited in their ability to raise taxes (Decker, 2023), and elected officials are incentivized to reduce tax rates for political favorability (Due & Mikesell, 1994). Discussions around taxation are always heated, and there is often no good answer, but taxation remains a necessary evil for the continued operation of government.

Of areas related to public budgeting and finance, research on taxes and revenue streams has been among the most prolific. Much of this work, however, has been either on the economic side of tax policy or has produced results that can be challenging for practitioners to implement. As the research on taxation and public revenues progresses, we encourage scholars to focus on how we can broaden our tax bases and diversify our revenue streams. An important consideration of this is how these aims can be achieved given the tax and expenditure limitations that most governments experience. We also believe that there is a continued need for research that will help us understand the impact of tax incentives, competition and collaboration, tax and expenditure limits as a form of state preemption, and sales and property tax policies. The final area of work on taxation and revenue that we would encourage is research that helps provide a better understanding of tax administration, which would help governments improve the efficiency and effectiveness of taxes by looking at the opportunities to take more proactive approaches to influencing taxpayer compliance. In turn, this could help reduce or redress differential tax burdens on our communities.



## Fiscal Health

A key challenge facing the administration of governments is their ability to meet their service commitments and obligations (Hendrick & Crawford, 2014). The availability of resources is central to the capacity of a government to provide or expand a program or service to its residents. During the height of the COVID-19 pandemic, however, the stability of many governments was challenged (de Jong & Ho, 2021; Maher et al., 2020; McDonald & Larson, 2020). Despite a growing concern about the financial constraints that governments experience, we have very little research at our disposal to understand when the constraints and spending obligations become too much and the fiscal health of the government is in jeopardy.

Significant research on the fiscal health of governments has been conducted in recent years (Gorina et al., 2017; Maher et al., 2023; McDonald et al., 2021; Stone et al., 2015). This research, however, has primarily focused on how fiscal health is measured and understood at different levels of government. These first-generation studies have been important for the field in helping us to know where our organizations stand, but we believe that the time has arrived for a new generation of research on fiscal health.

This second generation of fiscal health research should carry the issues of measurement forward to help us develop measurement approaches that are both easily understandable and focus on the long-term health of the government. That research should also help us to understand better what may drive a government to fiscal stress and how we can improve its standing. Other pressing needs of research include work that helps us better understand the impact of a government's fiscal health on its budgetary allocations and the internal processes that take place when a government begins to struggle. Lastly, as public finance forecasting improves (Larson & Overton, 2024; Lee et al., 2024), we should start applying these methodologies to the issue of fiscal health so that we can begin to plan for the long-term condition of a government.

## Capital Budgeting

Capital budgeting refers to the planning, financing, and managing of large asset purchases by governments. These purchases can include the computers and vehicles necessary for government officials to do their jobs, but they also include the purchase or construction of buildings, roads, and bridges. We argue that a focus on capital budgeting is particularly important in this day and age, given the condition of infrastructure around the country (Chen & Bartle, 2022; Fisher & Wassmer, 2015) and the growing complexity of government acquisitions, which require strong contracting and project management approaches (Brown, Potoski, & Van Slyke, 2018; Grandage & Mitchell, 2023). Not only are capital projects expensive, but their useful lifespan typically expands beyond the service of elected officials. This makes it politically easy for officials to ignore reinvestment and maintenance that previous purchases might need. The result is that the infrastructure of many governments are suffering, even failing.

Research questions related to capital budgeting that we need to address are ones that help us improve the accuracy of capital forecasts and develop better funding plans for capital projects. These questions include the need for additional scholarship on capital accounting and reporting and long-term capital planning during times of uncertainty.

## Data and Methods

The tools of statistical analysis have developed rapidly over the past three decades, an advancement that has been both good and bad for the public finance community (Lee et al., 2024). The improvement of our techniques has brought with it improvements in the accuracy of results (Larson & Overton, 2024). At the same time, the skills needed to conduct these analyses have increased, and few governments are able to employ experts to implement them. This is particularly important for budget offices, where staff work with data on a daily basis and are often called upon to conduct forecasts and other statistical analyses.

Given the rate at which statistical analysis, data analytics, and data management are developing, including developments in machine learning and AI, the community of practice needs help to understand which tools they should use and how to implement them effectively. It is in addressing this area that significant contributions to the capacity of governments and budget offices can be made. We encourage research to be conducted on the broad use of new technology in the public budgeting process. Studies addressing this area could focus on how data analytics can be used to improve policy analysis and decision-making, as well as the accuracy of budget and revenue forecasting. Also of interest is how to improve the financial data collected by public service organizations so that it can be made more accessible.

## Emergency Management

The ability to withstand an emergency is a growing concern for local governments. Not only do local governments have to shoulder an increasingly large burden of responsibility in implementing homeland security policies (Krueger et al., 2009), but the number of natural disasters that local governments in the United States and Canada have to respond to has increased significantly in recent years (Public Safety Canada, 2022; Smith, 2023). Disasters can have a considerable financial impact on local governments, and governments are often ill-prepared to respond to large-scale emergencies (Xiang, 2022). At no time has this been more clearly witnessed than with the onset of the COVID-19 pandemic in 2020 (Scognamiglio et al., 2023).

When faced with decisions about financing emergency preparedness, governments are confronted with a number of constraints, including tax limitations and the anti-tax sentiments of their residents (Krueger et al., 2009). They are also faced with a growing list of programs and services from other departments that are seeking a budget allocation (Chen, 2020). Preparedness is important, but the likelihood of a government experiencing an event in any single year is small. As a result, emergency management offices often find themselves at the losing end of budget discussions. Not only have governments left those offices behind in their funding decisions, but we have also largely ignored questions surrounding emergency management and public finance when conducting research.

Understanding that we will continue to experience natural disasters and security threats, any research on the issue is welcome. There are, however, two key research questions that we would encourage scholars to begin with. These are: (1) how can local governments financially prepare for emergencies when they do not know what the emergency will be or when it will occur? And (2) how we can improve financial decision-making in order to help governments survive and recover from an emergency event.

## Education Finance

Education finance centers on the development of better and more equitable funding models for K-12 schools, community colleges, and public universities (Jones et al., 2021). All governments have struggled with issues of education finance as the costs associated with providing quality education have risen faster than the funding available (Rubenstein, 2002). Changes in the nature of how education is provided and how students learn (Zhao & Watterson, 2021), along with declines in students' learning outcomes (Wyse et al., 2020) and challenges of hiring and retaining qualified teachers (Shuls & Flores, 2020), highlight the need for increased education funding and/or increased productivity in education. Where this funding will come from and how we can prioritize the growing list of needs for education remains uncertain. From a public budgeting and finance perspective, we have historically paid little attention to the issue of education finance. Yet, strong educational institutions are needed within our communities in order to promote growth among our residents.

As public budgeting and finance scholars undertake research into education finance, we would encourage them to focus on helping provide a better understanding of how schools and educational institutions budget, how they can budget more effectively, how they forecast, and how they manage their debt and other forms of fiscal constraints. We also believe that there is a need to develop a better understanding of the relationship between school finance and the finances of the surrounding local governments.

## Managing Budget Offices

The final area where we believe research is needed is concerning the management of our budget and finance offices. Office management is about ensuring that the office supports the overall objectives of both the office and the government it serves. We have spent considerable time discussing the aspects of budgeting itself but have given little attention to the operation of our offices.

Understanding how to best run our offices is becoming increasingly important given the challenges we face with staff recruitment. Governments at all levels have experienced a decline in interest in government jobs (Oliveira et al., 2023). At the same time, they have also experienced an increase in the number of public servants leaving the sector. Many of the departures can be attributed to scheduled retirements, but some can also be attributed to a decline in the public service mindset that drew individuals to us (Favero et al., 2023). Budgeting and finance officers are not immune (Walsh & Nason, 2022). Yet, the role we play in the day-to-day operation of our governments and the level of specialized skill needed to succeed in our field means that there is no quick solution and that the implications for our governments can be severe.

As we noted, there has been little research to date on the issue of a sufficiently trained budget and finance workforce, leaving significant room for new research. As research is designed, however, we encourage the academic community to explore questions related to the staffing and organizing of budget offices. This research could focus on how an office is best managed given its unique mission in the government, as well as how alternative organizational structures might improve outcomes. We also encourage research that focuses on the individual level, specifically looking at how to recruit and train budget and finance staff for the future, how

Table 2. Results of Ranked Choice Voting

Category	Round 1		Round 2		Round 3		Round 4		Round 5		Round 6		Round 7		Round 8	
	%		%	+/-	%	+/-	%	+/-	%	+/-	%	+/-	%	+/-	%	+/-
Fiscal	31.03		31.61	0.57	32.76	1.15	35.06	2.30	36.63	1.57	39.66	3.03	46.82	7.17	56.80	9.98
Health																
Social	23.56		24.71	1.15	25.29	0.57	28.16	2.87	30.23	2.07	33.33	3.10	36.99	3.66	43.30	6.20
Equity																
Budgeting																
Budgeting	9.20		9.77	0.57	10.92	1.15	10.92	0.00	12.79	1.87	14.94	2.15	16.18	1.24	Eliminated	
Systems																
Tax and	7.47		8.05	0.57	8.62	0.57	9.20	0.57	10.47	1.27	12.07	1.60	Eliminated			
Revenue																
Data and	9.20		9.77	0.57	9.77	0.00	9.77	0.00	9.88	0.11	Eliminated					
Methods																
Community	6.90		6.90	0.00	6.90	0.00	6.90	0.00	Eliminated							
Engagement																
Emergency	5.75		5.75	0.00	5.75	0.00	Eliminated									
Management																
Capital	2.87		3.45	3.45	Eliminated											
Budgeting																
Education	2.30	Eliminated														
Finance																
Managing	1.72	Eliminated														
Budget																
Offices																



Table 3. Comparison of Prioritizations

Category	All Voters	Academic Voters	Practitioner Voters
Fiscal Health	1	1	1
Social Equity Budgeting	2	2	2
Budgeting Systems	3	3	9
Tax and Revenue	4	4	7
Data and Methods	5	6	3
Community Engagement	6	7	5
Emergency Management	7	5	10
Capital Budgeting	8	8	4
Education Finance	9	9	6
Managing Budget Offices	10	10	8

to manage budget staff effectively, and how to prepare staff for ethical decision-making in the budget process.

### Prioritizing the Agenda

Thus far, we have discussed specific areas of research that we believe are needed to help communities in both the academic and field of practice to move forward. This discussion provided ten broad areas of work, each with a number of research questions that are important for scholars to undertake. Following the ranked-choice voting process established earlier in this paper, a vote was held amongst the authors of this manuscript to establish a priority for research on the ten areas of need. The results of the ballot are provided in Table 2.

As the results show, the scholars and practitioners in this study recommended that priority for research in public budgeting and finance be given to work that addresses issues around the fiscal health of a government and the incorporation of social equity principles into the budgeting process. Interestingly, these results correspond nicely with the Government Finance Officers Association's "Rethinking Budgeting" initiative (see Government Finance Officers Association, 2024).

To understand if there is variation between the priorities of the academic and practitioner communities, the votes were separated by community and recounted. An overview of the prioritization of the two communities in comparison to the entire group is provided in Table 3. The detailed tables of the ranked voting results for the two groups are provided in the appendix of this article, which is available on the journal's website. According to the results of the recount, the prioritizations of the two communities aligned for the first two priorities (fiscal health and social equity budgeting) but differed on what their other priorities were. The academic community favored research that follows the status quo of scholarly work by looking at budgeting systems and tax and revenue policies. The practitioner community, however, prioritized research into data and research methods and capital budgeting.

Why is there a difference in the prioritization amongst the academic and practitioner communities? One reason may be that each community ranked their choices based on the needs

of their community rather than the needs of the field. For example, the study of budgeting systems has been given significant attention in the literature over the years, and its understanding is central to how we train MPA students. However, while the budgeting system in which we operate often appears flawed, the systems currently in place are relatively fixed and are unlikely to change in the near future. While academics might want to study how to change or improve the system, practitioners are more likely to be interested in topics that can have an impact on the position of their governments today. As a result, practitioners prioritize research topics based on the urgency at which they experience the area in their day-to-day jobs.

## **Conclusion**

Our understanding of public budgeting and finance has made significant progress in the last several decades. This progress has come in both the types of questions we seek to answer and how we answer those questions. Through this progress, we have embraced the notion of public budgeting and finance as a scientific endeavor. At the same time, however, this advancement has come at a cost. As the scholarship of the field has pushed forward, we have lost track of our origins and our connection with the field of practice. And from this, the research that we conduct has often failed to address the questions that governments are struggling with. In this study, we have sought to tackle this disconnect head-on by bringing the academic and practitioner communities together and establishing a research agenda for the field that takes the needs of both groups into account.

Using ranked order voting processes, the two leading priorities for public budgeting and finance research relate to improving our understanding of fiscal health and social equity budgeting. In both cases, the research questions most pressing to be addressed focus on questions of implementation and utilization. For example, we recommend that fiscal health scholars focus on a second generation of questions that include how public administrators can manage and influence the condition of their government. Similarly, research related to social equity budgeting should prioritize scholarship that can help government officials improve the equity of the budgeting process and allocations.

We also concluded that a concerted effort is needed to address research in several other areas, including community engagement, taxation and revenue policy, capital budgeting, and the data and methods of public finance. Within these categories, we believe that it is important for scholars to focus on questions that help advance academic scholarship, but that also have clear applicability for governments in the United States and Canada. The challenges we face as a society are large, and the governments we serve need to be prepared to address them head-on.

## **Note**

As noted later in this manuscript, as a community project, our approach to authorship is inclusive and represents a wide variety of contributions and collaborations. We recommend special consideration to this point during the academic tenure and promotion process as co-authorship roles vary within this manuscript.

## Disclosure Statement

The authors declare that there are no conflicts of interest that relate to the research, authorship, or publication of this article.

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# ***Modeling Approach Matters, But Not as Much as Preprocessing: Comparison of Machine Learning and Traditional Revenue Forecasting Techniques***

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Revenue forecasting accuracy is critical to governmental operations. This paper addresses the question: What is the best technique for forecasting sales tax revenue? Prior studies in this area have focused on the differences between machine learning techniques and traditional approaches and neglected to consider how differences in pre-processing steps for the data before the forecasting model is applied are important. Here, we show that machine learning techniques do not always provide increased forecasting accuracy. Instead, the modeling choices matter, but less than the prior literature and practice suggested. Rather, pre-processing makes the most significant difference in forecasting accuracy, and forecasters need to understand the unique characteristics of time series data to improve forecasting performance. The immediate implications of these findings are that the focus of practitioners of in sales tax revenue forecasting should shift from prioritizing model choice towards data pre-processing.

Keywords: Machine Learning, Revenue Forecasting, Sales Taxation

What is the best technique to forecast revenue? State and local governments have grappled with this question for decades (Grizzle & Klay, 1994; Rodgers & Joyce, 1996; Rubin, Mantell, & Pagano, 1999). Differences in forecasting practices exist across countries (Buettner & Kauder, 2010), and overall forecasting accuracy can depend on political and organizational influences (Bretschneider & Gorr, 1992; Bretschneider et al., 1989).

The prior literature has also attempted to identify the accuracy of various methods (Boyd & Dadayan, 2014; Grizzle & Klay, 1994), such as regression (Wong, 1995) and time series models (Frank, 1990). Mikesell (2011) even advocated that “having the experience of ‘old hands,’ who have seen almost everything play out at least once before, can be crucial to getting

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those impacts correctly in the forecast” (p. 569), highlighting the importance of the human component and individual forecaster knowledge in the process. Yet, the accuracy of different methodological approaches depends on the unit of analysis, with damped trend analysis and exponential smoothing performing the best when forecasting monthly and quarterly data and naive approaches when forecasting switched to annual data (Williams & Kavanagh, 2016).

Recently, researchers have explored the accuracy of machine learning techniques as new revenue forecasting tools for state and local governments. Buxton et al. (2019) found that the two deep learning approaches, simple Multi-Layer Perception and global Multi-Layer Perception models, outperform the traditional moving average approach to forecasting for sales tax data within Illinois. Their study also broke out sales tax revenue by type, dividing the information into ten different categories of sales tax revenue within the state. In contrast, Chung, Williams, and Do (2022) focus on multiple types of local government revenue sources and the accuracy of machine learning forecasting techniques when compared to methods traditionally used by forecasters at the local level. They found that a machine learning method, k-nearest neighbor, performed the best at forecasting property taxes. In contrast, they found that a traditional forecasting approach dampened trend exponential smoothing, providing the best accuracy for forecasting sales taxes. In summation, the ability of the machine and deep learning methods to forecast with greater accuracy than traditional forecasting techniques remains inconclusive.

This paper addresses the question: What is the best technique for forecasting sales tax revenue? Like Buxton et al. (2019) and Chung et al. (2022), we focus on the differences in performance accuracy between traditional, non-machine learning techniques and machine learning techniques. However, methods are only as good as the quality of data used to analyze them (Cole, 1969). In this vein, we include an exploration of pre-processing steps—tasks taken to improve the quality of data prior to any analysis—across different forecasting time periods using monthly, quarterly, and annual sales tax data. Understanding that the ideal number and type of pre-processing steps might vary across forecasting time periods, we look at each time period separately. Therefore, the research question can be expanded to two questions. First, what is the best technique for forecasting sales tax revenue in both the number and type of pre-processing steps to the data and the forecasting method? Second, how do those findings change when the data are forecasted monthly versus quarterly versus annually?

The modeling and pre-processing techniques are defined in Table 1. The modeling (i.e., forecasting) techniques selected include three classical methods, three machine learning methods, and four benchmark methods to help us understand the importance of more sophisticated classical and machine learning style forecasting methods. These are listed in order in the table. The three classical or traditional methods are autoregressive integrated moving average (ARIMA), dampened trend exponential smoothing (DT ETS), and linear trend model. These methods were selected to provide approaches from both the time-series analysis or causal-like approaches found within traditional forecasting and have been common forecasting techniques for decades. The three machine learning approaches are K-nearest neighbor (KNN), neural network autoregressive (NNAR), and extreme gradient boosting (XGBOOST). The three machine learning approaches use different algorithms through a training process to find underlying patterns and relationships in the data. Finally, the four benchmarking methods are used to create a series of baseline forecasts and include drift, naïve, seasonal naïve, and average methods.

The pre-processing actions included in this study are either general data pre-processing steps or those specifically required for time series data. General pre-processing steps include

Table 1. Model and Preprocessing Description

Type	Abbreviation	Long Name	Description
<b>Preprocessing</b>			
General	IHS	Inverse Hyperbolic Sine	Natural logarithm of a case plus the square root of a case-squared plus one.
General	Log	Natural Log	Natural logarithmic transformation of time series data.
Time Series	SA	Seasonally Adjusted	Average seasonal detrended time series obtained using multiplicative classical decomposition.
Time Series	Detrend	Detrend	Time series with the trend removed using multiplicative classical decomposition.
<b>Model</b>			
Traditional	ARIMA	Autoregressive Integrated Moving Average	Forecast using an automated process to determine the need and values for time series data differencing, autoregression, and moving averages.
Traditional	DT ETS	Dampened Trend Exponential Smoothing	Forecast using weighted averages of historical time series that are exponentially decayed and account for seasonality and trends using a "dampening" method to correct for over-forecasting.
Traditional	Linear Trend	Linear Trend Model	Forecast using a trend calculated from historical time series data using linear regression.
Machine Learning	KKNN	K-Nearest Neighbor	Forecast using the "k" most similar case from historical time series data and aggregates them.
Machine Learning	NNAR	Neural Network Autoregression	Forecast using a trend calculated from historical time series data using linear regression.
Machine Learning	XGBOOST	Extreme Gradient Boosting	Forecast using an ensemble of gradient-boosted, regression tree algorithms.
Benchmark	Drift	Drift Method Benchmark	Forecast using the average change of the historical time series data.
Benchmark	Naïve	Naïve Method Benchmark	Forecast using the value of the most recent time series observation.
Benchmark	SNaïve	Seasonal Naïve Method Benchmark	Forecast using the value of the most recent time series observation from the same seasonal period.
Benchmark	Mean	Average Method Benchmark	Forecast using the average value of historical time series data.

adjusting for inflation to make purchasing power comparable at different time periods and the data-normalization procedures of natural logarithm and inverse hyperbolic sine (IHS) transformations. Data normalization involves the mathematical transformation of a variable to make the distribution of data points more closely resemble a normal distribution, the benefits of which are important for statistical reasons. Transforming the distribution to resemble a normal distribution should aid in forecasting accuracy and decrease the impact of outliers within the data set.

The second set of pre-processing steps involves cleaning the data using time series-specific steps. Time series data are data points measuring some phenomena (like sales tax revenue collection) at different past points in time and, as such, are used in forecasting methods. However, time series data require special care as trends (long-term movements in the data) and seasonality (repeating fluctuations in data at regular intervals) are often present and can undermine various methodological procedures. To highlight the importance of accounting for these time series-specific data concerns, we include the following time series-specific pre-processing steps: classical multiplicative time series decomposition procedures to adjust seasonality in monthly and quarterly data in addition to detrending time series data.

Next, we provide a summary of the existing literature on revenue forecasting. Then, we go over the data sources for this manuscript and the pre-processing steps we are undertaking. Next, we present the findings of our forecasting exercise. Finally, we discuss conclusions about the best technique for sales tax forecasting, limitations, and future research areas.

## Background

Revenue forecasting in public finance has traditionally fallen into one of two camps: time-series analysis or causal-like approaches (Williams & Calabrese, 2016). Henceforth, these approaches will be referenced as traditional revenue forecasting approaches. The underlying assumption within revenue forecasting is that either previous trends impact future revenues or that a deterministic model of a set of variables can predict revenues. In the case of time series approaches, researchers and practitioners exploit the autocorrelative nature of revenue and the assumption that earlier observed revenue value will help predict future revenues (Williams & Calabrese, 2016). The vast majority of municipalities use a time series approach (Reddick, 2004).

In contrast, causal methods depend on a series of independent variables to predict the dependent forecasted revenue (Mikesell, 2011). Two serious shortcomings of the causal approaches are omitted variable bias (i.e., leaving out important control variables) and a lack of idealized or standardized independent variables (i.e., data that is accessible to local governments). These shortcomings may be why only a small minority of municipalities use this approach (Reddick, 2004).

Machine learning techniques have not been discussed extensively in the public finance literature. According to Chung et al. (2022), 16 articles and conference papers apply machine learning techniques to government revenue forecasts. Of those 16, five were focused on the state level in the United States, and they focused on three states: Indiana, Utah, and Virginia (Carmody & Wiipongwii, 2018; Hansen & Nelson, 1997, 2002; Muh & Jang, 2019; Voorhees, 2006). One omission from the list provided by Chung et al. (2022) was Buxton et al. (2019), which focused on forecasting sales tax revenue in Illinois, broken into ten different retail categories. Findings of the superiority of machine learning or traditional models were not uniform throughout the various studies.

Understanding the accuracy of machine learning techniques as the means of revenue forecasting has not been widely tested nor explored using a wide variety of different study locations. In addition, none of those articles spoke of machine learning techniques being applied actively in practice. Instead, they compared one or more machine learning techniques to traditional models, actual data, existing practices, or other machine learning techniques. A review of the six articles based at the state level found that there has been minimal discussion in those articles of the pre-processing techniques outside of the identification of what pre-processing techniques, if any, were undertaken. In addition, there was no discussion of how variations in pre-processing techniques might change their findings. There is still a wide range of existing knowledge that could be gathered by understanding how both forecasting accuracy and various pre-processing techniques could improve municipal and state revenue forecasting.

The limited literature on revenue forecasting in public finance is not uniform in its account of the superiority of either traditional or machine-learning revenue forecasting techniques. The literature lacks examples of machine learning being applied in practice.

Variation in pre-processing steps also suggests a need for more agreement regarding the best approach.

### Data Pre-processing

The literature is mixed regarding the need for pre-processing within revenue forecasting, specifically in cases of machine learning methods. Research has shown that neural networks, when used for forecasting, can adapt to any type of data, thereby negating the need for pre-processing (Gorr, 1994). Similar arguments are made about multivariate autoregressive conditional heteroskedasticity models (Nelson, 1996).

In contrast, scholars have argued that pre-processing is necessary, even in the case of machine learning methods, to produce optimal forecasts. Systematic methodology has been proposed to determine whether weights need to be removed during pre-processing (Cottrell et al., 1995). In other cases, neural networks cannot fully capture seasonal or trend variations to reduce forecasting errors and increase efficiency (Zhang & Qi, 2005). Therefore, when using machine learning techniques that depend on neural networks, researchers should either detrend or engage in deseasonalization of their data.

In addition to the question of the need for pre-processing, the research is also mixed on the number and order of necessary pre-processing steps, specifically as it relates to forecasting with time series data (Balkin & Ord, 2000; Miller & Williams, 2004; Zhang & Qi, 2005; Zhang, Cao, & Schniederjans, 2004). This variation is in part due to the fact that not all time series are the same; some have an aspect of seasonality, others may possess an exponential or linear trend, and others may fluctuate around some level or baseline value. Differences in forecasting accuracy in testing three different pre-processing approaches: no special pre-processing, time series differencing, and taking moving averages have been found (Ahmed et al., 2010). In addition, prior research has suggested performing multiple transformations on data, such as log transformation, deseasonalization, and scaling (Ahmed et al., 2010).

One common pre-processing step in revenue forecasting and with time series data that involves currency is adjusting for inflation. Removal of inflation is seen as a key part of the decomposition of revenue and expenditure data (Ammons, 1991, 2001). Armstrong (2001) directly spoke to inflation adjustments within the comprehensive set of principles for forecasting. Further, it has been suggested that “local governments may further benefit by obtaining inflation forecasts from a reputable national firm” (Williams & Kavanagh, 2016, p. 493) and warned that “forecasting the tax revenue or the nominal tax base without adjusting for these factors could lead to significant error” (Williams, 2017, p. 357).

Therefore, due to the need for more evident consensus in pre-processing approaches, researchers would be well served by potentially engaging in a variety of pre-processing steps and varying the order in which they apply them in the case of time series data. As not all time series are the same (Ahmed et al., 2010), what might be the ideal set of pre-processing steps for one revenue forecasting data set might be different for another data set.

### Accuracy

Prior research has suggested that picking the correct measurement of error within forecasting can be challenging (Mathews & Diamantopoulos, 1994). In particular, no one measure provides an unambiguous measurement of forecasting performance. In addition, if one relies on multiple

measures of accuracy, comparisons among forecasting approaches become difficult (Mathews & Diamantopoulos, 1994). A variety of accuracy measures can be used to determine the accuracy of a forecast, including mean absolute percent error (MAPE), symmetric mean absolute percentage error (sMAPE), revised mean absolute percentage error (r-MAPE), mean squared error (MSE), and model fit.

MAPE provides a percentage of absolute or positive percentage error between the value provided through the forecasting technique and the actual observed value or revenue dollars collected. At the same time, sMAPE adjusts the percentage error calculation to include the sum of the absolute actual observed value and the absolute forecasted value divided by two, which creates a lower and upper bound. r-MAPE divides the traditional MAPE calculation by the number of periods considered. MSE uses the average of the square of the difference between the actual and forecasted value. The model fit looks at statistical measures of the overall fit of the analysis, such as adjusted R-square in the case of linear regression. Each of these approaches has strengths and weaknesses, and it is not appropriate on all occasions. For example, with some of the traditional regression approaches, model fit is a straightforward measure of accuracy. In contrast, MSE depends on the number of observations (Chung et al., 2022).

One argument in the literature is that the sMAPE is the superior accuracy measure (Chung et al., 2022). One of the main reasons for this argument is that in times of variation of the scale of observations between series, a few series with larger values can dominate the comparison within the MAPE (Chatfield, 1988). Equal errors above the actual values and equal errors below the actual value will not create the same absolute percent error (APE) (Makridakis, 1993). Equal values above lead to a greater APE (Armstrong & Collopy, 1992). Therefore, there are numerous examples of the sMAPE being used or recommended (Chung et al., 2022; Hyndman & Koehler, 2006; Makridakis & Hibon, 2000; Taieb et al., 2012; Williams & Miller, 1999).

In contrast, a separate line of argument in the literature points to errors with sMAPE (Goodwin & Lawton, 1999). For example, in some instances, a non-monotonic relationship can occur between sMAPE and absolute forecasting errors. Inconsistent performance in sMAPE estimators has been found depending on whether the forecasted value underestimated or overestimated the actual value (Tayman & Swanson, 1999). In addition, they found that differences between sMAPE and MAPE were related to the side of the over or underestimate. In addition, sMAPE tends towards high error values when the error is small (Mathai et al., 2016). Similar to sMAPE, there are numerous examples of MAPE being used or recommended within the literature (Callen et al., 1996; Halimawan & Sukarno, 2013; Prayudani et al., 2019; Singh, Hussain, & Bazaz, 2017; Vivas, Allende-Cid, & Salas, 2020).

Therefore, the literature has not coalesced around one particular measurement tool for forecasting accuracy. This lack of uniformity harkens back to Mathews and Diamantopoulos's (1994) argument that no one measure provides an unambiguous measurement of performance. Therefore, a measurement of accuracy must be selected and justified.

## **Texas Sales Tax**

Similar to prior studies, the basis of our study will be at the state level, in part due to variations in sales tax laws between states in the United States. However, we are not following the prior precedent of using Illinois, Indiana, Utah, and Virginia. Texas was selected because of the large

number of cities that issue sales taxes and the relatively limited variation in sales tax rates. For our sample, we collected data on over 1,000 cities for 16 years. This gives us a substantial number of jurisdictions to assess forecast methods. Additionally, sales tax rates are relatively stable in Texas, both between and within cities.

In Texas, counties and cities can impose a 1% sales tax, with the option to add another 1% through various entities like economic development corporations, public transportation governments, and police and fire districts. The state has a maximum sales tax rate of 8.25%, with 6.25% allocated to the state's general fund (Texas Comptroller of Public Accounts, 2015). Registered businesses are required to collect sales taxes on behalf of the state comptroller's office during normal operations and to submit sales tax revenue to the state on a monthly, quarterly, or annual basis, depending on the size of their organizations. Using only Texas, we ensure that institutional rules on collection, tax base, and other state administrative policies are uniform across the cross-sectional units.

## **Forecasting Methodology and Comparisons**

To understand the most accurate forecasting approaches, monthly sales tax collection data for every city in Texas were collected between January 1991 and December 2017 using the Texas Comptroller website. Unfortunately, not all the monthly data were available for the entire time frame for every city in Texas. Only cities with complete time series were included in the analyses, resulting in 822 cities with complete monthly data, 976 cities with complete quarterly data, and 1,005 cities with complete yearly data. While rare, some cities in Texas changed their sales tax rates during the period under study. Cities that did not have a uniform sales tax throughout the period of study were time-series comparable. This ensured that the rate changes would not affect the forecasting accuracy.

To compare forecasts, we ran each pre-processing step and forecasting model on each city using its monthly, quarterly, and yearly data. This approach resulted in a unique forecast for each city. Forecast accuracy was evaluated using the MAPE score on the latest 24 months, eight quarters, or four years of data. These city-level MAPE scores were then aggregated for every model-preprocessing (MP) combination, producing MAPE averages and standard deviations at the MP level. City-level forecasts three times the interquartile range were identified as outliers and removed before MP aggregation.

## **Results**

To evaluate and compare MP forecasting performance, we have provided the average MAPE, standard deviation, performance ranking, the percentage difference from the best forming model MAPE called diminished performance (%), the minimum and maximum MAPE within each model, the total number of cities forecasted in each model, and the number of outlier cities removed. These metrics provide useful context on how models and pre-processing steps perform across the entire population of forecasted cities. To streamline the results, we only included the top 30 MP forecasts for the monthly and quarterly forecasts and every forecast that performed above the MAPE average for the yearly forecasts. Monthly MP forecasts are in Table 2,



Table 2. Monthly Sales Tax Forecast Accuracy

	Average	Standard Deviation	Min	Max	Performance Ranking	Diminished Performance	Forecasts	Outlier Forecasts
<b>(IHS) (Detrend)</b>								
KKNN	1.000	0.452	0.276	2.346	1	--	759	63
XGBOOST	1.044	0.508	0.336	2.443	2	4.4%	756	66
SNaïve*	1.128	1.037	0.117	8.293	5	12.8%	822	0
Linear Trend	1.192	0.431	0.472	2.318	6	19.1%	747	75
Mean*	1.381	0.777	0.476	6.782	15	38.1%	822	0
Naïve*	1.644	1.502	0.462	22.468	21	64.4%	822	0
Drift*	1.660	1.538	0.469	23.209	22	66.0%	822	0
NNAR	2.763	1.902	0.286	8.890	39	176.2%	756	66
<b>(Log) (Detrend)</b>								
KKNN	1.075	0.501	0.289	2.544	3	7.5%	764	58
XGBOOST	1.081	0.518	0.275	2.571	4	8.1%	745	77
SNaïve*	1.208	1.125	0.123	9.041	7	20.8%	822	0
Linear Trend	1.273	0.473	0.501	2.509	11	27.3%	750	72
Mean*	1.474	0.846	0.505	7.456	17	47.4%	822	0
Naïve*	1.756	1.621	0.479	23.987	27	75.6%	822	0
Drift*	1.773	1.659	0.487	24.779	28	77.2%	822	0
NNAR	2.885	1.977	0.249	9.119	40	188.4%	749	73
<b>(IHS)</b>								
DT ETS	1.213	0.752	0.203	3.456	8	21.3%	759	63
ARIMA	1.226	0.678	0.257	3.286	9	22.6%	747	75
SNaïve*	1.610	1.688	0.170	30.373	20	61.0%	822	0
Linear Trend	1.821	0.896	0.434	4.321	31	82.1%	750	72
Drift*	1.834	1.781	0.428	24.261	32	83.3%	822	0
Naïve*	1.840	1.731	0.491	23.288	33	83.9%	822	0
<b>(IHS) (SA)</b>								
KKNN	1.255	0.716	0.181	3.361	10	25.4%	760	62
XGBOOST	1.466	0.665	0.302	3.374	16	46.5%	753	69
SNaïve*	1.608	1.687	0.170	30.430	19	60.8%	822	0
Naïve*	1.676	1.812	0.205	22.710	23	67.6%	822	0
Linear Trend	1.753	1.093	0.185	4.898	26	75.3%	776	46
Drift*	1.812	1.879	0.195	23.956	30	81.2%	822	0
NNAR	2.986	2.130	0.288	10.274	41	198.5%	747	75
<b>(Log)</b>								
DT ETS	1.307	0.820	0.216	3.912	12	30.6%	759	63
ARIMA	1.313	0.738	0.267	3.557	13	31.2%	749	73
SNaïve*	1.722	1.841	0.177	33.702	25	72.2%	822	0
Linear Trend	1.954	0.979	0.451	4.707	36	95.3%	754	68
Drift*	1.959	1.923	0.445	25.883	37	95.9%	822	0
Naïve*	1.965	1.870	0.510	24.846	38	96.5%	822	0
<b>(Log) (SA)</b>								
KKNN	1.337	0.771	0.189	3.607	14	33.7%	760	62
XGBOOST	1.548	0.717	0.304	3.597	18	54.7%	754	68
SNaïve*	1.721	1.841	0.177	33.773	24	72.0%	822	0
Naïve*	1.793	1.956	0.215	24.566	29	79.3%	822	0
Linear Trend	1.873	1.177	0.192	5.296	34	87.2%	777	45
Drift*	1.938	2.027	0.205	25.913	35	93.8%	822	0

\*Denotes a benchmark model.

Grey highlighted row = ranked 1-5

Green highlighted row = ranked 6-10

Table 3. Quarterly Sales Tax Forecast Accuracy

	Average	Standard Deviation	Min	Max	Performance Ranking	Diminished Performance	Forecasts	Outlier Forecasts
<b>(IHS) (Detrend)</b>								
Linear Trend	0.406	0.261	0.040	1.226	1	--	893	83
KKNN	0.474	0.312	0.027	1.472	3	16.5%	900	76
Mean*	0.544	0.594	0.040	7.161	5	33.9%	976	0
XGBOOST	0.607	0.206	0.223	1.190	7	49.3%	840	136
SNaïve*	0.706	0.835	0.029	12.133	9	73.8%	976	0
Naïve*	0.833	1.027	0.056	12.735	11	105.0%	976	0
Drift*	0.852	1.055	0.058	13.141	12	109.5%	976	0
NNAR	2.506	2.577	0.077	11.811	41	516.4%	893	83
<b>(Log) (Detrend)</b>								
Linear Trend	0.431	0.279	0.042	1.314	2	6.1%	893	83
KKNN	0.502	0.333	0.028	1.571	4	23.5%	899	77
Mean*	0.580	0.637	0.041	7.605	6	42.6%	976	0
XGBOOST	0.634	0.232	0.208	1.319	8	55.9%	847	129
SNaïve*	0.753	0.897	0.030	12.953	10	85.2%	976	0
Naïve*	0.887	1.101	0.059	13.689	14	118.3%	976	0
Drift*	0.907	1.131	0.062	14.126	15	123.1%	976	0
NNAR	2.518	2.595	0.071	11.947	42	519.4%	879	97
<b>(IHS)</b>								
DT ETS	0.875	0.554	0.086	2.574	13	115.2%	367	36
DT ETS	0.923	0.649	0.080	2.897	16	127.0%	540	33
ARIMA	0.938	0.641	0.097	2.973	17	130.7%	902	74
Naïve*	1.196	1.428	0.060	16.888	24	194.3%	976	0
Drift*	1.225	1.466	0.096	16.863	26	201.4%	976	0
SNaïve*	1.333	1.518	0.058	25.048	32	227.8%	976	0
Linear Trend	1.536	1.125	0.077	4.981	38	277.9%	930	46
<b>(Log)</b>								
DT ETS	0.943	0.609	0.090	2.846	18	131.9%	367	30
DT ETS	0.975	0.691	0.085	3.015	19	140.0%	542	37
ARIMA	0.998	0.690	0.101	3.184	21	145.5%	903	73
Naïve*	1.274	1.534	0.062	18.449	28	213.3%	976	0
Drift*	1.304	1.574	0.100	18.081	30	220.9%	976	0
SNaïve*	1.419	1.633	0.061	27.341	35	249.0%	976	0
Linear Trend	1.622	1.188	0.081	5.280	39	299.1%	928	48
<b>(IHS) (SA)</b>								
KKNN	0.979	0.683	0.088	3.087	20	140.7%	906	70
Naïve*	1.192	1.428	0.058	16.941	23	193.1%	976	0
Drift*	1.221	1.458	0.050	16.536	25	200.4%	976	0
SNaïve*	1.332	1.518	0.058	25.068	31	227.8%	976	0
XGBOOST	1.411	0.668	0.174	3.136	33	247.1%	904	72
Linear Trend	1.534	1.134	0.066	5.019	37	277.4%	931	45
<b>(Log) (SA)</b>								
KKNN	1.044	0.737	0.092	3.352	22	156.9%	908	68
Naïve*	1.269	1.534	0.061	18.511	27	212.2%	976	0
Drift*	1.300	1.566	0.053	17.731	29	219.9%	976	0
SNaïve*	1.418	1.634	0.061	27.366	34	248.9%	976	0
XGBOOST	1.464	0.716	0.171	3.332	36	260.2%	907	69
Linear Trend	1.624	1.202	0.069	5.286	40	299.5%	930	46

\*Denotes a benchmark model.

Grey highlighted row = ranked 1-5

Green highlighted row = ranked 6-10

Table 4. Annual Sales Tax Forecast Accuracy

	Average	Standard Deviation	Min	Max	Performance Ranking	Diminished Performance	Forecasts	Outlier Forecasts
<b>(IHS)</b>								
Drift*	1.400	1.771	0.032	20.717	1	--	1005	0
ARIMA	1.437	0.951	0.060	4.336	2	2.6%	942	63
Naïve*	1.447	1.609	0.048	17.739	3	3.4%	1005	0
DT ETS	1.489	1.335	0.040	5.886	5	6.4%	939	63
Linear Trend	1.511	1.145	0.045	5.286	6	8.0%	951	54
NNAR	1.995	1.857	0.028	8.756	11	42.5%	902	103
Mean*	3.627	2.920	0.053	19.969	13	159.1%	1005	0
<b>(Log)</b>								
Drift*	1.480	1.888	0.033	22.278	4	5.8%	1005	0
ARIMA	1.512	1.003	0.063	4.574	7	8.0%	941	64
Naïve*	1.529	1.714	0.051	19.076	8	9.2%	1005	0
DT ETS	1.570	1.413	0.041	6.208	9	12.2%	941	63
Linear Trend	1.581	1.192	0.047	5.559	10	13.0%	948	57
NNAR	2.130	2.000	0.038	9.143	12	52.2%	904	101
Mean*	3.822	3.083	0.055	21.167	14	173.1%	1005	0

\*Denotes a benchmark model

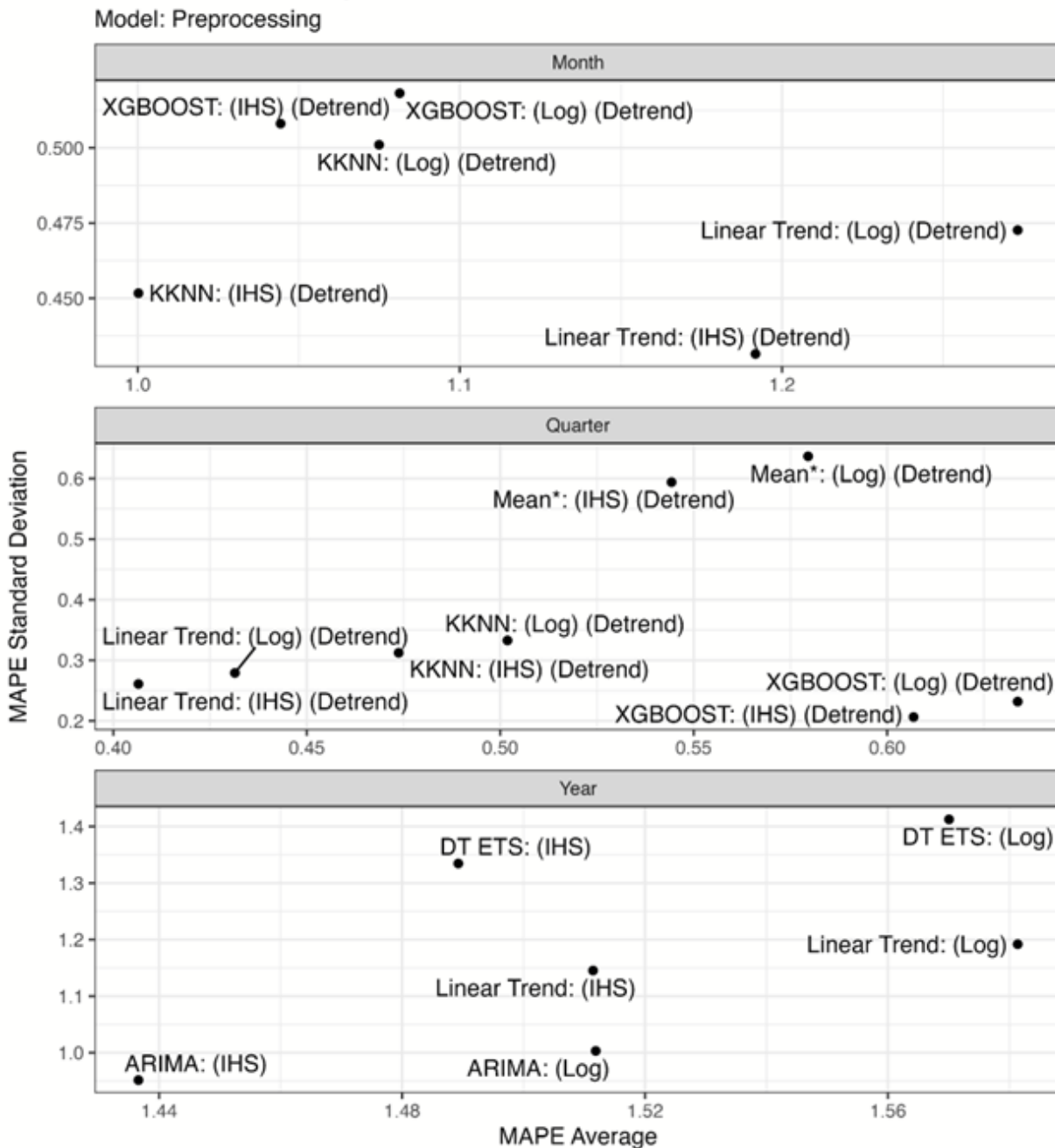
Grey highlighted row = ranked 1-5

quarterly forecasts are in Table 3, and annual forecasts are in Table 4. The complete results are in the appendix, which is available on the journal's website.

To identify the most accurate MP forecasts using both the average MAPE and standard deviation MAPE, k-means exploratory cluster analysis was performed. K-means exploratory cluster analysis groups similar observations together into groups based on multiple variables, which will give us an approximation of both the most accurate (measured using average MAPE) and the most consistent (measured using standard deviation of MAPE) models and pre-processing steps. As the goal of forecasting may be accuracy or consistency, this provides interesting findings about the differences between the two based on the approach. The optimal number of clusters was determined using a visual inspection of the explanatory power of different numbers of clusters called the elbow method (Humaira & Rasyidah, 2020), and it indicated that eight clusters from the monthly forecasts, four clusters from the quarterly, and four clusters from the yearly forecasts were optimal. The most accurate MP forecasts from the cluster analyses are in Figure 1.

The performance of each MP average MAPE is compared to the most accurate MP forecast and reported in the column Diminished Performance (%). For the monthly forecasts, the most accurate model had an average MAPE of 1 using KKNN with IHS detrended data. The average diminished performance of the top ten MP forecasts was 15.78%, and for all models presented in Table 1, it was 44.97%. For the quarterly forecasts, the most accurate model was Linear Trend with IHS detrended data that had an average MAPE of 0.406. The average diminished performance of the top 10 quarterly MP forecasts was 42.98%, and for all models presented in Table 2, it was 123.66%. For the yearly forecasts, the most accurate model was the Drift benchmark model with IHS data with an average MAPE of 1.400. The average diminished performance of the top five MP forecasts was 4.54%, and for all models presented in Table 3, it

Figure 1. Most Accurate Yearly Forecasts



was 38.1%. Interestingly, the most accurate forecasts from each period used IHS pre-processing steps, while a different model resulted in more accurate forecasts for each period. This suggests that stable forecasting improvements can be made across different time periods with the implementation of similar pre-processing steps, but not through similar modeling approaches.

Table 5 presents the results of averaged percent diminished MP performance across different models but holds pre-processing steps constant. Table 6 compares the average

Table 5. Average Percentage Diminished Performance with Constant Preprocessing

	All Forecasts			Outlier Models	No Outlying Forecasts	
	Average Diminished Performance	Average Performance Ranking	Total Models		Average Diminished Performance	Average Performance Ranking
Monthly						
(IHS) Detrend)	47.6%	1	8	0	47.6%	1
(Log) Detrend)	56.5%	2	8	0	56.5%	2
(IHS)	96.1%	3	7	0	96.1%	3
(IHS) (SA)	108.4%	4	8	0	108.4%	4
(Log)	109.6%	5	7	0	109.6%	5
(Log) (SA)	123.3%	6	8	0	123.3%	6
(Detrend)	1,672.0%	7	8	5	1,094.5%	7
No Transformation	1,955.2%	8	7	4	1,454.1%	9
(SA)	2,097.0%	9	8	5	1,406.9%	8
Quarterly						
(IHS) Detrend)	113.1%	1	8	0	113.1%	1
(Log) Detrend)	121.8%	2	8	0	121.8%	2
(IHS)	266.9%	3	8	0	266.9%	3
(Log)	289.9%	4	8	0	289.9%	4
(IHS) (SA)	353.8%	5	8	0	353.8%	5
(Log) (SA)	386.1%	6	8	0	386.1%	6
(Detrend)	2,452.2%	7	8	1	1,798.5%	7
No Transformation	3,862.2%	8	8	4	2,894.3%	8
(SA)	4,721.9%	9	8	5	3,062.8%	9
Yearly						
(IHS)	31.7%	1	7	0	31.7%	1
(Log)	39.1%	2	7	0	39.1%	2
No Transformation	1,440.5%	3	7	0	1,440.5%	3

diminishing performance of different pre-processing steps but holds the model constant. Table 7 provides the range of improvement from pre-processing (Table 5), and modeling (Table 6).

## Discussions

The purpose of this study is to identify the most accurate sales tax forecasting method, and the analysis suggests three overarching lessons: pre-processing makes the most significant difference in forecasting accuracy, understanding the unique characteristics of time series data improves forecasting performance, and modeling choices matter, but less than the prior literature and practice suggested.

### Processing Matters

The most significant improvement in our analysis occurred when data were transformed using the IHS method, followed closely by logging—both of which were data-normalizing pre-processing steps. This finding is consistent across all three periods. Most studies recommend some form of pre-processing that normalizes the time series data, including previous studies on sales tax forecasting (Williams & Calabrese, 2016). What this study suggests is that regardless of

Table 6. Average Percentage Diminished Performance with Constant Models

	All Forecasts		Total Preprocessing	Outlier Models	No Outlying Forecasts	
	Average Diminished Performance	Average Performance Ranking			Average Diminished Performance	Average Performance Ranking
Monthly						
XGBOOST	395.8%	1	6	0	395.8%	6
KKNN	396.5%	2	6	0	396.5%	7
ARIMA	439.2%	3	3	0	439.2%	8
DT ETS	461.0%	4	3	0	461.0%	9
Linear Trend	565.0%	5	9	0	565.0%	10
SNaïve*	613.4%	6	9	3	49.9%	1
Naïve*	696.5%	7	9	3	77.9%	2
Drift*	714.6%	8	9	3	82.9%	3
Mean*	1,090.9%	9	9	3	233.3%	5
NNAR	1,231.1%	10	6	2	197.6%	4
Quarterly						
KKNN	729.1%	1	6	0	729.1%	5
XGBOOST	780.6%	2	6	0	780.6%	7
DT ETS	935.6%	3	6	0	935.6%	8
ARIMA	955.1%	4	3	0	955.1%	9
Linear Trend	1,119.9%	5	9	0	1,119.9%	10
Naïve*	1,161.6%	6	9	2	502.2%	2
Drift*	1,184.4%	7	9	2	515.1%	3
SNaïve*	1,250.5%	8	9	2	447.3%	1
Mean*	2,406.8%	9	9	2	749.6%	6
NNAR	3,149.4%	10	6	2	623.1%	4
Yearly						
ARIMA	383.5%	1	3	0	383.5%	1
Linear Trend	398.4%	2	3	0	398.4%	2
Drift*	416.0%	3	3	0	416.0%	3
Naïve*	422.2%	4	3	0	422.2%	4
DT ETS	426.9%	5	3	0	426.9%	5
NNAR	586.8%	6	3	0	586.8%	6
Mean*	892.3%	7	3	0	892.3%	7

\*Denotes a benchmark model.

the period used, the biggest improvement in forecast performance comes from IHS transformation.

Two exciting patterns emerged in the comparisons of pre-processing steps. The first pattern was that removing outlying average forecasts did not drastically alter the rank order of model performance. In the monthly and quarterly forecasts, the first seven of nine pre-processing steps stayed in the same rank order regardless of whether outlying model forecasts were included or removed. This suggests that improvements to individual city forecasts from data pre-processing are likely to improve forecasts even in cities that are relative forecasting outliers.

The second pattern was the lower average diminishing performance of the top six pre-processing steps in the monthly and quarterly data, as seen in Table 6. The low average diminished performance associated with data pre-processing is stark compared to the much larger average diminished performance across models (i.e., Table 7). This finding suggests that variations within a pre-processing step and across models are smaller than vice versa. Making sure that data are transformed results in better and more stable forecast accuracy.



Table 7. Range of Improvement from Preprocessing

	All Forecasts		No Outlying Forecasts	
	Model Diminished Performance	Preprocessing Diminished Performance	Model Diminished Performance	Preprocessing Diminished Performance
	Range	Performance Range	Range	Performance Range
Monthly	835.3%	2,049.3%	515.0%	1,406.5%
Quarterly	2,420.3%	4,608.8%	672.6%	2,949.7%
Yearly	508.8%	1,408.8%	508.8%	1,408.8%

Table 8. Inflation Adjustment Performance Comparison

					% of Forecasts Better/Worse Adjusting for Inflation	
	Average	Standard Deviation	Min	Max	Better	Worse
Monthly	2.4%	3.2%	-2.7%	10.0%	85.4%	14.6%
Quarterly	1.4%	4.6%	-22.2%	12.5%	92.9%	7.1%
Yearly	31.3%	67.7%	-9.8%	193.6%	57.1%	42.9%

A standard pre-processing step in time series data is adjusting for inflation, which is important for integrating<sup>1</sup> time series data. Table 8 shows the average improvement in accuracy for adjusting a forecast for inflation. The average improvement from inflation adjustment is 2.4%, 1.4%, and 31.3% for monthly, quarterly, and yearly periods, respectively. While there is forecasting improvement in all three periods, the improvement in average forecasting accuracy is considerably smaller than improvements gained by IHS or logging the time series data. Another interesting development is that adjusting for inflation did not always improve forecasting accuracy. Adjusting for inflation led to reductions in model/pre-processing accuracy of 14.6%, 7.1%, and 42.9% for monthly, quarterly, and yearly data, respectively. Adjusting for inflation is an important part of forecasting financial data, but it does not always translate to improved forecasting accuracy.

### Understanding Time-Series Data Matters

The results highlight the importance of understanding the nature of time series data and using that knowledge when forecasting. In our analyses, detrending and seasonally adjusting data improved forecasting accuracy. The top seven performing models in the monthly data and all top 10 models in the quarterly data were detrended time series. Adjusting for seasonality did not result in the same performance improvements, but it did result in relative improvements in accuracy over a non-seasonally adjusted time series. Further, accounting for seasonality and trends resulted in improvements in machine learning models, which were the best-performing models in the monthly and quarterly forecasts.

Finally, another crucial finding was that the time interval affects the effectiveness of models. The best-performing models change across time intervals, and certain pre-processing steps make a bigger difference for certain time periods. For example, seasonally adjusting data does not apply to annual data, but adjusting for inflation made the biggest positive difference to

<sup>1</sup> Integration is a statistical term that refers broadly to “detrending” time series data and making it more statistically “stable.”

yearly data by a large percentage. What time interval is best? The answer depends on what data is most thorough and accurately reflects when the sales tax was collected (Overton, Nukpezah, & Ismayilov, 2017). There were significant performance differences between the three periods, suggesting that attention should be paid to the frequency of time series data used for sales tax forecasts, with a preference for the intervals at which the sales tax was collected.

### Modeling Matters, But Not as Much as Everything Else

Table 7 shows that forecasting accuracy improved most from pre-processing decisions rather than modeling decisions. In addition, Table 7 illustrates how the average diminished performance based on modeling decisions was much larger than that of the pre-processing steps. Pre-processing steps led to considerably larger improvements in forecasting accuracy than modeling decisions. Therefore, the focus of both public finance professionals and researchers should be on conducting the appropriate pre-processing steps.

One additional pattern that emerged is that the rank of average model forecasting accuracy changed drastically once outlying average forecasts were removed. Before outlier removal, XGBOOST, KNN, ARIMA, DT ETS, and Linear Trend models performed best. However, once outliers were removed, the average performance of all four benchmark models outperformed that of the machine learning and traditional methods. However, it should be noted that the XGBOOST, KNN, ARIMA, DT ETS, and Linear Trend models did not produce any model-level MAPE outliers, suggesting that their accuracy is less prone to variations in pre-processing. Therefore, one should carefully weigh average forecasting performance against the likelihood of generating forecasting outliers when evaluating forecast-generating methods.

### **Conclusion**

Returning to the question we started with, what is the best technique for forecasting sales tax revenue, the answer is not as simple, as traditional methods can outperform machine learning techniques or vice versa. In fact, the existing literature tackling this problem might have been asking the wrong question in its entirety. Scholars such as Chung et al. (2022) and Buxton et al. (2019) provided direct comparisons of machine learning techniques with traditional ones regarding forecasting accuracy. They should consider additional analysis to determine whether their findings hold in the case of different pre-processing steps. In our attempt to answer the question, findings held that perhaps the question should have been: What pre-processing steps did you take before engaging in forecasting? In many ways, we provide strong evidence that the arguments by Gorr (1994) and Nelson (1996) are fundamentally flawed while supporting the findings of Zhang and Qi (2005) that neural networks cannot fully capture seasonal or trend variation and pre-processing of time series data matters.

However, not all pre-processing steps are as important as the previous literature suggested (see Ammons, 1991, 2001; Armstrong, 2001; Williams & Kavanagh, 2016). Adjusting for inflation is an important part of forecasting, but it does not always translate into improved forecasting accuracy. Therefore, researchers and practitioners should exercise caution in adjusting for inflation. In contrast, IHS, or logging the time series data, led to larger gains in overall forecast accuracy.

Understanding the nature of time series data is essential for individuals engaging in revenue forecasting. Detrending and seasonally adjusting data should be common practice for those working with monthly or quarterly data. In addition, the interval affects the effectiveness of models, and individuals should attempt to select what accurately reflects when the sales tax was collected.

So, what is the best technique for forecasting sales tax revenue? Should local governmental officials study machine learning techniques to improve their forecasting accuracy? Well, part of the answer to the question relies on outliers. XGBOOST, KNN, ARIMA, DT ETS, and Linear Trend models did not produce any model-level MAPE outliers, suggesting that their accuracy is less prone to variations in pre-processing. However, before outlier removal, the XGBOOST, KNN, ARIMA, DT ETS, and Linear Trend models performed best. Which individual approach performed best—machine learning or traditional models—depended on the interval of time. Therefore, a rush to machine learning techniques may not be necessary for municipalities if they collect sales taxes quarterly or yearly.

Instead of focusing on the technique, revenue forecasting practitioners should be focusing on the pre-processing steps they are using on their data. The pre-processing provided much better forecasting accuracy than simply a model selection. Therefore, future researchers should shift the focus from machine learning or traditional models towards an approach that takes a holistic approach and includes various pre-processing steps. Testing the findings from this research on data from a different state with different rules on collection, tax base, and other state administrative policies would be a logical next step toward understanding and expanding the knowledge base of revenue forecasting. Regardless, the focus within the literature and in practice should shift from what forecasting technique performs best to what pre-processing steps in combination with a forecasting technique perform best. Simply focusing on technique ignores the larger concern in achieving greater accuracy—pre-processing steps.

## Disclosure Statement

The authors declare that there are no conflicts of interest that relate to the research, authorship, or publication of this article.

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# *AI as a Budgeting Tool: Panacea or Pandora's Box?*


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Local government officials are consistently tasked with doing more with less. The combination of fiscal institutions, devolution of fiscal federalism, voter frustration, and economic shocks have been the leading causes of these more recent challenges. However, the reality is that smaller local governments, by their very nature, struggle with service provision. This paper explores the next evolution of change to local governments – artificial intelligence (AI), specifically ChatGPT – and its potential for local governments. We discuss the use of AI in budgeting, with a focus on financial data management and statistical analysis, including forecasting and policy recommendations for a small Nebraska municipality. Our experience with ChatGPT highlights its powerful capabilities for data processing. Transitioning to ChatGPT-4 from ChatGPT-3.5 (with or without Python) improved data processing efficiency but introduced financial costs, and we observed that the use of detailed and precise prompts enhances output quality across all versions. Achieving a balance between time, cost, data preparation, and prompt precision is crucial for optimizing the potential of ChatGPT in financial data analysis.

Keywords: Artificial Intelligence, Local Governments, Public Budgeting and Financial Management

The growth of artificial intelligence (AI), particularly ChatGPT, has recently generated a great deal of excitement (and angst). AI offers both opportunities and challenges for policymakers and analysts in public budgeting and finance. For example, a recent study by Valle-Cruz, Gil-Garcia, and Fernandex-Cortez (2020) explored the utilization of AI in public budgeting. However, the methodologies employed in the study are complex, catering mainly to practitioners with advanced training in statistics, coding, and AI applications.

The timing of AI's growth may prove fortuitous for local government professionals who are saddled with “doing more with less” amid labor shortages. This paper adopts an applied

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approach by examining AI applications for local government practitioners. We focus on a small municipality in Nebraska and utilize easily accessible data to explore the data analysis capabilities of three different AI approaches: the free version of ChatGPT, ChatGPT with coding processes from free programming applications like R and Python; and ChatGPT-4, which offers increased data analysis capacity at a monthly subscription fee.

The analyses focused on the same outputs: data description, financial condition indicators, forecasting, and policy recommendations. The goal was to illustrate the strengths and weaknesses of each AI tool and discuss their relevance for policymakers and analysts. Our findings suggest that the free version of ChatGPT has limited potential for data analysis but can serve as a resource for policy guidance. Using ChatGPT as a tutorial for learning Python was also highly effective but proved to be very time-consuming for novices, raising questions about its utility for local government practitioners. Conversely, ChatGPT version 4.0, with a monthly subscription, emerges as a powerful tool for both data analysis and policy guidance.

## Literature Review

From March 2020 to 2022, local government employment reportedly decreased by about 300,000 workers (National League of Cities, 2023). Despite the improvement in hiring in 2023, responses to this labor shortage have been challenging, particularly for employee recruitment and retention (Mission Square, 2023). This challenge is particularly acute in public budgeting and finance. According to Walsh and Nason (2022), “[t]he supply-demand gap for state and local public finance workers is widening faster than the same gap for the finance sector overall, the public sector overall, and the economy overall” (p. 5).

In addition to reexamining recruitment strategies, salaries, and benefits, the use of technology is also a means of helping address some of these personnel challenges. According to Hinkley (2023), “Advanced technologies—algorithms, artificial intelligence, robotic process automation—have begun to change some public jobs significantly, either augmenting or replacing some human decision-making” (p. 6). She notes that the key drivers of technology adoption are efficiency, performance (including reliability and accuracy), transparency, and crisis management (Hinkley, 2023). When we consider some of the analytic functions required of financial personnel - forecasting, comparative analysis, budget analysis, etc. – technology has played a key role. Nevertheless, the adoption of such analytical tools in small local governments is hindered by limited resources, including trained personnel and necessary hardware/software.

Kim and Bretschneider (2004) assert that “[w]hile new IT tools, especially web-based applications, are becoming more and more prevalent in local government, applying new IT continues to depend on the general ability of local governments to obtain, manage and effectively use IT...” (p. 1). What makes this era different from the past 40-50 years of government capacity and fiscal policy discussions is that, for the first time, resources – hardware, software, and personnel – are less demanding for the end user with the advent of AI, and ChatGPT, in particular. What remains to be seen is its value to local policymakers.

A growing body of work explores AI applications in public budgeting, accounting, and financial management. For instance, Anders (2023) highlights ChatGPT’s value for CPAs, identifying resources such as accounting “influencers,” websites, and bloggers. The paper is a useful resource for public finance professionals interested in learning about the array of resources readily available. One of the noted resources is “How to use ChatGPT for Financial

Analysis” (Pop! Automation, 2023), which offers insights into horizontal analysis (recent historical analysis), vertical analysis (e.g., the accounting treatment for gains and losses arising from a cash flow hedge), and financial ratio analysis. Similarly, Larson and Overton’s (2024) new study examines the effectiveness of machine learning for revenue forecasting.

Exploring the technological evolution in public financial management is valuable, given the significant transformations that have made tasks more accessible and efficient. Srivastava and Jain (2023) delineate distinct phases in the Management of Technology (MoT) from 1972 to 1995, emphasizing Information Technology implementation and strategic alignment. Developments from 1996-2010 focused on strategic flexibility and technology learning, while the maturation of MoT from 2011 to 2022 integrated technology with broader strategic objectives. Similarly, Egodawale, Sedera, and Bui (2022) highlight a surge in digital transformation research from 2015, indicating a shift towards sophisticated technological capabilities in public financial management, proposing the RC3O nomological net as a tracing framework. Additionally, Ciancarini, Giancarlo, and Grimaudo (2023) analyzed the digital transformation in public administrations, emphasizing increased demand for digital services, the central role of data, and technology integration in public service delivery, illustrating a shift from a narrow technological approach to a comprehensive and integrated strategy encompassing various aspects of public service and policymaking.

The development of governmental accounting and reporting standards, as advocated by the Governmental Accounting Standards Board (GASB), marks a significant shift in local governments’ fiscal management and transparency. The implementation of GASB Statements like No. 68 and 45 has compelled local governments to disclose pension and post-employment benefit obligations, thereby influencing their fiscal decisions and resource allocations (Coe & Rivenbark, 2010; Dambra, Even-Tov, & Naughton, 2023). Furthermore, GASB’s recent standards, including Statements No. 67 and 68, not only standardize pension reporting, increase transparency, and potentially impact financial statement configurations (Lowe, 2014), but they also address collective action issues, thereby enhancing comparability and assessment in financial conditions across governments (Baber, Beck, and Koester, 2024; Rivenbark & Roenigk, 2011). Moreover, GASB’s proposed guidelines for service efforts and accomplishments reporting underscore its ongoing commitment to improving performance and data transparency, which are crucial for evaluating service efficiency and effectiveness (Sage & Sage, 2010.). These developments, in tandem with the advent of AI and tools like ChatGPT, present an unprecedented opportunity for local policymakers to harness enhanced data availability and analytical capabilities for more informed decision-making.

The rapid rise of AI has also raised concerns in the public sector, particularly regarding transparency. Recent work by Schiff, Schiff, and Pierson (2022) finds that “public value failures associated with artificial intelligence have significant negative impacts on citizens’ evaluation of public service.” These perceptions were primarily caused by citizens’ concerns about the lack of transparency in policy processes run by AI. This finding is consistent with Wenzelburger et al. (2024), who find that algorithms (critical to AI) are more accepted by citizens when they view the organization operating the algorithm more favorably (trust) and when the algorithm is of personal importance. Hence, financial managers must be given care to ensure transparency in AI processes. We thus have compelling reasons to understand better the utility of recent technological advances, specifically AI, for local government administrators. There is speculation about a range of possible outcomes from AI for budgeting and finance professionals. These possibilities range from AI replacing budgeting and finance professionals to having

limited utility, particularly for local government officials in smaller governments who lack the time and resources to invest in these technologies. This experiment offers a practical assessment of existing AI technologies to articulate the challenges and benefits associated with ChatGPT in its current form.

## **Research Design**

With a focus on small local governments, we selected Fort Calhoun, NE, as our unit of analysis. Fort Calhoun is in eastern Nebraska, north of Omaha. The city's population is just over 1,100, yet it is in the top quartile of cities in Nebraska at 102nd out of 579. Therefore, while considered by most a small city, Fort Calhoun surpasses many cities in size in this state and region. Offering a comprehensive range of municipal services such as fire and rescue, parks and recreation, economic development, water, and sewer, Fort Calhoun operates under a council-mayor form of government. Although lacking a finance director or manager, it has a clerk, treasurer, and an administrator referred to as a community coordinator. With a low unemployment rate of 2.9 percent, Fort Calhoun fits our profile as a small city with limited capacity to conduct the financial analyses we expect from most larger cities. Ultimately, by assessing the strengths and weaknesses of each AI tool, this study will provide a discussion on their relevance to financial tasks for local government practitioners.

The financial data used in this study were collected from the Nebraska Auditor of Public Accounts (2024). The data are consistently reported to the state and have been reviewed by the Auditor's office for compliance with property tax and debt limitation requirements. The data comprises property taxes, debt, expenditures, revenues, and property valuation. We selected the years 2001 to 2016 due to the accessibility of the financial data.

The next section presents a comprehensive evaluation of three distinct versions of ChatGPT, namely the ChatGPT-3.5 free version, ChatGPT-3.5 as a Python tutorial, and the advanced ChatGPT 4.0. Our assessment explores key aspects such as the capacity to handle varying data volumes, the accuracy of outputs generated, and the time taken to reach desired results. Time considerations encompass both the experimentation with prompts to achieve the expected output and the execution of codes, either within ChatGPT or on external platforms. Each version's performance is scrutinized across critical tasks, including descriptive analysis, fiscal condition analysis, forecasting, visualization, and policy recommendations.

## **Results**

### **ChatGPT-3.5**

ChatGPT-3.5's ability to internalize data is limited. When data was copied and pasted from an Excel spreadsheet into ChatGPT-3.5, it became evident that the program was constrained in processing information. Specifically, the program was limited to about nine columns and 16 rows of data.

Table 1. Descriptive Analysis, Valuation

<b>Descriptive Analysis</b>	<b>ChatGPT-3.5 Output</b>	<b>MS Excel Output</b>
Mean	\$54,852,713	\$56,417,414
Median	\$66,495,044	\$61,150,868
Minimum	\$40,507,996	\$40,507,996
Maximum	\$69,395,085	\$69,395,085
Standard Deviation	\$9,543,006	\$11,195,600

### *Descriptive Analysis*

Focusing on financial data from 2001-2016 for Fort Calhoun, NE, our descriptive analysis successfully provided an output for mean, median, minimum, maximum, and standard deviation, as shown in Table 1, with valuation as an example. However, subsequent error checking via Microsoft Excel revealed slight discrepancies in the populated mean, median, and standard deviation, whereas the minimum and maximum values were generally accurate.

Next, we requested ChatGPT-3.5 to identify patterns, fluctuations, or significant changes in the imported data. This prompt yielded the following valuation output: “The valuation of Washington County’s Fort Calhoun subdivision shows an overall increasing trend from 2000-2001 to 2015-2016, with some fluctuations along the way. There is a notable spike in valuation around 2005-2006 and a steady increase thereafter.”

### *Fiscal Condition Analysis*

For the fiscal condition analysis, we prompted ChatGPT with the instruction, “Please perform some fiscal condition analyses.” However, instead of executing any analysis, ChatGPT-3.5 outlined four possible options: “Relationship between Valuation and Net Cash Balance, Relationship between General Government Expenditure and Total Disbursements & Transfers, Debt Analysis, and Relationship between Total Property Tax Request and General Government Expenditure.” Only after further prompting with “Please conduct the four analyses as suggested” did the model proceed to conduct the specified fiscal analyses. Here is an example output of a fiscal condition analysis conducted by ChatGPT on the relationship between total property tax request and general government expenditure for Fort Calhoun, along with a summary of its findings:

- “Relationship between Total Property Tax Request and General Government Expenditure:
  - Calculating the correlation coefficient between total property tax request and general government expenditure:
- Correlation coefficient: 0.043
- The low correlation coefficient suggests a weak relationship between total property tax request and general government expenditure. It indicates that there is no significant association between the amount of property tax revenue generated and the level of government expenditure.”

Table 2. Financial Health Analysis, Net Cash Balance as a Percentage of General Government Expenditure

Year	Percentage
2000-2001	0.43%
2001-2002	0.81%
2002-2003	0.93%
2003-2004	1.50%
2004-2005	1.30%
2005-2006	1.46%
2006-2007	0.83%
2007-2008	2.17%
2008-2009	42.35%
2009-2010	7.13%
2010-2011	10.13%
2011-2012	33.67%
2012-2013	23.20%
2013-2014	26.64%
2014-2015	24.84%
2015-2016	19.66%

Overall, this proved to be useful as the output included correlation coefficients, directions, and strengths of the relationships. These results can help identify the degree to which two variables relate to each other, i.e., how one variable might co-vary with another. In this example of property tax and expenditures, a positive correlation could suggest that as property tax revenue increases, spending on government programs and services is likely to increase as well. However, because the strength of the correlation is weak, perhaps property tax has a limited influence on government spending decisions.

Similarly, ChatGPT-3.5 only generated descriptions of various financial health analyses – “debt-to-valuation ratio, net cash balance as a percentage of general government expenditure, property tax dependency, and debt service ratio” – without actually executing them. Again, only through additional prompting did ChatGPT-3.5 perform its suggested analyses with outputs including percentages and ranges over time.

An example output produced by ChatGPT on the net cash balance as a percentage of general government expenditures for Fort Calhoun with a summary of its findings is provided below and in Table 2.

- “Net Cash Balance as a Percentage of General Government Expenditure:
  - Calculate the net cash balance as a percentage of general government expenditure by dividing the net cash balance by general government expenditure and multiplying by 100:
- Using the provided data, the Net Cash Balance as a Percentage of General Government Expenditure for each year is as follows:
- The Net Cash Balance as a Percentage of General Government Expenditure represents the cash reserves relative to the government’s overall expenditure. The



values range from around 0.43% to 42.35% over the years, indicating varying levels of liquidity.”

### *Policy Recommendations*

Wanting to make use of the analysis, we prompted ChatGPT to provide some policy recommendations based on the two sets of financial condition analyses conducted: “Please provide some policy recommendation based on the two sets of financial condition analyses conducted.” The policy recommendations from the analysis included debt management, cash reserve management, revenue diversity, debt service planning, long-term financial planning, and regular monitoring and reporting. These policy recommendations seemed to be well thought-out, as seen through the concise, detailed recommendations that incorporated specific insights from the fiscal condition analyses done above. Below is an example of output produced by ChatGPT on Cash Reserve Management for Fort Calhoun:

- “Cash Reserve Management:
  - As indicated by the net cash balance as a percentage of general government expenditure, the subdivision has experienced varying levels of liquidity. It is recommended to maintain an adequate cash reserve that can cover a reasonable proportion of general government expenditure to ensure financial stability during times of unexpected expenses or revenue shortfalls.
- Suggestions for Improvement:
  - It is important to note that these recommendations should be considered in conjunction with a more detailed understanding of the specific circumstances, goals, and constraints of the Fort Calhoun subdivision. Additionally, involving relevant stakeholders and seeking expert financial advice can further enhance the effectiveness of these policy recommendations.”

### *Forecasting Data*

Our next task for ChatGPT-3.5 was to demonstrate its ability to provide simple forecasts for the imported variables of valuation, net cash balance, general government expenditures, total disbursements and Transfers, total property tax request, and total outstanding debt for the next 15 years using only data from the original dataset. To do so, the model used the average annual growth rate that it had calculated.

An example output of the forecasted Valuation values produced by ChatGPT for Fort Calhoun with some suggestions for improvement is provided below and in Table 3.

- “Here is the forecast for the next 15 years (from 2015-2016) using the average annual growth rates:
- Valuation Forecast:
  - Average Annual Growth Rate: 2.63%
- Please note that these forecasts are based solely on historical data trends and do not take into account any external factors or changes in economic conditions. They should be used as a rough estimation and further analysis with up-to-date

Table 3. Valuation Forecast

Year	Valuation Forecast
2016	\$71,283,454
2017	\$73,195,188
2018	\$75,180,356
2019	\$77,240,297
2020	\$79,376,445
2021	\$81,590,338
2022	\$83,883,515
2023	\$86,257,520
2024	\$88,713,903
2025	\$91,254,215
2026	\$93,880,009
2027	\$96,592,842
2028	\$99,394,380
2029	\$102,284,251
2030	\$105,300,094

- data and careful consideration of other factors is recommended for more accurate projections.”

#### *Discussion of ChatGPT-3.5 Free Version*

ChatGPT-3.5 (free version) is limited in terms of data import and processing capacity. However, the output was generally useful and detailed when carefully prompted. Specifically, ChatGPT was effective in identifying fluctuations, general trends, and spikes in the data, which could be beneficial for analysts, as fluctuations or spikes in data can prompt a thorough review of data entry to ensure accuracy in the dataset. Furthermore, general trends in the data can provide analysts with a quick understanding of the overall direction of a city’s finances and identify potential data input errors. Although ChatGPT consistently provided suggestions for both sets of financial condition analyses, we found it necessary to explicitly prompt it to execute the analysis rather than solely describing the procedure. While ChatGPT-3.5 provided policy recommendations, it noted that such recommendations should be constructed with the involvement of relevant stakeholders and financial experts and with additional factors like circumstances, goals, and constraints of the city in mind. ChatGPT was also able to conduct a simple forecast using the average annual growth rate of imported data, though it noted the limitations associated with such a forecast.

#### Using ChatGPT-3.5 to code in Python

We first asked ChatGPT to recommend a good AI program for graphing data, and Python was its first recommendation. Python is a free programming language that is widely used for a variety of purposes, including data analysis. Figuring out how to operate in Python, we asked ChatGPT how to get started with Python. The program recommended choosing an “Integrated Development Environment” (IDE), which is an application that runs Python code. The first IDE-

recommended program was called Jupyter Notebook. We asked ChatGPT to explain Jupyter Notebook and how to install the program. Getting to the stage of being able to type code into Jupyter Notebook took several hours. It included asking ChatGPT a host of questions, including how to use the program, a basic code to run in Jupyter Notebook, how to use the program for graphing data, and how to import data into Jupyter Notebook. From our perspective, while time-consuming and cumbersome, one of the benefits of Python is its ability to read several file types, including MS Excel, so there was no need to convert the existing dataset into a CSV file and risk problems associated with the conversion process. Having never run code before, let alone Python, presented some challenges and a good deal of time to get these data in operational form. Along the way, we ran into multiple coding errors, but fortunately, ChatGPT was able to help.

Once these data were loaded into Python, we asked ChatGPT how to run descriptives. We were given the code and answers to a host of coding errors, but ultimately, the program generated descriptives that included the mean, standard deviation, minimum, maximum, and quartiles for property valuation, total outstanding debt, net balances, property taxes, total revenues, and total expenditures. After another series of struggles with Python and ChatGPT, we were able to run simple graphs in Jupyter Notebook. While a bit crude, Python generated trend lines and box plots for our key variables. From there, we pivoted to generating financial ratios that included revenues to expenditures, cash balances relative to expenditures, and debt by valuation.

The real challenge began when we tried to learn how to forecast in Python. We typed in ChatGPT, “You are an analyst. How can I get Jupyter Notebook to generate 5-year forecasts?” To which ChatGPT responded: “To generate 5-year forecasts in Jupyter Notebook, you can use various forecasting techniques and libraries available in Python. Here’s a general guide on how to generate 5-year forecasts.” ChatGPT proceeded to describe a 6-step process that included how to import the necessary libraries for data analysis and forecasting (e.g., pandas, numpy, and forecasting tools such as statsmodels and scikit-learn), how to load the data, selecting the forecasting model, training the forecasting model, generating forecasts, and visualizing the forecasts.

For the experienced programmer, these steps probably make sense. Truth be told, we spent more than five hours trying to get Python to run a forecast. Even after watching YouTube videos, our efforts were unsuccessful. We got error message after error message, and even when we asked ChatGPT to help us fix the errors, we were unsuccessful in getting Python to generate the forecast. In summary, while highly effective and powerful, the idea that a local finance officer or local government officer in a smaller community will have the time and patience to learn coding from ChatGPT to conduct financial analyses in Python is unrealistic.

ChatGPT-4

In the ChatGPT-4 experiment, we aligned the input and prompts with those used in the 3.5 experiments. A key distinction between the two ChatGPT versions is that with ChatGPT-4, the model not only suggested Python code but could also execute it through a code interpreter plugin. Users could input data, and when prompted, the program would execute it directly within the chat. Code execution occurred in a secure environment, and both results and the code were displayed directly in the chat box. The user could also ask questions or request further analysis, and ChatGPT-4 would respond with the appropriate Python code and code execution. Overall, ChatGPT-4 was able to perform an interactive data analysis, which allowed for a deeper exploration of the data and provided more nuanced insights. Additionally, ChatGPT-4 was able to present data and calculation results in a more conversational style than ChatGPT-3.5.

Table 4. Descriptive Analysis, Valuation

Descriptive Analysis	ChatGPT-4
Count	16
Mean	56,417,410
Standard Deviation	11,195,600
Min	40,508,000
25%	44,084,260
50%	61,150,870
75%	66,527,510
Max	69,395,085

### *Descriptive Analysis*

Focusing on the same data, our descriptive analysis successfully provided output for mean, median, minimum, maximum, and standard deviation. Below is an example output of valuation from ChatGPT-4 of both a summary and table (see Table 4):

- “Valuation: The average valuation is approximately 56,417,410. The standard deviation is 11,195,600, which indicates a relatively large spread around the mean. The minimum valuation is 40,507,996 and the maximum valuation is 69,395,085”.

### *Visualization and Explanation*

A unique feature of ChatGPT-4 is that the visualizer plugin can provide visualizations along with a brief narrative of the results, as shown in the example of valuation over the years in Figure 1 below. This made the analysis more accessible and understandable, especially for non-expert users.

- “To identify patterns, fluctuations, or significant changes in the data, let’s examine the line plots for each variable over the years:
- Valuation:
  - The valuation of Washington County’s Fort Calhoun subdivision shows an overall increasing trend from 2000-2001 to 2015-2016, with some fluctuations along the way. There is a notable spike in valuation around 2005-2006 and a steady increase thereafter.”
- Whereas the code interpreting GPT 4 would use Python to plot the data and provide an interpretation as follows:
- “Valuation: There is a general trend of increasing valuation over the years. There is a significant increase from 2005-2006 to 2008-2009, after which the growth slows down.”

Figure 1. Valuation of Fort Calhoun, ChatGPT 4

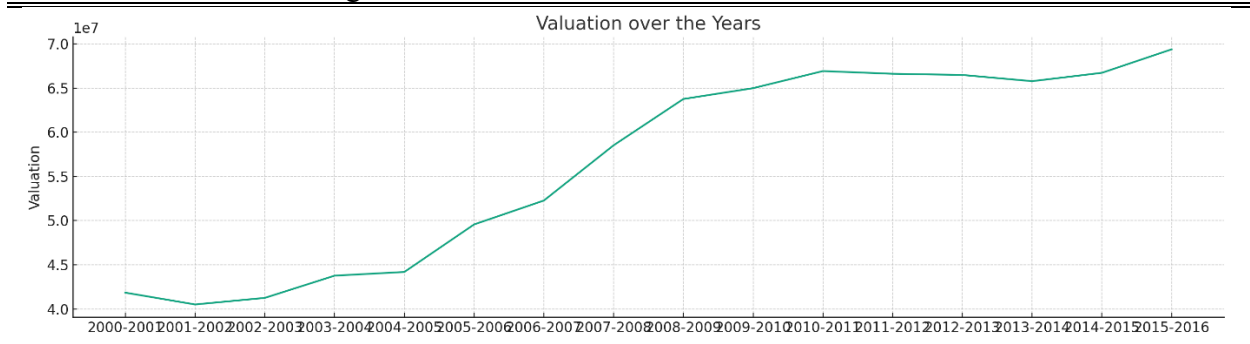
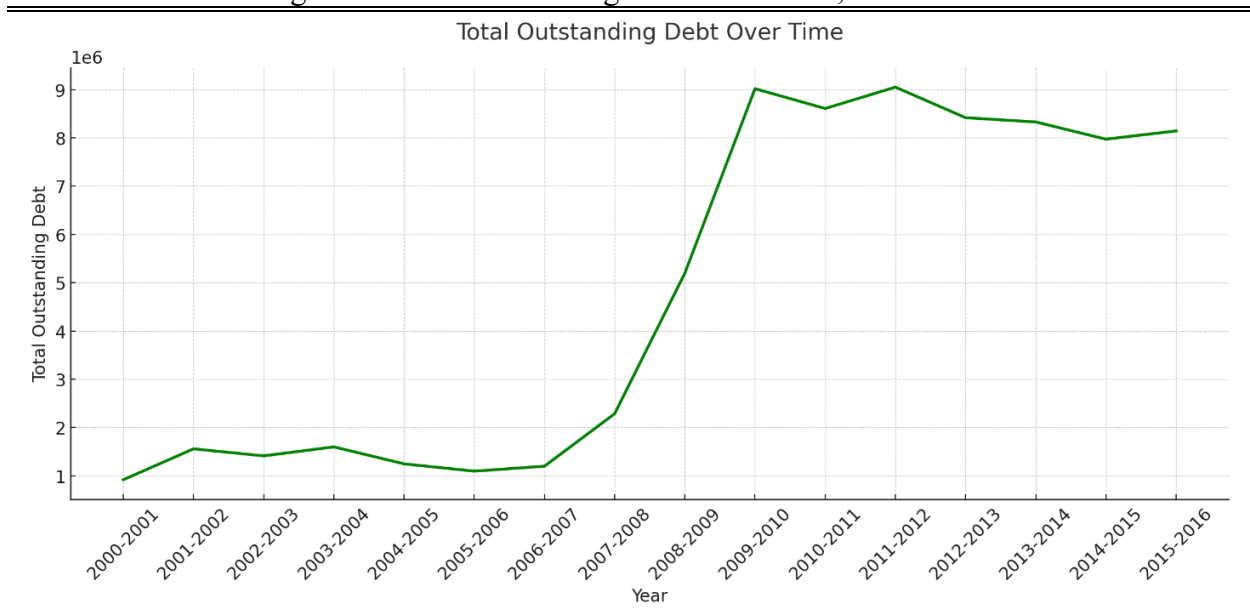


Figure 2. Total Outstanding Debt Over Time, ChatGPT 4



### *Financial Condition Analysis*

ChatGPT4 conducted a financial condition analysis using the following prompt: “Please conduct a financial condition analysis on the original dataset.” An example output with a visualization and description, along with some suggestions for improvement, is as follows (see also Figure 2):

- “There’s a significant spike in debt starting from around 2007-2008, reaching its peak in 2009-2010.
- After 2009-2010, the outstanding debt seems to have decreased slightly and then stabilized, with minor fluctuations in the subsequent years.
- The sharp increase in debt around 2007-2008 and its peak in 2009-2010 suggests that there might have been major investments, projects, or financial decisions made during that period. It would be essential to understand the reasons behind

this surge and how it aligns with the broader fiscal and strategic goals of Fort Calhoun.

- Overall, the financial health of a municipality depends on a combination of factors, including its ability to meet short-term obligations (liquidity), long-term financial stability (solvency), efficiency in government operations, and trends in valuation and debt. The analysis above provides a basic view of these aspects, but a more in-depth analysis could include additional factors such as revenue sources, expenditure commitments, demographic trends, and more.
- For a thorough assessment of financial health, it may also be helpful to compare these metrics with those of similar municipalities, or to benchmark against state or national averages.”

### *Policy Recommendations*

We prompted ChatGPT-4 to provide policy recommendations using the following prompt: “Please provide some policy recommendations based on the two sets of analyses conducted.” Here is an example output of a policy recommendation produced by ChatGPT-4 on Fort Calhoun:

- “Fort Calhoun has a high liquidity ratio, suggesting a strong short-term financial position. However, the high solvency ratio and increasing outstanding debt indicate potential long-term financial risks. Policies could be implemented to manage and reduce debt levels.
- Despite the high solvency ratio, the efficiency ratio is relatively low, suggesting effective management of disbursements and transfers. The municipality should continue to maintain this efficiency”.

These ChatGPT-4 recommendations were based on the analysis done, and the user could further interact with it to explore the provided recommendations, such as asking for more details or clarifications as needed. Notably, Chat GPT-4 moved through a series of ‘follow-ups,’ letting the user know of the limits of its recommendations and analyses based on the available data. An example follow-up provided by ChatGPT-4 is as such: “Remember, these recommendations are based on the data available and the analyses conducted. A more comprehensive policy recommendation would require a deeper understanding of the county’s specific context, needs, and constraints, as well as additional data and analyses.”

### *Forecasting*

Following this very brief and generic series of recommendations, we prompted ChatGPT-4 to do a forecast of the financial variables for the next 15 years. Here is an example output for the forecast done with the code interpreter plugin:

- “To provide a simple forecast for the next 15 years, we can use a method called linear regression. This method assumes that the future trend will continue in the same direction as the past trend. It should be noted that this is a simplified approach and doesn’t take into account potential changes in economic conditions, policy changes, or other factors that could impact these values in the future.

- Based on a linear regression model, below are the 15-year forecasted values for Fort Calhoun:
  - Forecasted Valuation: Increases from approximately \$66.6 million in 2016 to \$96.9 million in 2030.
  - Forecasted Net Cash Balance: Increases from approximately \$1.7 million in 2016 to \$2.5 million in 2030.
  - Forecasted General Government Expenditure: Increases from approximately \$577,077 in 2016 to \$815,138 in 2030.
  - Forecasted Total Disbursements & Transfers: Increases from approximately \$3.0 million in 2016 to \$4.3 million in 2030.
  - Forecasted Total Property Tax Request: Increases from approximately \$473,220 in 2016 to \$669,382 in 2030.
  - Forecasted Total Outstanding Debt: Increases from approximately \$5.6 million in 2016 to \$8.0 million in 2030.”

### *Discussion of ChatGPT-4*

Our exploration of financial data analysis tools engaged OpenAI’s ChatGPT-4 in a novel and interactive manner. ChatGPT -4’s integrated Jupyter notebook-like environment allowed us to perform sophisticated analysis on the Excel file containing Fort Calhoun’s financial data. For instance, ChatGPT-4 not only executed Python coding of data analysis but also offered detailed commentary at each stage of the output. Furthermore, the incorporation of a code interpreter within the chat interface made ChatGPT-4 highly beneficial to anyone, regardless of their coding background, even those with minimal coding proficiency. Also, the interactive nature of the interface permitted an iterative analysis process, fostering transparency through in-depth explanations at each step. However, the code interpreter’s limitations surfaced when complex and custom analyses demanded specific data types. Hence, even in the sandboxed local environment bounded by Python, a person with an innate understanding of the data being fed to the code interpreter must be present. This issue was mainly seen with the use of an unfiltered data spreadsheet. Hence, while the AI model could manage a wide range of analyses, specific cases or data types might fall outside its competency.

### **Challenges and Concerns**

One of the main challenges we encountered with the ChatGPT platform was the cost in terms of time, particularly when working with the free version of ChatGPT-3.5 alone and with Python. Specifically, in testing the capabilities of the free version, we noticed a steep learning curve where determining the optimal prompt proved to be time-consuming. On average, it took approximately five rewrites to achieve the desired results. As for ChatGPT-3.5 with Python, though this combination allowed for more flexibility and control, the main time cost was trying to decipher the optimal prompt for generating the intended code. Furthermore, the use of Python also required multiple troubleshooting and debugging efforts when errors occurred.

With ChatGPT-4, significant improvements in data processing enabled direct data file uploads, which significantly reduced time costs. However, despite the powerful capabilities of ChatGPT-4’s code interpreter, limitations persisted where a preference for “CSV” over “xlsx”



file types required additional data cleaning. Furthermore, the AI model lacked proficiency in handling specific complex analyses with simpler linear regression models for forecasting, which were chosen over more advanced options like Autoregressive Integrated Moving Average or machine learning models such as neural networks despite their being suggested. Still, accurate outputs were dependent on detailed or concise prompts, and ChatGPT-4 operated on a monthly subscription of \$20, unlike the free version of ChatGPT-3.5, with or without Python.

Retrospectively, here are a few lessons for the practitioner:

1. The quality of results depends on the quality of the data. While tools like Chat GPT and other AI models offer revolutionary analysis capabilities, they struggle with unreliable or unstructured data. Moreover, tools that aim to clean and correct data cannot help with such a situation at this point.
2. If practitioners lack knowledge and experience with the code interpreter's tools, they might overlook errors in calculations or thought processes that could potentially lead to inaccuracies. Practitioners need to be aware of their limitations when working with AI tools. Hence, we recommend integrating technical experts in the review process, especially given the public nature of the results. Specifically, local or national associations could offer specialized training programs that equip professionals with the necessary skills to effectively operate AI models accurately.

Overall, our experience with the ChatGPT platform highlights its powerful capabilities for generating outputs. The challenge, however, lies in the investment of time to understand and optimize prompts effectively. Transitioning to ChatGPT-4 improved data processing but introduced financial costs. We also observed better performance with a CSV data format and noted that regardless of which version was used, detailed prompts inevitably enhanced output quality. Hence, striking the right balance between time, cost, data preparation, and accurate and detailed prompts is essential for leveraging the ChatGPT platform's full potential in financial data analysis.

## Conclusion

This article introduces AI as a tool for analyzing Fort Calhoun's financial data through the following approaches: ChatGPT-3.5, ChatGPT-3.5 with Python, and ChatGPT-4. The tested AI capabilities cover descriptive analysis, fiscal health assessment, forecasting, visualization, and policy recommendations. ChatGPT's ability to perform these fiscal tasks is particularly valuable for smaller local governments with limited resources and capacity for financial analysis. Overall, ChatGPT-3.5 alone demonstrates promising potential for financial analysis in local government contexts, especially for smaller governments. Further advancements in the model's capabilities, when used with other programs or through the more powerful version of ChatGPT-4, AI could certainly benefit local governments in their financial decision-making processes.

A comparison between ChatGPT-4 and its predecessor, ChatGPT-3.5, reflects the strides made in AI. Unlike ChatGPT-3.5, which requires manual data input, ChatGPT-4 allows direct file uploads in the code interpreter. While ChatGPT-3.5 offers quick financial insights like averages, ranges, patterns, and even correlation analysis among variables, its output should be

treated as a general guide due to minor inaccuracies found in the output and its inability to process large datasets. Additionally, ChatGPT-3.5 lacks visualization capabilities. Hence, we recommend using the free version's outputs for a broad understanding rather than relying on them for practical applications or future research, especially in assessing the financial health of subdivisions like Fort Calhoun.

For Chatgpt-3.5 with Python, the output has the potential to be more sophisticated and accurate with the coding platform enabling visualizations for forecasting, descriptives, and fiscal analyses. However, this two-step approach requires someone with an adequate understanding of coding for effective utilization and troubleshooting. Hence, while ChatGPT-3.5 with Python holds the potential to achieve the fiscal analyses expected of a clerk or financial manager of a small city, the external execution of code poses a challenge for those lacking coding skills or an appropriate environment.

Contrastingly, ChatGPT-4 facilitates direct code execution within the chat interface, providing a seamless and accessible experience. However, challenges persist in terms of the data format and complexity of analysis as described. Nevertheless, the use of AI in city financial analyses holds promising implications for practice and policy, particularly in staff capacity enhancement. By automating data processing and analysis tasks, AI can enable staff to focus on higher-level decision-making and policy formulation. Furthermore, AI's capability to analyze historical data, forecast trends, and provide policy insights can lead to informed budget decisions and increased fiscal responsibility. Additionally, AI-generated policy recommendations that are tailored to community circumstances can offer policymakers valuable insights through pattern recognition in financial data for evidence-based decision-making.

We acknowledge that the findings of this study are limited to the ChatGPT platform, while other AI platforms like Bing AI and Anthropic Claude have been unexplored. Future research could thus compare different AI platforms to identify the most suitable one for specific financial analysis tasks. Also, while this study only explores the capabilities of ChatGPT through a single local government, future research could conduct a comparative analysis across multiple cities to deepen our understanding of AI. Additionally, as this study solely focuses on standard financial data, future research could explore different AI models for forecasting and analysis, incorporating economic data, market trends, and political or legislative changes. Finally, the study's emphasis on numerical data analysis could be broadened by investigating how AI can interpret financial text, such as Annual Comprehensive Financial Reports, Pension Valuation Reports, and Management Discussion and Analysis. This AI-driven text analysis could extract valuable insights, thereby enhancing accessibility and understanding for policymakers, stakeholders, and the community.

Engaging the community in AI usage is also a crucial aspect of future research. By leveraging AI for insights based on city financial data and reports, policymakers can foster transparency and involve citizens in the decision-making process. AI-powered financial tools can empower residents with accessible information, enabling participation in discussions on relevant fiscal matters. In conclusion, while this study highlights AI's benefits in local financial analysis, future research should explore diverse AI platforms, extend applications to financial text analysis, and how AI can actively engage the community for more informed decision-making and policy formulation in city finances.

## Disclosure Statement

The authors declare that there are no conflicts of interest that relate to the research, authorship, or publication of this article.

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# ***Adoption of Property Tax and Expenditure Limitations by U.S. States: A Multiple Events History Analysis***

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Property tax expenditure and limitations (TELs) are key tools used by U.S. states to control local government spending and taxing authority. This paper employs a multiple events history analysis to understand the factors influencing the adoption of county-level property tax TELs by state governments. The findings show that external factors such as policy learning, competition, imitation, and coercion play crucial roles in this process. Notably, the study reveals that higher out-migration rates and the presence of voter-based ballot initiatives significantly increase the likelihood of TEL adoption. Additionally, the spread of TELs is influenced more by national trends rather than neighboring state actions, highlighting the saliency of these policies. These findings shed light on the dynamics of policy diffusion and provide insights into the interplay between state-level decisions and local government financial autonomy. The study's implications extend beyond public finance, offering a nuanced understanding of policy adoption and diffusion in federal systems.

Keywords: Property Tax, Tax Diffusion, Tax and Expenditure Limitations, TELs

Tax and Expenditure Limitations (TELs) are legal measures that constrain a government's power over taxes and expenditures. These tools regained popularity in the United States during the taxpayer revolts of the 1970s and 1980s as a means to curb government growth (Goodman et al., 2021; Mullins & Wallin, 2004). Most notably, TELs have been used to restrict the ability of local governments to generate revenue through property taxes, including overall rate limits, specific tax rate limits, levy limits, and assessment increase limits (Mullins & Joyce, 1996). Research has examined the effects of property tax TELs on government finance, revealing that while these limitations prompt a reorganization of revenue channels, they do not significantly reduce overall spending (Kousser et al., 2008; Stallmann et al., 2017). Despite their mixed success, 37 states

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have implemented some form of TEL that impacts the property tax revenues of their county governments (Tax Policy Center, 2020).

The decision to adopt a TEL is influenced by internal and external factors specific to a state's environment. Internal factors, such as political, economic, and social elements, have been shown to significantly impact the diffusion of a policy (Berry & Berry, 2018; Shipan & Volden, 2008). Conversely, external factors are intergovernmental and vary depending on the policy in question, though four factors are commonly viewed to drive the adoption of a policy. These are policy learning, competition, imitation, and coercion.

Using data from all 50 states from 1977 to 2016, a multiple-event history analysis was used to study the question of why states adopt TELs. Understanding these external dynamics is crucial for comprehending the adoption of TELs, as it will further shed light on the dynamic between state and local government financial policy.

## **Background**

Tax and Expenditure Limits (TELs) serve as vital regulatory tools, curbing government revenue and expenditure growth to prevent excessive tax hikes and foster fiscal discipline (Decker, 2023). Primarily targeting revenue sources, TELs notably affect property taxes due to their direct impact on taxpayers. States employ various property tax TELs, including rate, levy, and assessment limits, to restrain property tax revenue expansion (Mullins & Wallin, 2004). These limits establish a comprehensive legal framework, significantly restricting county governments' revenue generation from property taxes while emphasizing their pivotal role in supporting local government functions and affecting fiscal autonomy.

TELs' impact on government outcomes, particularly property tax revenue, is multifaceted, necessitating innovative financial approaches amidst the demand for quality public services. Research highlights diverse effects, from reduced public spending to increased reliance on alternative revenue sources like sales taxes or fees (Luna, 2004; McDonald, 2019; Mullins, 2004; Zhang & Hou, 2020). This underscores property tax TELs' significance in county governance, stressing their influence on operational and fiscal stability and highlighting counties' essential role in service delivery.

## **Diffusion of Innovation**

The Innovation and Diffusion Framework (IDF) is used to study the characteristics that support the adoption of property tax TELs. IDF explains how an innovation for a solution to a governing problem in one jurisdiction spreads, or diffuses, to other government jurisdictions (Berry & Berry, 2018). A policy is said to diffuse when other government jurisdictions decide to adopt the same innovation as the inventing jurisdiction to solve a similar issue (Shipan & Volden, 2008).

Decisions regarding innovation adoption are influenced by both internal and external mechanisms (Berry & Berry, 2018; Shipan & Volden, 2012). Internal mechanisms encompass factors within the jurisdiction driving innovation, including governmental, economic, demographic, and political characteristics (Berry & Berry, 2018). These factors are crucial as governments operate within an open system (McDonald et al., 2020). External mechanisms are pathways through which governments are influenced by others' policies, facilitating innovation adoption (Berry & Berry, 2018). Research underscores that learning, competition, imitation, and

coercion significantly shape the likelihood of policy adoption (Kim et al., 2018). By examining these dynamics, this article develops hypotheses that capture the intricate process of property tax TELs policy diffusion.

### Theory and Hypotheses

The first external mechanism, *policy learning*, is when policymakers in one jurisdiction observe and evaluate the effectiveness of policies from others, facilitating the adoption of innovative solutions (Shipan & Volden, 2008). This learning process involves adjusting understandings and beliefs about policies based on new information. Due to the high costs and time required for gathering information, governments often rely on insights from others' experiences.

The adoption of property tax TELs appears to be significantly influenced by policy learning mechanisms. This learning process has been particularly catalyzed by public dissatisfaction over escalating property tax bills, leading to widespread tax revolts during the 1970s and 1980s. Such public unrest, exemplified by the tax revolts and the election of fiscal conservatives, underscored a growing concern that local governments were becoming overly reliant on expanding tax revenue, thus becoming too large and powerful (Martin, 2009; Cabral & Hoxby, 2012). In response, lawmakers sought strategies to mitigate property tax increases and curb local government growth.

The observation of California's Proposition 13 showed legislators nationwide the political appeal and public support for property tax TELs to ease growing tax burdens. This spurred interest in similar policies, particularly in states facing high property tax pressures, emphasizing the need for actions to retain voter support and ensure reelection. Thus, states with higher per capita property tax bills tended to adopt TELs, suggesting that heavier tax burdens might drive the adoption of TELs to satisfy constituent demands and secure political stability, leading to the first hypothesis.

*H<sub>1</sub>: States with higher average per capita property tax bills are more likely to adopt property tax TELs.*

Next, *competition* is an external diffusion mechanism that encourages governments to adopt certain innovations to achieve an economic advantage over other jurisdictions (Berry & Berry, 2018). When there are positive economic benefits from adopting a policy, a government is more inclined to implement that policy. While economic competition comes in various forms, one type of particularly prevalent competition between states is location-choice competition. Location-choice competition happens when governments seek to influence the location where individuals acquire some good or service that is available in more than one jurisdiction. Governments compete to have residents within their boundaries so that they can collect tax revenue and supply a strong workforce to promote economic growth.

Regarding property tax TELs, governments must balance encouraging residents to move into the jurisdiction through low tax rates while collecting enough revenue to provide the desired public goods and services (Boehmke & Witmer, 2004). Known as the Tiebout hypothesis, Tiebout (1956) argues that residents choose locations that provide public services desired at the appropriate cost. If either the services are lacking or the price tag is too expensive, it is thought that people will move to locations that better fit their desires (Boehmke & Witmer, 2004). If residents are moving out of a state, it indicates to lawmakers that either the public services

offered or the cost of said services do not match residents' desires. As a result, lawmakers may look to innovations that make them more competitive with the states to which their residents are migrating.

One way for a state to be more competitive in the location-choice competition is to implement property tax TELs. If people are moving into a state at a high rate, it indicates that individuals are happy with the services they are receiving in relation to the taxes paid. However, if people are migrating out of state at a high rate, this may indicate that property tax burdens are too high and that people would rather live somewhere else that matches their desires. This leads to the second hypothesis:

*H<sub>2</sub>: States with higher out-migration rates are more likely to adopt property tax TELs.*

*Imitation*, the third external diffusion mechanism, occurs when a government adopts an innovation to look like other government jurisdictions (Berry & Berry, 2018; Shipan & Volden, 2008). Imitation differs from learning mechanisms in that the innovation is adopted independently from any evaluation of the policy or its outcomes. When deciding who to imitate, jurisdictions often look to leader jurisdictions to imitate innovations. However, which governments serve as leader jurisdictions are influenced by the saliency of the policy intended to solve a problem.

Policy saliency refers to how prominently a policy is known by the general public (Mitchell, 2018). A highly salient policy is likely to diffuse widely because it is easier to comprehend the policy and its consequences, and its effects are discussed more widely in society, allowing leader jurisdictions to be located anywhere. In contrast, a low-saliency policy is more complicated, making it difficult to assess the consequences of adopting a policy. When policy saliency is low, policymakers try to emulate decisions of jurisdictions' demographic patterns, making states that are similar more likely to imitate each other (Shipan & Volden, 2012). As a result, the diffusion of a low-saliency policy is often more geographically constrained to neighboring states or states that have similar demographic characteristics as leader governments (McDonald et al., 2021).

Heightened awareness of property tax burdens, a prominent levy in the United States (Cabral & Hoxby, 2012), is compounded by widespread media coverage of tax revolts, fostering a sense of national unity in the pursuit of tax reduction (Mitchell, 2018). These mounting citizen pressures prompted elected officials to seek solutions by observing strategies employed across states. California's implementation of Proposition 13 served as a catalyst for property tax TELs, inspiring confidence among other state leaders that similar policies would address citizen concerns. This propensity to emulate other states intensifies as more jurisdictions adopt property tax TELs, leading to the subsequent hypothesis:

*H<sub>3</sub>: The more states that adopt property tax TELs, the more likely the state of interest will also adopt a property tax TEL*

Coercion, as an external mechanism, involves one government actor compelling another to adopt a policy through incentives or force (Berry & Berry, 2018; Shipan & Volden, 2008). Past literature has applied coercion to explain cross-national policy innovation and vertical coercion within federalist systems (Berry & Berry, 2018). Larger, more powerful governments



leverage tools such as military force, economic sanctions, or financial incentives like grants to coerce smaller governments into policy adoption. Unlike horizontal mechanisms such as policy learning, competition, and imitation, coercion operates vertically, establishing a power dynamic necessary for enforcing policy adoption (Shipan & Volden, 2008).

This paper extends the concept of coercion beyond government entities to include the ability of voters to compel their government into action. Central to this mechanism is the disparity in power dynamics. Typically, state lawmakers remain somewhat insulated from the day-to-day concerns of their constituents, being primarily held accountable during elections every two to four years. Consequently, lawmakers traditionally dictate the agenda and shape public discourse.

Residents have sought to reclaim power from their state legislatures by initiating ballot measures through public support. These initiatives allow state citizens to propose and enact new legislation via popular vote (Smith, 2002), thereby wresting control of the agenda from lawmakers and compelling them to act or risk direct intervention by voters. This form of voter coercion through ballot initiatives is evident in the diffusion of property tax TELs. California voters, recognizing their ability to effect change independently of elected officials, passed Proposition 13 via a ballot initiative (Martin, 2009), followed by Massachusetts' adoption of Proposition 2 ½ through a similar process (Hale, 1993). While property tax TELs have predominantly been adopted through state statutes, the ability of residents to introduce ballot initiatives endows them with greater influence over their elected officials' actions.

Given that an elected official's primary objective is reelection, politicians strive to appear responsive to their constituents' concerns (Tavares et al., 2022). Faced with the prospect of voter-led initiatives, politicians may preemptively address these issues within the state legislature. In essence, residents can coerce elected officials into action by threatening ballot initiatives. Thus, states with more accessible processes for adding ballot initiatives annually are more likely to witness voter coercion of their governments into action, leading to the final hypothesis:

*H<sub>4</sub>: States that have easier access to voter-based ballot initiatives are more likely to adopt a property tax TEL.*

## **Model, Data, and Methodology**

Building on the theoretical underpinning for exploring state decisions on property tax TEL adoptions, this study employs an event history analysis (EHA) methodology. An EHA is concerned with patterns and causes of qualitative changes (or "events") at a given point in time. The intent is to determine how a variable, or set of variables, affected the probability that an organization would transition into a new social state. For this study, the use of an EHA allows us to see how different factors influence the likelihood of imposing TELs on county governments, focusing on understanding the external mechanisms at play (McDonald & Gabrini, 2014).

Initially, EHA models focused on singular events, with subjects exiting the risk set upon experiencing the event. However, in the social sciences, especially in public finance, it's critical to account for multiple events, including the possibility of policy repeals or supersessions. This analysis treats the adoption of property tax TELs by state governments as unordered, varied events—encompassing rate, levy, and assessment limits—without dependence on previous

Table 1. State Adoption of County Property Tax TEL since 1977

State	Rate Limit	Levy Limit	Assessment Limit	State	Rate Limit	Levy Limit	Assessment Limit
AL	1978	---	---	MT	---	1987	---
AK	---	---	---	NE	1998	1978	---
AZ	1980	1980	1980	NV	1979	1983, 2005	---
AR	---	1981	2001	NH	---	---	---
CA	1978	---	1978	NJ	---	---	---
CO	1992	1992	1982	NM	1978	1979	2000
CT	---	---	---	NY	---	2011	1981
DE	---	---	---	NC	---	---	---
FL	2007	---	1995	ND	---	1981	---
GA	---	---	1983	OH	---	---	---
HI	---	---	---	OK	---	---	1996
ID	1978	1979-1992, 1995	1978-1982	OR	1991	---	1996
IL	---	1991	2003	PA	---	2006	---
IN	---	2008	---	RI	---	1985	---
IA	1989	---	1978	SC	1995	---	2006
KS	---	1999	---	SD	---	1997	---
KY	---	1979	---	TN	---	---	---
LA	---	1978	---	TX	---	1982	1997
ME	---	---	2005	UT	---	1987	---
MD	---	---	---	VT	---	---	---
MA	1980	1980	---	VA	---	---	---
MI	1994	1978	1994	WA	---	2007	---
MN	---	1998-1999, 2009-2011	---	WV	---	1990	---
MS	---	1980	---	WI	1994	2005	---
MO	---	1980	---	WY	---	---	---

Source: Lincoln Institute of Land Policy (2023).

actions. Consequently, this study employs a competing risks model alongside a time-constant regression approach, facilitating a nuanced examination through a time-constant, competing risks Cox regression model. The resulting hazard ratio reflects the probability of an event's occurrence within a specific timeframe. It is influenced by diverse factors across different years and states, serving as a dynamic measure of event likelihood (McDonald & Gabrini, 2014).

External mechanisms, as outlined in the theory section, play a crucial role in the diffusion of property tax TELs, interacting dynamically with internal factors. Berry and Berry (2018) highlight that policy decisions are influenced by a confluence of mechanisms, including governmental, economic, demographic, and political factors. Given that government organizations interact with and are shaped by their surroundings, integrating both external and internal determinants in a unified model is essential for a comprehensive analysis of adoption decisions.

Table 2. Variable Definitions and Sources

Variable	Measurement	Source
<b>Dependent Variables</b>		
Adoption - All	If a state adopted any of the three property tax TELs in a particular year, coded as 1 for all years TEL is present	Lincoln Institute of Land Policy
Adoption - Multiple Events	If a state adopts any of the three property tax TELs in a particular year, coded as 1 for that year ONLY	Lincoln Institute of Land Policy
Rate Limit Adoption	If a state adopted a property tax rate limit TEL in a particular year, coded as 1 for all years TEL is present	Lincoln Institute of Land Policy
Levy Limit Adoption	If a state adopted a property tax levy TEL in a particular year, coded as 1 for all years TEL is present	Lincoln Institute of Land Policy
Assessment Limit Adoption	If a state adopted a property tax assessment TEL in a particular year, coded as 1 for all years TEL is present	Lincoln Institute of Land Policy
<b>Independent Variables</b>		
Learning	Property tax per capita for a state in a given year	Lincoln Institute of Land Policy
Competition	The rate at which people move into a state in a given year	U.S. Census Bureau
Imitation - Neighbor	The ratio of neighboring states that have adopted a property tax TEL in a given year	---
Imitation - National	The ratio of U.S. states that have adopted a property tax TEL in a given year	---
Coercion	If a state has a mechanism for bringing voter initiatives, coded as 1 for all years present	National Conference of State Legislatures
<b>Governmental Characteristics</b>		
Special Districts	Number of special districts in a state	U.S. Census Bureau
Municipalities	Number of municipalities in a state	U.S. Census Bureau
Efficiency Ratio (ln)	The ratio of state total expenditures to revenue	Pierson et al. (2015)
IGR Ratio (ln)	The ratio of total IGR to state revenues	Pierson et al. (2015)
Debt Ratio (ln)	The ratio of state total debt to total assets	Pierson et al. (2015)
<b>Economic Characteristics</b>		
Economic Output (ln)	Gross State Product (GSP) of a state in a particular year	Bureau of Economic Analysis
Income (ln)	Median household income	Bureau of Economic Analysis
Unemployment (ln)	Percentage of the labor force who is unemployed	Bureau of Economic Analysis
<b>Demographic Characteristics</b>		
Population Density (ln)	Population per square mile	Centers for Disease Control and Prevention
Age 65+ (ln)	Percentage of residents that are aged 65 and over	Centers for Disease Control and Prevention
BIPOC Population (ln)	Percentage of the population identifying as Black, Indigenous, or Person of Color	Centers for Disease Control and Prevention
Female Population (ln)	Percentage of the population identifying as female	Centers for Disease Control and Prevention
Education (ln)	Percentage of the population with a bachelor's degree	Centers for Disease Control and Prevention
<b>Political Characteristics</b>		
Democratic Legislature	If a state's legislature is controlled by the Democratic Party, coded as 1 for that year	National Conference of State Legislatures
Democratic Governor	If a state's governorship is controlled by the Democratic Party, coded as 1 for that year	National Governors Association
Annual Budget	If a state's legislature has an annual budget session, coded as 1 for that year	National Conference of State Legislatures

Note: All values expressed in 2015 real dollars.  
All continuous variables are logged.

Table 3. Descriptive Statistics

Variable	Mean	Std. Dev.	Minimum	Maximum
<b>Dependent Variables</b>				
Adoption - All	0.5520	0.4974	0	1
Adoption - Multiple Events	0.0280	0.1650	0	1
Rate Limit Adoption	0.2080	.04060	0	1
Levy Limit Adoption	0.3850	0.4071	0	1
Assessment Limit Adoption	0.2095	0.4071	0	1
<b>Independent Variables</b>				
Learning	0.0626	0.2442	0	3.7230
Competition	0.0099	0.0105	-0.0599	0.0863
Imitation - Neighbor	0.5802	0.3334	0	1
Imitation - National	0.5520	0.5001	0	0.7400
Coercion	0.5000	0.5001	0	1
<b>Governmental Characteristics</b>				
Special Districts	654.8875	660.8385	0	3,327
Municipalities	385.0675	319.0202	1	1,298
Efficiency Ratio (ln)	-0.0431	0.2186	-0.8104	1.9159
IGR Ratio (ln)	-1.4435	0.3200	-2.7786	0.7058
Debt Ratio (ln)	-1.2232	0.6096	-3.6797	0.6749
<b>Economic Characteristics</b>				
Economic Output (ln)	11.9198	1.1418	9.4784	17.0032
Income (ln)	10.9565	0.4372	7.8766	13.6312
Unemployment (ln)	-2.8635	0.3586	-4.0174	-0.1734
<b>Demographic Characteristics</b>				
Population Density (ln)	4.2827	1.3306	-0.5202	6.9246
Age 65+ (ln)	-2.0584	0.1804	-3.2096	-1.6162
BIPOC Population (ln)	0.8836	0.0255	0.8094	0.9697
Female Population (ln)	-2.6048	0.1901	-3.8463	-2.2140
Education (ln)	-1.5886	0.2382	-2.3539	-0.8486
<b>Political Characteristics</b>				
Democratic Legislature	0.4705	0.4992	0	1
Democratic Governor	0.5020	0.5001	0	1
Annual Budget	0.6200	0.4855	0	1

Note: All values expressed in 2015 real dollars.

State-level data were collected from 1977 to 2016 to estimate the EHA model and test the hypotheses. Table 1 provides an overview of state-imposed property tax TELs. Table 2 provides the variables, their definitions, and data sources used in this study. Table 3 provides the descriptive statistics of the data.

An event, the dependent variable of this study, is the adoption of a property tax TEL innovation by a state. Five different *adopted* dependent variables are calculated to analyze the three models mentioned previously. For the first model, an *adoption-all* dependent variable is created, coded as 1 for every year a state has a property tax TEL in place upon a county

government, regardless of the property tax TEL type, and coded as 0 for all other years. The second model, *adoption-multiple events*, is coded as a 1 for the year in which a state adopts any of the three property tax TELs only and coded as 0 in all other years. These two models are compared to determine which iteration of the dependent variable best captures the variance in the model. Once this is determined, three additional dependent variables are created, *adoption-rate*, *adoption-levy*, and *adoption-assessment*, and are dichotomously coded accordingly.

Next, the model incorporates external mechanisms from the theory section as independent variables to analyze state property tax TEL adoption. *Learning* is measured by per capita property tax revenue. *Competition* is defined by migration rates, representing the ratio of incoming and outgoing residents. *Imitation* is quantified through the variables neighbor and national, reflecting the adoption of property tax TELs by bordering states, and the overall U.S. *Coercion* is captured by a binary variable coded 1 to indicate the presence of state-wide ballot initiatives.

## Results

As stated above, property tax TEL adoption was analyzed first by comparing two models, a pooled analysis and an event-specific analysis. Once the appropriate analysis model was selected, a nested model that contains all three types of property tax TELs is then analyzed. To understand which dependent variables best represent the risk regression analysis, the *adoption-all* and *adoption multiple events* models were estimated. These results are provided in Table 4.

As stated previously, when comparing time-constant, competing risk Cox regression models, the  $-2 \times \log\text{-likelihood}$  is used to measure the model's contribution to the explanation of the duration of time until the event, in the case of TEL adoption. Since the log-likelihood runs from infinity to negative infinity, it cannot show specific amounts of variation explained but can be used to compare models. As seen in Table 4, the log-likelihood is significant in both of the models. The  $-2 \times \log\text{-likelihood}$  of the *adoption-all* model is over 14,000 compared to the *adoption-multiple events*-  $2 \times \log\text{-likelihood}$  over nearly 700. This result indicates that the *adoption-all* model does a better job of explaining the effects of the covariates on adoption. As a result, the *adoption-all* dependent variable coding is used for the nested model, which includes rate limits, levy limits, and assessment limits nested within the *adoption-all* model.

Turning attention to the nested model that includes each of the different types of property tax TELs, the results are provided in Table 5. All three property tax TEL models demonstrate strong explanatory power for variance, highlighting their significance in multiple event analyses. The comprehensive *adoptions-all* model, integrating all TEL types, showcases superior performance with a -2LL over 14000, affirming its effectiveness in capturing the simultaneous impact of various external mechanisms.

Hazard ratios, indicating the impact of predictor variables on event occurrence risk, are vital for interpreting our model's results. These ratios, adjusted for all other predictors, show the effect size: a ratio above 1 suggests an increased event occurrence likelihood, below 1 indicates a reduced likelihood, and around 1 signifies minimal impact. Continuous variables' hazard ratios reflect risk changes per unit increase, while dichotomous variables compare hazard rates between groups. This information is critical for hypothesis evaluation.

As shown In Table 5, the first hypothesis on policy learning cannot be confirmed. Contrary to expectations, higher average per capita *property tax bills* decrease the likelihood of a

Table 4. Cox Regression, Adoption – All versus Adoption – Multiple Events

Variables	All	Multiple Events
<b>Independent Variables</b>		
Learning	0.7574*	1.4202
Competition	1,450,000.0000***	104,000,000.0000*
Imitation - Neighbor	0.8587	0.5137
Imitation - National	11.6854***	0.1801
Coercion	1.9590***	2.1861*
<b>Governmental Characteristics</b>		
Special Districts	1.0004***	1.0002
Municipalities	0.9990***	0.9997
Efficiency Ratio (ln)	3.7280***	2.4429
IGR Ratio (ln)	1.0559	0.4434
Debt Ratio (ln)	0.8316***	0.74345
<b>Economic Characteristics</b>		
Economic Output (ln)	1.8166***	2.0729*
Income (ln)	0.4505***	0.0851***
Unemployment (ln)	1.4736***	1.0100
<b>Demographic Characteristics</b>		
Population Density (ln)	0.6350***	0.6999
Age 65+ (ln)	0.0154*	6.9662
BIPOC Population (ln)	226.4539*	7.8960
Female Population (ln)	681.7920***	1.0212
Education (ln)	0.9909	1.745
<b>Political Characteristics</b>		
Democratic Legislative	1.0977	1.1985
Democratic Governorship	0.8432***	0.7100
Annual Budget	3.3159***	2.9952***
<b>Significance</b>		
-2LL	14,206.5734***	696.1490

Note: \*p < .10. \*\*p < .05. \*\*\*p < .01.

state adopting a property tax TEL, possibly due to potential revenue shortfalls. If the governments in a state rely more heavily on property tax revenue, they may be less likely to adopt a property tax TEL because of the shortfall in revenue it may cause.

The second hypothesis focuses on competition mechanisms via the state's *migration rate*. The results show that a one percent decrease in migration increases the probability of adopting a property tax TEL by 14,500,000 times, assuming all other factors remain constant. This assumption is theoretical, as isolating variables is impractical. This hazard ratio underscores the substantial effect of migration rate on property tax TEL adoption despite the migration rate ranging from 0.0863 to -0.0598.

The third hypothesis, examining imitation through *imitation-national*, finds strong support, indicating a state's increasing likelihood to adopt a property tax TEL with each percentage point increase in adoption among states. *Imitation-national* is notably significant, contrasting with the nonsignificant *imitation-neighbor*, underscoring the saliency of property tax

Table 5. Cox Regression Results

Variables	Rate Limit Adoption	Levy Limit Adoption	Assessment Limit Adoption	All Adoptions
<b>Independent Variables</b>				
Learning	0.2439***	0.7253*	0.7030*	0.7574*
Competition	2,350,000.0***	402,000,000.0***	432,000,000.0***	1,450,000.0***
Imitation - Neighbor	0.6902	0.8192	0.6199*	0.8587
Imitation - National	5.6604***	23.2152***	18.9963***	11.6854***
Coercion	1.0190	2.4247***	1.1677	1.9590***
<b>Governmental Characteristics</b>				
Special Districts	1.0005***	1.0007***	1.0000	1.0004***
Municipalities	0.9959***	0.9993**	0.9987***	0.9990***
Efficiency Ratio (ln)	14.9611***	0.9529	4.3497***	3.7280***
IRG Ratio (ln)	0.6628**	1.3025	9.5150***	1.0559
Debt Ratio (ln)	0.6537***	0.9795	0.1114***	0.8316***
<b>Economic Characteristics</b>				
Economic Output (ln)	4.4104***	1.0409	9.5150***	1.8166***
Income (ln)	0.1734***	0.8424	0.1114***	0.4505***
Unemployment (ln)	1.9480***	1.5890***	2.3016***	1.4736***
<b>Demographic Characteristics</b>				
Population Density (ln)	0.4519***	0.8339***	0.1908***	0.6350***
Age 65 + (ln)	1.1708	0.0344	0.0086	0.0154*
BIPOC Population (ln)	0.0000144*	2908.0530*	0.0000***	226.4539
Female Population (ln)	1.1346	171.5348**	46.3244	681.7920***
Education (ln)	1.6266*	0.7491	3.3035***	0.9909
<b>Political Characteristics</b>				
Democratic Legislature	0.9641	1.1051	1.2409*	1.1985
Democratic Governor	0.8081*	0.7990**	1.2854***	0.7100***
Annual Budget	7.3582***	2.7090***	13.04859***	2.9952***
<b>Significance</b>				
-2LL	4910.2848***	9912.4702***	4985.2512***	14206.5734***

Note: All values expressed in 2015 real dollars

\*p < .10. \*\*p < .05. \*\*\*p < .01.

TELs for widespread imitation rather than proximity-based adoption, thus affirming the hypothesis.

While not significant in two of the three specific TEL models, the presence of a ballot initiative is significant in the pooled model and the hypothesized direction, confirming hypothesis four regarding coercion. Since ballot initiatives are dichotomous variables, the results indicate that the presence of a ballot initiative increases the odds that adoption will occur compared to states without public ballot initiatives.

Attention is next turned to the control variables. Based on the results, governmental control variables like *special districts* and *municipalities*, though statistically significant, have minimal impact on property tax TEL adoption. Fiscal health indicators show that an increase in the efficiency ratio boosts the likelihood of TEL adoption, reflecting that more efficient

governments tend to adopt TELs. In contrast, a higher debt ratio reduces adoption chances due to increased revenue needs for debt repayment. The *IGR ratio*'s insignificance suggests it does not influence TEL adoption.

All three economic control variables were statistically significant. An increase in the economic output and unemployment rate both appear to make property tax TEL adoption more likely for a state. On the other hand, an increase in the median household income appears to decrease the likelihood of TEL adoption. As household income increases, so does the tax revenue that the government collects from this household, making governments more hesitant to implement property tax TELs and cap their increasing revenues.

Demographic characteristics of population density, the proportion of the population ages 65 and up, and the female population are significant in the nested model. Increases in population density and age 65 and up population decrease the likelihood of property tax TEL adoption. The significance of the portion of the population ages 65 and up tracks with the reasons TELs were adopted in the first place: to protect residents on fixed incomes. Further, as population density increases, local governments also grow to meet demands. As such, more revenue is needed to fund this growth. An increase in the female population also increases the likelihood of adoption.

Finally, the political characteristics of a democratic governorship and annual legislative budget session are statistically significant. The presence of a Democratic governor makes it less likely that a state adopts a property tax TEL. This aligns with the expectations of current political parties and the assumption that Democrats are more likely to support taxes. States that have an annual legislative budget session are more likely to adopt a property tax TEL than states that do not have annual budget sessions.

## Conclusion

This study contributes to the public finance discourse by showcasing event history analysis in examining property tax TEL adoption, marking a shift from its traditional applications toward addressing fiscal policy dynamics. By utilizing a time-constant, competing risk Cox regression model, this work not only sheds light on the intricacies of property tax TELs but also equips future scholars with robust analytical tools for fiscal policy evaluation.

This study underscores the critical role of both external and internal fiscal factors in shaping policy outcomes. The significance of external factors on fiscal decisions underscores the intricate relationship between taxation policies and state fiscal health. This insight is pivotal for public administrators and finance professionals, emphasizing the need for nuanced fiscal strategies that consider broader economic and demographic trends.

Furthermore, the significant role of national diffusion over neighborly diffusion redefines our understanding of fiscal policy saliency and its implications for nationwide fiscal legislation trends. The examination of coercive diffusion through public ballot initiatives presents a novel perspective on citizen engagement in fiscal policy-making, challenging traditional notions of governmental authority and highlighting the power of direct democracy in shaping fiscal policies. In closing, this research advances the field of public budgeting and finance by dissecting the complex factors influencing property tax TEL adoption, offering valuable insights for both policymakers and practitioners in devising effective fiscal policies and enhancing governmental fiscal health.



## Disclosure Statement

The author declares that there are no conflicts of interest that relate to the research, authorship, or publication of this article.

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# ***The Municipal Financial Crisis: A Framework for Understanding and Fixing Government Budgeting***

Kenneth W. Hunter<sup>1</sup>

Moses, M. (2022). *The municipal financial crisis: A framework for understanding and fixing government budgeting*. Palgrave Macmillan, 184 pp., \$49.99 (paperback), ISBN: 978-3-030-87835-1.

Keywords: City Finance, Financial Crisis, Municipal Bankruptcy, Public Pensions

Mark Moses, the author and a veteran local government finance professional with experience in several California jurisdictions, proposes a transformative, systematic solution to the fiscal crises and paralysis facing towns, cities, and counties across the country in his retrospective manifesto, *The Municipal Financial Crisis: A Framework for Understanding and Fixing Government Budgeting*. Drawing primarily upon his observations and challenges as a public finance executive, Moses dwells into common exasperations felt by many in our field of practice. He uses them to frame a solution rooted not in improvements to process but rather in a seismic decision-making shift rooted in the embrace of traditional Libertarian philosophies to the role of government.

The first six chapters of the reader link the structural challenges of financing today's local governments (the "crisis") with examples the author witnessed during his career. Examining the multiple efforts made in the recent past to improve budgeting processes to deviate away from a path to insolvency and unaffordable service costs for citizens (I.e., zero-based budgeting, program-based budgeting, and outcome-based budgeting), Moses finds and outlines his inherent problems with all of these. He argues the problem is not with the process because the process, as he sees it, will always be flawed if local government leaders are not aware and focused solely on what their jurisdictions should and should not be doing.

What should local governments be doing or not doing? From here, Moses asserts an approach grounded in a fundamentalist Libertarian philosophy comprising most of the mainstream-available books in this genre. After concluding, based on his ideology that government can only function using group force (coercion), he states this approach must be limited to the other option he presents for decision-making: individual freedom.

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Moses ties these together as a means to an end for local government. He devises a model of “Budgeting for Scope.” Existing and future functions of municipalities and counties are assigned to one of five categories of diminishing relationship to protect individual freedom (governmental and legislative enforcement, governmental regulation, municipal monopoly, commercial services, and noncommercial activities) and subsequently right-sized (to fundamental responsibilities only), privatized, or eliminated.

This framework may have started as a slide deck where he was confident about the solution. However, for every page he offers and explains his prescription for correction, Moses spends two pages describing and rationalizing his contempt for our current situation and the processes enabling it.

Mark Moses is on to something if the title of this book was “The Municipal Crisis in California.” Those less familiar or untied to the challenges created by The Golden State’s adherence to home rule, referendums, and public sector unions may find his background unrelatable. Many of us, including me, are not saddled with these vehicles that have led to a significant increase in the scale and size of governments and, more importantly, their financial demands for California and a few other notable states. The resulting tax burdens these jurisdictions now require meeting with their legally binding responsibilities, including generous pension and post-employment benefits, likely contributed partly to their recent population exodus and subsequent inward migration to other states, especially to the Sunbelt.

Moses applies a geographically limited personal survey of local financial challenges and the political, policy, and management failures facilitating them. While there are a few moments where he ties in challenges and failures elsewhere, this autobiographical approach to describing the reasons for his discontent with traditional local government budgeting lacks relevance for many. This is further exacerbated by his limited, almost nonexistent use of references to provide salient backup or confirm his conclusions and diagnoses. The author does not establish objectivity throughout the first two-thirds of the book. As a result, Moses’ rationale for the “cure” he presents in the final chapters and pages reads more like an unstructured rant (perhaps justified) that is familiar to budget and finance professionals.

For a book on a topic like this to be salient and credible, the author (practitioner or academic) must commit to validating their perspective with the work of others and present awareness of conflicting viewpoints. In Moses’ first six chapters, where he attempts to identify the problems with current budgeting processes and traditional financial reporting and analysis, he provides a small number of footnotes. He only incorporates less than ten actual research articles or presentations. If not for the work of GFOA, he would not have much.

Instead, Moses “goes to the well,” already established by many intelligent, well-read policy advisors and commentators with no real public sector experience to speak of. Namely, Moses’ solutions apply approaches devoid of actual consideration of how government responsibilities and their unique “consent of the governed” relationship with residents and citizens are far from the limited nature advocated by fundamental Libertarianism.

As I mentioned before, I was interested in reading this book before it was assigned. Very rarely, if ever, have experienced local practitioners (who are not elected) shared their experiences and perspectives. Moses has over 30 years of experience in local budgeting and finance and 25 years as a direct finance officer/CFO.

Moses also possessed the opportunities and resources to build a work tying his field-level insight to the world of academic public budgeting and finance study. As a student and graduate of the University of California at Berkeley during the heyday of faculty member and prominent

public administration researcher Aaron Wildavsky (1930-1993), Moses could've offered a revaluation of Wildavsky's critical work of the relationship between policy, politics, budgeting, and administration. Moses could have built on forecasts Wildavsky would have likely stated, consistent with his analysis of case studies from the 1960s to the 1980s, and brought forth means of improvement, incorporating the 30 years of books and journal articles written since Wildavsky's death building on his essential, pivotal body of work.

Wildavsky, unfortunately, is not referenced in Moses' book. Perhaps being an industrial engineering major, Moses was unaware of Wildavsky as a student. Despite spending his entire career in California, Moses does not appear to be aware of one of the most significant resources, Wildavsky's work in the field, and how it applies directly to Moses' challenges.

Instead, Moses applies an insular approach, devolving into a repetitive vent on all the problems he ran into during his public budgeting and finance career and how he could not do anything to solve them because of the people, processes, and mentality around him. He needs to acknowledge the competing interests of elected officials, the legacies of past policies creating disparities within local populations, and the inability of private markets (for-profit and nonprofit) to adequately meet needs in delivering services even when local governments are forbidden.

On multiple occasions, Moses references telecommunications, which we now associate with the infrastructure and delivery of high-speed broadband. Moses believes this service, like almost all public utilities, should be privatized and out of the hands of local governments. Unfortunately, just as many localities established electric, natural gas, water, and sewer utilities a century or more ago because private investors were not willing to enter their markets, many parts of the country have struggled to see private investment in broadband fiber optic infrastructure despite restrictions and even prohibitions on their potential participation. Given how the lack of this service hampers the delivery of education, medical treatment, and other essential services to individuals (especially during the COVID pandemic), one could argue that the lack of local government participation in this area hampers and diminishes the ability of citizens to maximize individual freedom in today's world unless they choose and can move elsewhere.

I doubt Moses read any of Wildavsky's essential works on budgeting, policy, and politics. If he had, he would have at least tried to rationalize his solution to accommodate these serious, notable issues. Instead, the author sticks to what is best described as what President John F. Kennedy (1963) would have said, "seemingly swift and simple solutions," particularly this: "A clear standard of purpose - i.e., to protect individual decision-making - addresses the needs of residents and delimits the organization's scope." Moses' solutions may sound ideal to some, including myself, but they are void of any acceptance of reality or reason. Nor is his statement that his approach is the only way: "The Budgeting for Scope framework must not just be another *tool in the toolbox*... This framework must *govern* the toolbox" (p. 153).

This book may make its rounds with Councilmembers and Commissioners at the local level. Moses has found an audience amongst some Libertarians and traditional Conservatives, so it is entirely plausible a public finance and budgeting professional may encounter an elected official referencing Moses' work as "the solution" to what ails the municipality or county. Some practitioners, like me, may even find some substance and solace within Moses' questioning of the broadening base of local government activities and the one statement he drives home where I agree, "[a]ctivities drive costs" (p. 136).

Now focused on writing and consulting, Moses can take this opportunity to build upon his wealth of experience, draw from the works of others, and present a precise, multi-faceted examination of the challenges we are facing at the local level with limited resources and

increasing demands. Perhaps in the next edition or another book, he can work on constructively applying his ideological precepts to developing solutions and models where serious, meaningful improvements (including direct reductions) in the scope of municipal services were obtainable in today's polarizing, challenging political environment.

### **Disclosure Statement**

The author declares that there are no conflicts of interest that relate to the research, authorship, or publication of this article.

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# ***Municipal Fiscal Stress, Bankruptcies, and Other Financial Emergencies***

Jonathan B. Justice<sup>1</sup>

Guzman, T., & Ermasova, N. (2023). *Municipal fiscal stress, bankruptcies, and other financial emergencies*. Routledge, 310 pp., \$49.95 (paperback), ISBN: 978-1-032-34938-1.

Keywords: Bankruptcy, Financial Management, Fiscal Stress, Municipal Finance

This book is physically compact but provides in its 15 chapters a cornucopia of material taken from the authors' extensive review of the relevant academic literature, think-tank reports, and other sources, and from their case studies of six recent local-government financial emergencies (Detroit, Colorado Springs, Jefferson County, Pittsburgh, Central Falls, and Vallejo). It can be read as a book-length scholarly argument leading up to a proposed descriptive model of the progression of municipal emergencies. Still, it can also be used as a handbook (or "sourcebook," to borrow a label from Miles and Huberman [1994]). As the authors suggest, "[t]his book could serve as a desk reference for practitioners" (p. ix). For practitioners and aspiring practitioners, Guzman and Ermasova provide good points of entry into the academic literature and a wealth of largely sound practical advice that nicely complements resources such as the GFOA's Best Practices and Fiscal First Aid guidance. For academics, there is a reasonable descriptive model of the trajectory into and out of financial crises, six rich case studies of fiscal emergencies that provide evidence to support that model, and extensive reference lists for the literature review and case-study chapters.

Following an introduction, Chapters 2 through 6 review the large and unruly bodies of literature related to local-government fiscal troubles, financial management and measurement, and municipal bankruptcy, and draw from those reviews a variety of general prescriptions for fiscal policy and practice and some research propositions for the case studies to follow. Reading these engagingly, if not always clearly written, chapters, I was reminded how extensive the relevant body of literature is and how short it falls of the ideal of cumulative progress toward settled knowledge. Guzman and Ermasova are not to blame for that collective disarray, of course; they do a great deal to impose order on the literature in ways that support both their practical prescriptions and their approaches to the case studies. I have been researching fiscal

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health and fiscal stress for over a decade, including co-editing a handbook on the topic, but even so, I encountered a great number of useful sources here for the first time. My copy of the book is heavily dog-eared and annotated so that I can follow up on many of the insights and sources cited in these chapters.

Practitioners and students will also find much value in these chapters. One of the ways in which Guzman and Ermasova impose order on the unruly prior literature is to digest it into some usable guidance about ways to manage local government finances to prevent severe fiscal crises or, if it is too late for that, at least to mitigate crises' harmful effects and hasten recovery. Although the authors do not make the connection explicit, they present the material and advice here in a way that complements and demonstrates the practical value of the Government Finance Officers Association's (GFOA, 2024a, 2024b) best practices and fiscal first aid guidance.

The relevance and utility of those sources of guidance are further demonstrated by the six case studies presented in Chapters 9-14 (Ch. 8 is an introduction to the case studies). Although the cases are (by design) highly diverse in their populations, histories, political cultures, and *fiscal policy spaces* (Pagano & Hoene, 2018), they follow similar trajectories: extended periods of experiencing multiple fiscal challenges associated with constrained fiscal policy spaces and economic conditions, exacerbated by fiscally unsound (and sometimes corrupt) decisions which eventually are brought to a crisis by some internal or external shock. The authors use the term *environmental jolt* (Meyer, 1982) to describe these shocks. However, some of the crises in the case studies seemed to stem as much from organizational behavior (e.g., dysfunctional labor relations in Vallejo, compounding effects of incompetence and corruption in Jefferson County) as from external events (long-term decline of dominant industries, abrupt departure of dominant employers, secular financial crises, and the like). Indeed, perhaps that is one lesson we can draw from the cases as from the literature reviewed in the earlier chapters: every fiscally unhappy local government is unhappy in its own way, and there are many complex ways in which organizational policies and practices can interact with external environments and events to produce, prevent, mitigate, or exacerbate fiscal stress and financial emergencies.

For academics, this is a good reminder of the likely inadequacy of strict and simplistic explanatory, or even descriptive, theories, and a defense against harsh criticism of our inability to package neatly our several decades of work in this area. For current and aspiring practitioners, the cases offer a cornucopia of points of comparison and object lessons: things that might happen, alternative ways to respond to them, and the ensuing outcomes. While the cases are in many respects outliers – company towns, shrinking cities, places dogged by incompetence and corruption – their extreme situations help to highlight pitfalls of more ordinary human and fiscal limitations. Guzman and Ermasova highlight the positive lessons to be learned from the eventual recoveries documented in the case studies.

The final chapter ties together the literature review chapters and the case studies by proposing a descriptive three-stage model of the development and resolution of fiscal crises. Guzman and Ermasova identify three general stages: a period of "haphazard" temporizing, an "emergency" period of dealing with an immediate crisis by substantially and abruptly increasing revenues and/or decreasing expenditures, and an "innovative" stage in which municipal leaders consolidate and put their fiscal houses in order for the long term. Similar to the stages of fiscal stress models from the previous century (e.g., Levine, Rubin, & Wolohojian, 1981; Wolman & Davis, 1980), this model implicitly posits an intuitive way of responding to challenges: taking the easy way out until that is no longer possible. Different from those earlier models, this model is less precisely stipulated and seems more generally applicable. Academics can and probably



will argue the strengths and weaknesses of this model compared to other stages models, and the usefulness of stages models in general compared to other ways of theorizing fiscal decision-making. For (aspiring) practitioners, this model helpfully draws together the lessons offered explicitly and implicitly by the book: financial emergencies may often be precipitated by unforeseeable external shocks, but it is possible (albeit not easy) to learn from the experiences of others (and from the authors' and GFOA's advice) how to manage your fiscal affairs in ways that can prevent a shock from becoming a crisis or at least facilitate robust recovery if a crisis occurs.

## Disclosure Statement

The author declares that there are no conflicts of interest that relate to the research, authorship, or publication of this article.

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# *Financial Strategy for Public Managers*

Stephanie Leiser<sup>1</sup>

Kioko, S., & Marlowe, J. (2023). *Financial strategy for public managers* (4th ed.). University of Washington, 254pp., \$0.00 (ebook), ISBN: 978-1-927-47259-0. <https://uw.pressbooks.pub/financialstrategy/>

Keywords: Budgeting, Financial Management, Governmental Accounting

When I was a freshly minted MPP student just starting my new job as a policy analyst in a state legislature, I got great advice from a senior colleague: “No matter what area of policy you work in, learn the budget.” So, I dove into the weeds of the appropriations process and tax policy and found myself among the “money people” – the subset of staffers who understand the language of finance, budget forecasting, and tax administration. I also experienced firsthand that in the public sector, as Sharon Kioko and Justin Marlowe point out in the new fourth edition of their book *Financial Strategy for Public Managers*, we tend to segregate ourselves into “money people” and “everyone else.” In writing this book, Kioko and Marlowe invite “everyone else” into the conversation and show them how they can be more effective leaders, policymakers, managers, and advocates when they understand the logic and language of money.

There are two important trends in public finance that this text addresses. First, “money people” (e.g., CFOs) are increasingly expected to be engaged not only in accounting and finance decisions but also big-picture discussions around policy and strategy. As public finance journalist Liz Farmer (2016) has noted, “Just as in the private sector, many public enterprises are looking for CFOs with talents that include creative thinking, communication skills and long-range planning.” The second trend is the current shortage of accountants generally and public finance professionals, particularly (Strickland 2023). A recent National Association of State Treasurers report notes that nearly one-third of the public finance workforce is over age 55, and the pressure to recruit talent has never been greater. To meet this demand, our profession must think outside the usual pipelines and draw in people with more general interests and experience.

For those of us who work in or teach public budgeting and finance, there are already dozens of books that focus on the nuts and bolts – how to do cost allocation, forecasting, benefit-cost analysis, enter transactions, set up debt service schedules, or calculate financial condition ratios. These books are great for practitioners who want to update their skills or students who already know they want to be “money people.” But there are not many books that help “everyone else” connect technical budget skills to the broader picture of policy, mission, and strategy. In

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my main budgeting course, an elective in an MPP program, most of my students are “everyone else” – students who go on to lead organizations, do policy analysis, and advocate for change.

In addition to being free and open source, Kioko and Marlowe’s book has three features that should appeal to practitioners and students with wide-ranging policy interests. First, *Financial Strategy for Public Managers* brings consistent attention to themes of equity, a top priority for policy students and policy professionals. For example, Kioko and Marlowe begin the very first chapter on “How We Pay for the Public Sector” by discussing the Department of Justice’s 2015 report on the City of Ferguson, MO, after the police killing of Michael Brown, which helped fuel the creation of the Black Lives Matter movement for racial justice. The DOJ report documented the City’s increasing pursuit of revenue from fines and fees, the impact of which fell disproportionately on low-income black residents. Similarly, in the chapter on cost analysis (Ch. 5), the authors discuss an example of a seemingly technical change in how federal government contracts with Native American tribes caused significant reductions in federal spending on services for tribal citizens. These examples are effective because they demonstrate that technical budget matters can have significant implications for core public sector values, a theme revisited throughout the text.

As they have published new editions of the text, Kioko and Marlowe continue to bring in more examples and connections to equity, highlighting both organizational exemplars and research findings. In the chapter on budget strategy (Ch. 6), for example, they describe work the City of Seattle and others have done to integrate race and social justice analyses into their budget processes. In addition, a section of the chapter on financial statement analysis (Ch. 3) discusses recent research on racial bias in philanthropy and grantmaking. Research on equity issues in public finance and budgeting is growing rapidly. There’s certainly room to expand the number of sidebars in the text to feature research that explores, for example, racial bias in city credit ratings and borrowing costs (Eldemire-Poindexter, Luchtenberg, & Wynter, 2022; Norris, 2023; Smull et al., 2023) or the inequitable effects of state intervention in local government and school district finances (Hughes, Dick, & Kopec, 2021; Nickels, Clark, & Wood 2020; Schueler & Bleiberg, 2022).

A second feature of *Financial Strategy for Public Managers* that helps readers see the larger context of budget/finance decisions is that it consistently explores the implications of these decisions for management strategy and policy. For example, the chapter on cost analysis (Ch. 5) covers the usual material on cost objectives and cost structures (fixed vs. variable, direct vs. indirect). However, it also explains how cost structures can drive strategy and inform mission alignment. For example, the recommended strategies for organizations with mainly step-fixed direct costs include increasing staffing ratios and focusing on enrollment caps/waitlists. Similarly, a section in Chapter 3 guides nonprofit leaders through considerations of how their “business model” and “capital structure” support their mission. Practitioners and students can bring these practical checklists and frameworks directly to their workplaces, even if their role is not directly related to budgeting or finance. Kioko and Marlowe also emphasize how budget/finance issues connect to larger policy discussions, including the use of tax expenditures as instruments of policy, the federal deficit and debt, interest rate policy, Medicaid expansion policy, infrastructure investment, and pandemic aid. By showing how budget/finance decisions are linked to larger policy questions, Kioko and Marlowe continue to break down barriers between the “money people” and “everyone else.”

The final feature of *Financial Strategy for Public Managers* that contributes to its broad appeal is the continued expansion of learning cases in new editions of the text. Case studies have

long been a core part of teaching and learning in public budgeting and financial management and have been proven to enhance student learning outcomes (McDonald & Jordan, 2022). Case-based learning may be particularly important for students less interested or comfortable with the more traditional abstract and quantitative presentation of budget and finance topics common in textbooks. In addition, most of the cases and examples in the book are from real organizations and governments, so it can give readers a more realistic picture of the types of problems and challenges public finance managers face.

While Kioko and Marlowe's text is accessible and engaging for non- "money people" and provides a useful primer on accrual accounting and transactions in Chapter 4, the tradeoff is that it provides less coverage of technical skills for students who may be more inclined toward spreadsheets and quantitative analysis. In my teaching, I have supplemented Kioko and Marlowe's main text with content on capital budgeting, forecasting, cost allocation, and flexible budget formats from more skills-oriented sources like Chen, Weikart, and Williams' *Budget Tools* (2015) and Wang's *Financial Management in the Public Sector: Tools, Applications, and Cases* (2015). These supplementary texts introduce students to spreadsheet techniques for creating forecast models, depreciation tables, life cycle costing, etc., and they provide bridges for students who want to go further and possibly become "money people." Nevertheless, I have found that using *Financial Strategy for Public Managers* as the primary text does an excellent job of convincing "everyone else" why understanding money is essential for a career in public policy.

## Disclosure Statement

The author declares that there are no conflicts of interest that relate to the research, authorship, or publication of this article.

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