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Effects of Advance Refunding Municipal Bonds After the U.S. Tax Cuts and Jobs Act

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EFFECTS OF ADVANCE REFUNDING MUNICIPAL BONDS AFTER THE U.S. TAX CUTS AND JOBS ACT

Doctoral Dissertation Research

Submitted to the Graduate Faculty of

Gardner-Webb University

In Partial Fulfillment

of the Requirements for the Degree of

Doctor of Business Administration

By

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ABSTRACT

The process when U.S. municipalities retire callable bonds early and refinance them with bonds of a lower coupon rate is called *advance refunding*. The advance refunding of debt is a widespread practice in municipal finance; however, the Tax Cuts and Jobs Act of 2017 removed the option to keep this debt tax-exempt and now requires municipalities to convert from tax-exempt to taxable. The purpose of this research was to evaluate the impact eliminating advance refunding of municipal debt into tax-exempt status has on the municipality's advance refunding decision making process, specifically at the state level. Municipal governments are still adjusting to the new market dynamics after passage of the tax legislation and have demonstrated a change in their debt management decisions regarding advance refunding, even in the low interest rate environment existing at the time of this study. To capture this change in behavior, both economic and bond data between 2005 and 2020 were collected across multiple database platforms. Panel and hierarchical regression models were used to evaluate the time periods before and after the Tax Cuts and Jobs Act as well as economic regions within the United States. These models incorporated state-specific variables to evaluate macroeconomic frictions, a departure from prior studies where researchers evaluated advance refunding from an aggregate approach of all municipal levels of government and lacked a public finance approach. Analysis showed that geography played a significant role in the evaluation of advance refunding activity and state tax revenue served as a primary driver of state debt management decisions in the existing regulatory environment. These findings are extremely valuable for policy makers and participants in the municipal bond markets because interest rates are expected to rise in future years.

DEDICATION

This dissertation is dedicated to my husband, Paul, who was a constant source of support and encouragement during the challenges of participating in a doctoral program as we grew our family. I am truly thankful for having you in my life. This work would not have been possible without you. I love you.

I also want to dedicate this work to my professor and long-time friend, Dr. Steven Johnson. Teaching me in my first master's class more than a decade ago, you inspired me to study finance and always encouraged me to learn more. Your guidance, support, and advice through the dissertation process enabled me to overcome the multiple hurdles life threw at me and finish. God bless.

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CHAPTER ONE: INTRODUCTION

U.S state and local governments, commonly referred to as municipalities, sell tax-exempt debt obligations, or bonds, for many purposes. One of the primary reasons is to finance capital projects such as roads, prisons, schools, and wastewater systems. Issuing debt allows governments that otherwise would not have the cash flow to complete such projects, with a repayment schedule typically between 20 to 40 years. Investors find municipal bonds attractive because the interest is generally exempt from federal income taxes. This results in investors accepting a lower interest rate than they would otherwise and allowing the issuers (i.e., municipalities) to have lower borrowing costs.

Due to the long-term nature of these bonds, the issuing governments frequently aim to achieve debt service savings or need to remove burdensome covenants when their economic or operational needs change. To do this, governments issue new debt to retire the existing debt, similar to refinancing a home mortgage. This is the same process corporate debt takes when a debt issuance becomes callable, except the terminology for municipal debt is called *refunding* (Internal Revenue Service [IRS], n.d.)

Municipalities can use two different types of refunding: current or advance. When a debt issuance becomes callable—or is within 90 days of the call date—the municipality can issue new, lower coupon debt to finance the retirement of the outstanding debt, called a *current refund* (Kalotay & May, 1998). However, an advance refunding occurs before the call date (IRS, n.d.). Using this method, the government will sell new bonds to buy back the outstanding debt, typically to allow the municipal issuer to obtain savings from a decline in interest rates (Government Finance Officers Association [GFOA], 2017; Kalotay & May, 1998). The focus of this paper is on advance refunding, which occurs

before the call date.

Significance of the Problem

The Tax Cuts and Jobs Act (TCJA) of 2017 eliminated the ability of municipalities to issue tax-exempt advance refunded bonds (Bond Buyer, 2019; Kalotay, 2018). The last comprehensive empirical study focusing on motivations of advance refunding municipal bonds was published before enactment of the new federal tax law. Since the new tax law took effect, multiple trade publications and a few academic journal articles have published articles on the topic, but no authors have explicitly explored the impact TCJA has had on municipalities' use of refunding or if motivations have changed.

One reason for this research was to address the dramatic increase in the number of municipal refunding issuances. In 2017, partially due to a rush of advance refunding before the implementation of the new tax legislation, a record-setting total of long-term municipal bond issuances occurred, amounting to $448.6 billion (Bond Buyer, 2019). That amount included $153.3 billion in refunding issuances and $91 billion exclusively advance refunding issues (Bond Buyer, 2019; Pierog, 2018). The following year saw refunding issuances decline by 61% to only $59.8 billion from the impact of the tax reform legislation prohibiting tax-exempt advance refunding (Bond Buyer, 2019). However, an unexpected increase in the issuance of taxable bonds occurred in 2019, totaling $70 billion and posting an increase of 135% when compared to 2018 (Kalotay, 2021; Ryan, 2020). According to industry experts, issuances for taxable municipal bonds should continue into the foreseeable future (Kalotay, 2021).

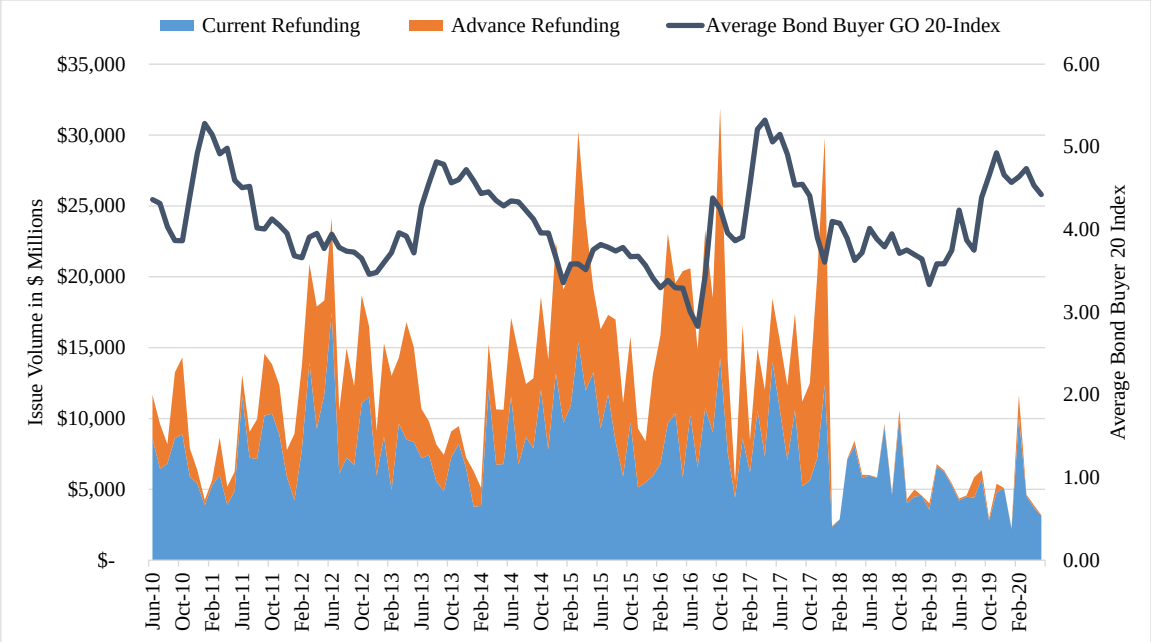
Figures 1, 2, and 3 are provided to give both historical context and a visual example of refunding activity over the last decade. The average Bond Buyer General

Obligation (GO) 20 index is included to show the average yields because bond yields drive the decision to refund (Municipal Securities Rulemaking Board [MSRB], 2017).

The time-series graph in Figure 1 shows the dollar volume of issues. A noticeable spike in both advance and current refundings in December 2017, followed by a steep decline in 2018, is evident. Notably, a jump in the average bond buyer index occurred late in 2019. According to theory, this should have deterred refunding issuances; however, the small jump in early 2020 is contrary to previous findings on refunding motivation.

Figure 1

Current and Advance Refundings Compared to Average Bond Buyer 20 Index

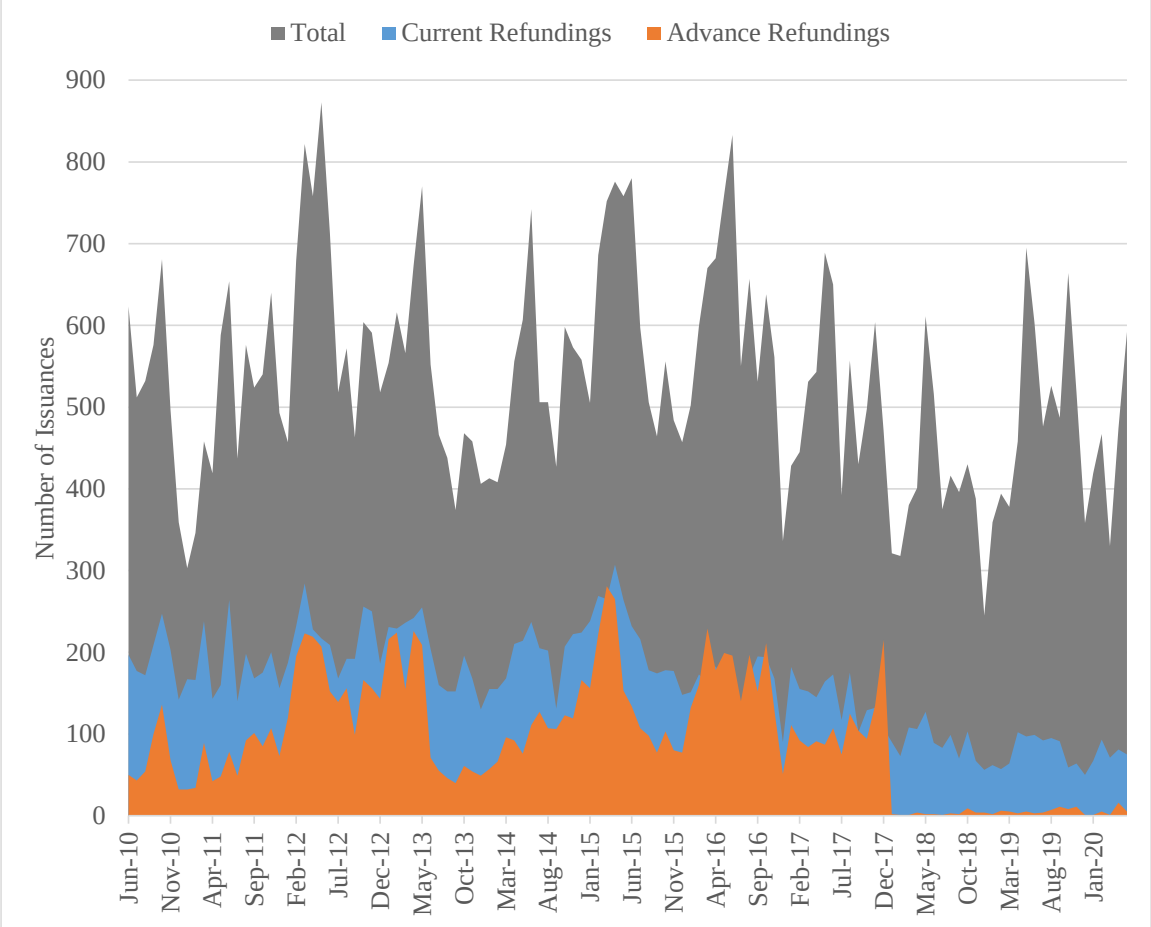


Note. Using Thomson Reuters monthly issuance data from June 1, 2010, through May 31, 2020.

Figure 2 shows the volume of refunding issuances, which is more telling of the TCJA impact. After the law's passage in late 2017, the municipal bond market experienced a 54% reduction in refundings as a percentage of total tax-exempt GO issuances for the years 2018–2020 relative to the years 2010–2017. Although the current refunding saw a decline, the number of issuances was less affected than advance refunding issuances.

Figure 2

Number of Current and Advance Refundings Compared to all Tax-Exempt General Obligation Issuances

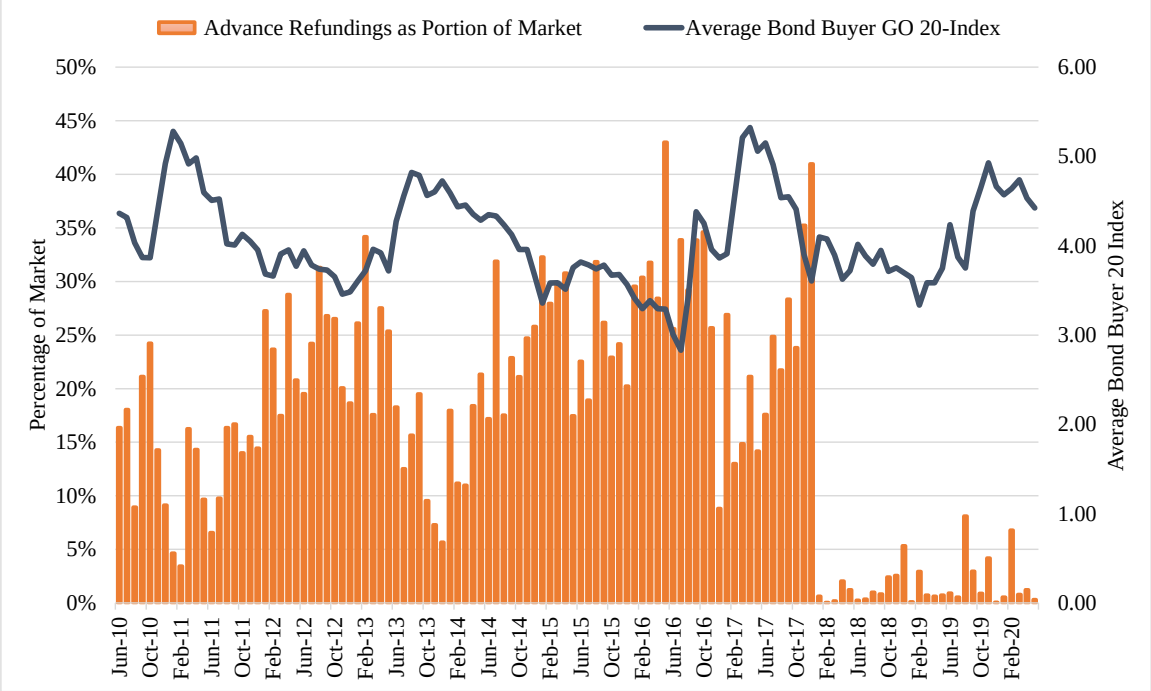


Note. Using Thomson Reuters monthly issuance data from June 1, 2010, through May 31, 2020.

Figure 3 shows advance refundings in percentage terms of all tax-exempt GO issues over the last decade using the Bond Buyer 20 index as a market comparison. Issuances reduced by 46% in tax-exempt GO bonds, inclusive of all refundings between the time periods of 2010–2017 and 2018–2020. When illustrated as a monthly percentage, advance refundings made up 21% of the tax-exempt GO market pre-TCJA, where after enactment, advance refundings only make up a monthly average of 2%.

Figure 3

Advance Refundings as Percentage of All Tax-Exempt General Obligation Issues Compared to Bond Buyer 20 Index



Note. Using Thomson Reuters monthly issuance data from June 1, 2010, through May 31, 2020.

According to H.R.1 Section 3602 of the TCJA, the interest on advance refunding bonds will be taxable after 2017, whereas the interest on current refunding bonds will continue to be tax-exempt (GFOA, 2017). In practice, many municipalities still issue advance refund bonds (Kalotay, 2018; Leckrone, 2019; Luby & Orr, 2019). The low interest rate environment contributes to this continued behavior, but concern exists that interest rates will rise in future years. When this occurs, municipalities that continue to advance refund their debt will see an increased debt service cost to taxpayers over the long term.

To remedy this situation, lobbyists have worked to reinstate the ability to issue tax-exempt advance refunding bonds. Since its elimination in 2017, Congress has

introduced legislation every year to reinstate the practice, but none have been enacted into law (To Amend the Internal Revenue Code, 2018; American Infrastructure Bonds Act, 2020; Investing in Our Communities Act, 2019; LOCAL Infrastructure Act, 2021).

Theoretical Basis for the Study

The central framework for this research was to expand upon the debt management decision made by municipalities when exercising the option to advance refund their debt. Researchers in the literature had concluded three primary motivations (Wood, 2008); however, this was before the removal of tax-exempt status. Post-TCJA, municipality behavior has changed, indicating a departure from established debt management practices (see Figure 3). One of the industry's leading academics concluded that "the demands of professional debt management will make it imperative that issuers and their financial advisors employ option-based analytics for determining the optimal time to call and refund" (Kalotay, 2018, p. 69).

Authors of numerous papers have investigated municipal bond pricing relative to their taxable counterparts. The empirical literature showed an unexplained relation between the yields of tax-exempt and taxable bonds, where the spread decreases with maturity (Chalmers, 1998, 2006; Dwek, 2002; Erickson et al., 2003; Lin et al., 2009). Many studies have shown that short-term tax-exempt bond yields are, on average, equal to 1 minus the highest marginal corporate tax rate times the short-term taxable yield (Fama 1977; Jordan & Pettway, 1985; Miller 1977; Poterba, 1986). However, others have found that "long-term municipal bond yields tend to be much higher than predicted" (Chalmers, 1998, p. 285). This empirical phenomenon has been labeled the "muni puzzle." Although this paper was not written to contribute to the muni puzzle literature, it

is worth stating because one of the popular explanations is that municipal bonds bear more default risk and include costly call options relative to taxable bonds (Chalmers, 1998, 2006).

Under the TCJA, underlying interest rate theory, financial theory, and capital structure and debt capacity theories will be indirectly applied since the price of bonds depends on their risk of default. Municipal defaults are possible, and during the 2020 COVID-19 pandemic, 50 municipals defaulted as of July 31, 2021, which Municipal Market Analytics reported as the most since 2011 (Pellejero, 2020). However, U.S. government bond default is near impossible, which is partially why "municipal default risk exceeds the default risk of corporate and U.S. Treasury bonds" (Chalmers, 1998, p. 282). This closely parallels the situation with corporate bankruptcy; however, the price of the municipal bonds is somewhat distorted from their corporate counterparts because taxpayers ultimately bear the underwriting fees and costs.

Option Pricing Theory

Extensive literature existed on the corporate bond market and applying the standard option pricing theory to the efficacy of refinancing and debt defeasance (Alderson et al., 2017; Booth et al., 2014; Kerins, 2001; Newberry & Novack, 1999). Although loosely referenced in the latter advance refunding papers, the value of the call option has always been applied in the tax-exempt status. With the elimination of tax-exempt advance refunding, the value of the call option has changed because advance refunding issuances must now be taxable (Kalotay, 2021).

Under the new law, when municipals switch to taxable debt, they expect a direct impact on the option value. Longstaff and Schwartz (2001) asserted: "At any exercise

time, the holder of an American option optimally compares the payoff from immediate exercise with the expected payoff from continuation, and then exercises the option if the immediate payoff is higher" (p. 114). Much of the established advance refunding literature focused on the valuation of the exercise features of the call option, which justifies updating the call option calculation to reflect the recent tax law change (Brooks, 1999; Kalotay et al., 1993; Kalotay & May, 1998; Orr & de la Nuez, 2013; Zhang & Li, 2005). Looking at a post-TCJA environment, the "trade-off is between the realized present value savings and the forfeited time value of the call option" (Kalotay, 2021, p. 50).

Controversy in Recent Literature

Additional justification for the continued analysis of the refunding option value appeared in the most recent advance refunding literature, where conflict exists between academics and practitioners on their respective conclusions. Ang et al. (2013) claimed that advance refunding has zero net present value, and waiting to the call date is always preferable because the transaction always destroys value. Kalotay and Raineri (2016) rejected this claim and found a positive value or a "free lunch" with regards to the option (p. 119). Ang et al. (2017) altered their central claim, finding that the timing of the refunding can be optimal.

Research Questions and Hypotheses

The primary research question guiding this study was: What is the impact of TCJA on states' advance refunding of debt? A subcomponent of this research question was: Do states operate in aggregate, or do unique fiscal or economic variables create unique refinancing behavior across different regions of the United States? Researchers

studying public finance have found that large states with lenient budget rules experience greater volatility in economic activity than other states (Krol & Svorny, 2007).

The literature revealed three agreed upon motivations for municipalities to engage in an advance refunding transaction: (a) to capitalize on lower interest rates to attain savings, (b) to restructure debt to create short-term budgetary relief or flexibility for additional borrowing, and (c) to remove restrictive bond covenants (GFOA, 2019; Wood, 2008). These motivations have undergirded existing studies and this study, which was designed to determine if the TCJA impacted these motivations.

This study included three hypotheses. Hypothesis 1 was: Bureau of Economic Analysis (BEA) regions will have a significant impact on advance refunding activity, both in predicting advance refunding par value and the number of issuances, and this activity will be unique across the eight regions of the United States. Past research has shown volatility in regional economies through regional business cycles to which states respond with varying degrees of fiscal policy (Cornia & Nelson, 2010; Gupta et al., 2018; Krol & Svorny, 2007; Levinson, 1998; Owyang et al., 2005). One fiscal policy tool used by states to combat volatility from economic cycles involves debt management, which would include refinancing existing debt through an advance refunding (National Conference of State Legislatures [NCSL], 2004).

Hypothesis 2 stated: The TCJA event has significantly changed states' behavior related to using advance refunding for their municipal debt offerings, with states issuing less advance refunded bonds in both par value and in the number of deals. The issuance of tax-exempt bonds has always been subject to federal regulations, and as these regulations change, the industry must adapt. As shown in Figure 3, after the TCJA event,

the volume of advance refundings as a portion of all tax-exempt GO issuances dropped considerably, but this behavior change has not been evaluated through empirical observation. Discussion of this hypothesis includes an exploration of what trade publication authors and scholars have identified as a behavior shift after TCJA implementation (Bond Buyer, 2019; Kalotay, 2018, 2021).

Hypothesis 3 was: The primary driving factor for advance refunding post-TCJA is state tax revenue. In theory and in practice, a municipality should only advance refund debt if it results in a positive net present value (GFOA, 2019). However, many municipalities face severe financial constraints that affect their debt management policies, which is why researchers have found that over 96% of all advance refundings result in immediate cash flow savings (Ang et al., 2017). Because tax revenues fund each respective municipality's debt service, it is important to know what macroeconomic or fiscal variables impact the volume of advance refunding in a post-TCJA environment (Ang et al., 2017; Crone, 2005; Kidwell & Hendershott, 1978; Levinson, 1998; Owyang et al., 2005).

Conclusion

This study contributes in numerous ways to the advance refunding literature. First, this is the first study to include a statistical evaluation of the frequency or motivation of advance refunding after the TCJA became law. Second, researchers in many of the previous studies did not introduce a geographic component into their analysis. To date, researchers in only three studies have used a limited sample addressing geography; however, none of these focused solely on U.S. states (Dzigbede, 2017; Moldogaziev & Luby, 2012; Vijayakumar, 1995). The geographic component provides

valuable information because state tax revenue sources have vastly different revenue elasticities from other municipal levels of government. And finally, the use of a new variable, tax revenue, introduces a public finance measurement in the advance refunding literature.

CHAPTER TWO: REVIEW OF THE LITERATURE

Introduction

This literature review provides a discussion and synthesis of the foundational and current literature surrounding the decision-making process of municipal advance refunding. Notably, this paper presents an evaluation of advance refunding at the state level only, and the literature covered in the review addressed the decision at the state and local levels in aggregate.

This literature review is divided into four sections. The first section provides historical background for the legislative changes and IRS regulations on the advance refunding transaction. Much of the literature referenced these events, yet many do not have a complete explanation or timeline of the legislative history. Thus, this historical discussion is primarily for the reader's benefit and to ground the academic literature's evolution over the last 60 years.

The second section provides an assessment of the literature on corporate bond refunding. The study of corporate decisions created an early framework, which has been frequently referenced in the initial studies on municipal bonds. This research subsequently set the stage for the municipal refunding stream of research.

The third section provides a review of the empirical academic literature on municipal bond refinancing. Although not as robust as the corporate literature, the studies on this topic were mostly limited to the efficiency, timing of bond refunding, and the value of the embedded call option. Not every study was directly applicable to this study's research question, yet each contributed to how the municipal advance refunding literature has evolved into its current state.

Finally, to address the specific research questions explored in this paper, relevant business cycle literature was also included in this review. Researchers studying the corporate debt stream have discussed the impact of the economic environment on debt management decisions at length; however, researchers studying advance refunding have not done the same. All levels of municipal governments are funded with their own unique combination of tax revenue streams, which are directly impacted by their business cycles.

Historical Background

The United States saw its first municipal bond offering in 1812 when New York City began building the Erie Canal. However, refundings only date back to the late 1860s, when Congress decided to differentiate callable and noncallable bonds by offering higher yields on the former (Winn & Hess, 1959). This, along with the industrial revolution, saw the U.S. municipal bond market grow exponentially until it peaked in the 1920s. Although the Great Depression dried up government tax revenues, causing 4,500 defaults across state and local governments, the 1930s also saw a rising volume of refundings due to the low interest rates (Malanga, 2010; Winn & Hess, 1959). The economic growth experienced by the private sector after WWII boosted spending by municipals, and over the last half-century, infrastructure spending has shifted noticeably from the federal government to state and local entities.

The practice of advance refunding became controversial in the early 1960s when the main motivation was to gain substantial arbitrage revenues. With little legislation regulating advance refunding at the time, municipalities would earn profits on their escrow investments because the rate they could invest usually exceeded their borrowing costs (Kidwell & Hendershott, 1978). The IRS recognized this and, in August 1966,

announced that it would no longer allow arbitrage profit as the primary motivation for an advance refund. Additionally, the IRS stipulated that if this occurred, the obligation would lose its tax-exempt status (Dyl & Joehnk, 1976). The House Ways and Means Committee addressed the IRS's concerns and issued a series of regulations with the U.S. Treasury Department that essentially prohibited arbitrage profits and became effective starting May 1973 (Dyl & Joehnk, 1976; Kidwell & Hendershott, 1978).

Even though federal regulations restricting municipals from earning arbitrage profits have existed since the late 1960s, research showed that advance refunding continued to create tax shelters and revenue losses for the U.S. Treasury from the practices of arbitrage (Kalotay & May, 1998; Petersen, 1987). The U.S Treasury and congressional committees specifically targeted advance refunding in reform proposals as early as 1984 and later included these in the final version of the Tax Reform Act of 1986 enacted on October 22, 1986 (Petersen, 1987). The major policy changes made to advance refunding in 1986 only allowed future issues to be advance refunded once. Before the change, they could be advance refunded twice (IRS, n.d.). To remedy the arbitrage problem, a rebate procedure was included, requiring that any earnings from the escrow be sent to the federal government. The procedure also required all bonds issued after 1985 to be redeemed at their earliest possible date if an advance refunding resulted in present value savings to the taxpayer or borrower (Driessen, 2020; Kalotay & May, 1998; Petersen, 1987).

The Tax Reform Act of 1986 represents the most significant change to the municipal bond market before the TCJA eliminated the federal tax exemption for advance refunding on municipal bonds in 2017 (Driessen, 2020; Petersen, 1987). The

rationale behind the decision was the need to offset tax reductions in the bill with other costs. The Joint Committee on Taxation estimated the cost to the U.S. Treasury over the next 10 years would be $17.4 billion if not repealed (Joint Committee on Taxation, 2017).

Since the enactment of the TCJA, legislators and lobbyists have worked to reinstate the federal tax exemption for interest income earned on advance refunding bonds. Multiple bills have been introduced to Congress to reinstate advance refunding; however, none have been enacted into law (To Amend the Internal Revenue Code, 2018; American Infrastructure Bonds Act, 2020; Investing in Our Communities Act, 2019; LOCAL Infrastructure Act, 2021). During the 2020 COVID-19 pandemic, interest grew in the 2019 bill to reinstate tax-exempt advance refunding as an economic stimulus measure for municipalities to offset the loss of tax revenue from the shutdown orders. In July 2020, the U.S. Senate introduced a piece of legislation aimed at supporting municipal infrastructure, which included restoring the tax exemption for advance refunding bonds; however, this too failed to become law (Driessen, 2020; Lucia, 2020; Wicker, 2020).

Although the main policy argument in the early years focused on the arbitrage situation, the current discussion about tax-exempt advance refunding circulates around the federal subsidy. Supporters argue that infrastructure typically financed with bonds may not occur without this benefit, whereas opponents believe the federal subsidy is an inefficient way to encourage investment, and the benefit goes primarily to the creditor and not the municipality (Driessen, 2020).

Corporate Bond Refunding

The corporate bond market literature included extensive analysis on the effectiveness of refinancing debt. Much of this literature was grounded in option pricing theory, where models have illustrated the value gained from refunding against the value of the bond's call option. Long-term corporate bonds are traditionally issued with a call option, where the issuing company reserves the right to "call" the bond prior to the bond's maturity date. Typically, corporations will refund a bond by replacing it with another that has a lower coupon or interest rate. According to standard option pricing theory, a bond should not be called until the savings achieved by refunding equals the value of the call option (Kalotay et al., 2007).

Bowlin (1966) conducted one of the first empirical studies showing that a refunding decision that provided a rate of return exceeding the cost of the funds used to finance the investment was profitable. Many researchers at the time looked at interest savings (Bierman, 1966; Weingartner, 1967), and others looked at the timing and opportunity costs associated with the decision (Boyce & Kalotay, 1979; Friedman & Lieber, 1975; Kraus, 1973). Researchers in one branch of the refunding literature focused on the impact on shareholder wealth. They used the net present value of the refunding decision in their models, resulting in mixed findings, but they introduced new analytical frameworks for future research (Sibley, 1974; Yawitz & Anderson, 1977). Researchers conducting later empirical studies found that the timing of when to call a bond continued to be a primary motivating factor, and as a result, corporations rarely maintained their capital structure, which directly impacted shareholder wealth (Emery & Lewellen, 1990; Lewellen & Rosenfeld, 1987; Longstaff & Tuckman, 1994; Mitchell, 1991). Others

looked at motivating factors for the decision to issue callable debt and at what point refunding was utilized as a debt management tool (Boyce & Kalotay, 1979; Brick & Palmon, 1993; Kalotay et al., 1993; Livingston, 1987; Yawitz & Anderson, 1977). Overall, the literature on the refunding decision has helped practitioners in a fast-changing environment with more complex bond structures than in prior decades.

Because of the volatile interest rates in the 1970s and 1980s, many buyers and sellers in the bond market expressed concern about the effect of call provisions on yields and if there were ways to hedge against the associated risk. Researchers expanded upon previous studies and calculated the value of a put option on bonds and the impact on reoffering yields (Chatfield & Moyer, 1986; Riener, 1980; Yawitz & Marshall, 1981). And although findings in this literature have noticeably impacted corporate debt management, they have also created a foundation for much of the municipal debt literature. Perhaps the greatest benefit has been the literature focused on understanding firm behavior based on bond call decisions. In this stream of the callable bond literature, researchers conducting empirical studies found that firms will use the refunding option to reduce agency costs, although it is unlikely to be the primary deciding factor (Alderson et al., 2017; Barnea et al., 1980; Crabbe & Helwege, 1994; Thatcher, 1985).

Municipal Bond Advance Refunding

Overall, the empirical academic literature focused on municipal bond financing was less comprehensive than the corporate bond literature. The literature in this stream began with the work of Dyl and Joehnk (1976) and Joehnk and Dyl (1979), who highlighted the multiple ways municipal bonds differ from their corporate counterparts while also offering a framework for the tax implications. These researchers shed light on

the differences, yet they also pointed out how difficult and unique the advance refunding method is when compared to current refunding. Babad and Speer (1978) looked specifically at the arbitrage scenario that existed during an advance refund and proposed an optimized procedure to maximize municipality savings. Dyl and Joehnk and Babad and Speer set the stage for the future municipal bond refunding literature, and their work is still referenced in current literature. Notably, at this point in history, it was assumed that the sole motivating factor for an advance refund was savings to the issuer.

After the tax reform of 1986 limited the number of refunds on each issue, researchers responded by focusing on the optimal timing to call the bond. Because bonds could only be refunded once, practitioners and scholars needed to understand when they could achieve the highest level of savings. They also continued analysis of the option value of the transaction under the new tax law (Brooks, 1999; Kalotay et al., 1993; Kalotay & May, 1998; Zhang & Li, 2005). Vijayakumar (1995) made a noticeable addition to the literature by using variables such as the form of government, political competition index, and whether or not the city received a certificate of excellence for their financial reporting. This introduced a more public finance approach to the refunding decision and provided for a more applicable understanding of debt management practices for policy makers and regulators.

At the time of this literature review, researchers in only three studies had taken a different approach from the option-value focused studies and conducted cross-sectional analysis evaluating the advance refund decision from a geographical perspective and with homogeneous samples. Vijayakumar (1995) chose to only evaluate bonds issued by cities with populations over 10,000 people. Even then, he narrowed the sample by removing

bonds where the issuer and those responsible for subsequent management were not the same entity. Moldogaziev and Luby (2012) chose to evaluate the refunding decision only using state and local bonds issued in California, and Dzigbede (2017) used a sample of Texas school districts.

Of the more recent studies addressing advance refunding, the focus centered around the option value of the refunding as well as how the conclusions related to practice. In a 2013 paper, the National Bureau of Economic Research claimed that advance refunding had zero net present value and asserted that waiting to the call date is always preferable because the transaction always destroys value (Ang et al., 2013). The paper was immediately criticized in a trade publication, *The Bond Buyer*, by two industry experts on the transaction. Leonard Weiser-Varon (2013), a municipal bond attorney, responded by stating, "some advance refundings are driven by factors other than interest rate savings, such as the need or desire to eliminate troublesome covenants, and therefore their timing and 'success' should not be evaluated solely on the economics" (para. 5). Andrew Kalotay (2013), another industry expert who is a quantitative analyst and leading authority on institutional debt management and fixed income valuation, corrected the study by pointing out that "cashflow savings commence at the time of the transaction" (para. 3) and that "it locks in savings no matter how interest rates evolve subsequently" (para. 5). Weiser-Varon and Kalotay approached their critique of the study differently, but they arrived at a similar conclusion. They believed the use of complex mathematical equations and occasional incidences where practice produced less-than-optimal results did not represent conclusive evidence to suggest the practice should be avoided or eliminated completely.

In a more formal response, Kalotay and Raineri (2016) published an article expanding upon the advance refunding option and clarifying the opposing view that the option offered a positive value or a "free lunch" (p. 119). The following year the authors of the highly criticized National Bureau of Economic Research paper incorporated the criticisms and changed their paper's claim that refunding can be optimal (Ang et al., 2017). Although the paper was published in the industry's leading publication, the *Journal of Finance*, it still garnered criticism from Andrew Kalotay (2017), who stated: "Without the flawed original claim, it is unclear that what remains is particularly new or insightful" (para. 3). Kalotay added that the paper revealed a "lack of familiarity with the muni market" (para. 3).

Significantly, the TCJA in 2017 repealed tax-exempt advance refunding, creating lasting impacts to the municipal bond market as well as those in practice. Kalotay (2018) quantified the impact as increasing the cost of long-term municipal debt by roughly five basis points annually, with everything else held equal. He later wrote about the evolving trend of taxable refundings and how "interest rate risk can be mitigated by issuing callable taxable bonds and replacing them with tax-exempt bonds once the original tax-exempt bonds are retired" (Kalotay, 2021, pp. 49–50). Apart from these academic papers, authors publishing in news and media outlets have written extensively about the topic post-TCJA. Many of these contributors continually make a case for reinstating the advance refund transaction.

Business Cycle

Although no overwhelming evidence exists of one motive that fits the average call decision, multiple studies in the corporate stream have provided evidence that interest

rate decreases and the economic environment directly impact call decisions, especially with lower rated debt (Alderson et al., 2017; Booth et al., 2014; Kerins, 2001; King & Maurer, 2000; McDonald & Van de Gucht, 1999). However, in the advance refunding literature, this had not been explored to the same extent and warranted additional analysis (Ang et al., 2017; Chen et al., 2021; Vijayakumar, 1995).

Business cycle theorists assume that an economy moves through all the phases or periods of a business cycle: economic expansion, recession, trough, and recovery. Although the U.S. economy experiences business cycles as a whole, each state also has its own economy that can be influenced when certain regions experience business cycles apart from others (Crone, 2005; Gupta et al., 2018; Levinson, 1998). States differ substantially in their incomes, tax bases, and levels of spending; however, each is uniquely impacted by its respective business cycle and other macroeconomic conditions directly influencing their debt management practices (Cornia & Nelson, 2010; Poterba & Rueben, 1999). Past researchers have used national aggregate data to evaluate macroeconomic variables, yet states operate in homogeneous legal environments and face many of the same fiscal pressures. Consequently, they provide a suitable sample type for evaluating advance refunding in a post-TCJA environment (Ang et al., 2017; Crone, 2005; Kidwell & Hendershott, 1978; Levinson, 1998; Owyang et al., 2005).

In his seminal research, Levinson (1998) found that state fiscal policy can influence a state's business cycle, particularly in the larger states. Included in this fiscal policy are balanced budget requirements, which Vijayakumar (1995) explored when he found political and economic influences in call decisions. Because states are bound by these balanced budget requirements, many municipalities face severe financial constraints

that affect their debt management policies, which is why most advance refundings result in immediate cash flow savings (Ang et al., 2017). Although some researchers have challenged Levinson's theory, they still concluded that state fiscal policy and economic activity are associated (Krol & Svorny, 2007).

Conclusion

Researchers in the literature agreed upon three primary motivations for municipals to engage in an advance refunding transaction: (a) take advantage of lower interest rates to attain savings, (b) restructure debt to create short-term budgetary relief or flexibility for additional borrowing, and (c) remove restrictive bond covenants (GFOA, 2019; Wood, 2008). However, researchers identified these motivations before the TCJA. The law's passage significantly reduced municipality's advance refunding behavior, even with record-low interest rates. Researchers conducting business cycle literature agreed that state fiscal policy and economic events are related, thus, providing a basis for integrating the regional analysis into the advance refunding research.

CHAPTER THREE: METHODOLOGY

The primary focus of this quantitative study was to evaluate the debt management decision made by states within BEA regions and to determine the primary drivers for advance refunding in states. In addition, the Tax Cuts and Jobs Act was evaluated as a noticeable event, and the time-series component of the statistical models described in Chapter Four were used to determine if there were any noticeable departures in state decision-making under the new tax policy. To do this, both data on the bonds traded as well as the macroeconomic variables that influence fiscal decisions related to debt management were needed. The evaluation of data in regions and also in two different time periods (i.e., before and after the tax law) allowed for an evaluation of behaviors that helped identify predictive motivations for advance refunding activity at the state level of municipal government.

Design Statement

In most of the existing literature on advance refunding of municipal bonds, researchers have focused on evaluating the call provision and calculating the option value through cash flow savings analysis to explain the decision to advance refund. Although this trend predominates in the advance refunding literature, Ang et al. (2017) attempted to understand better what factors drive advance refunding activity, specifically "the role that financial frictions and constraints play in influencing municipalities to advance refund their debt" (p. 1668).

Frictions can involve anything that influences or impacts the economy, such as a shock (Brunnermeier et al., 2012). For example, the Great Recession of 2008 made clear that financial sector frictions can impact business cycle fluctuations, and as a result,

should be included in macroeconomic models (Quadrini, 2011).

No researchers have published studies post-TCJA evaluating the decision-making process of advance refunding under the new tax law. In addition, researchers in only three studies have attempted to do a cross-sectional analysis of advance refunding. Dzigbede (2017) only evaluated Texas school districts; Moldogaziev and Luby (2012) concentrated on state and local issuers in the state of California, and Vijayakumar (1995) limited his sample to cities larger than 10,000 in population. In the most recent study, Ang et al. (2017) found that "macroeconomic variables confirm that advance refunding activity is significantly influenced by the fiscal condition of states and local governments" (p. 1670); however, Ang et al. also found that the broader macroeconomic measures failed to yield a significance in the regression. The lack of significance is partly because the decision to advance refund is based upon local- or state-level financial frictions and previous studies used national aggregate macroeconomic variables that would mitigate regional or state-level business cycle fluctuations.

The focus of this study's research questions is to expand upon the finding that macroeconomic frictions influence the decision to advance refund. However, the methodology in this study differed from previous studies by taking a cross-sectional approach and only evaluated states' decisions to advance refund.

States tend to utilize taxes with higher revenue elasticity, such as personal and corporate income taxes, and each is comprised of a different mix of taxes, which are each uniquely impacted by their macroeconomic conditions (Cornia & Nelson, 2010). Because these tax revenues fund each respective state's debt service, researchers must know what macroeconomic situations, if any, impact the advance refunding decision in a post-TCJA

environment (Ang et al., 2017; Crone, 2005; Kidwell & Hendershott, 1978; Levinson, 1998; Owyang et al., 2005).

To compare the unique fiscal situation a state experiences to all municipals in aggregate, researchers must perform region-level analyses. In these analyses, they can examine whether advance refunding activity can be explained and predicted as a state response to macroeconomic frictions and if the TCJA event changed the state's behavior. Time-series regressions have long been applied to bond data, especially government bonds with their easily accessible return data and lack of sensitivity to changing risk characteristics (Ang et al., 2017; Elton et al., 1995; Fama & French, 1993; Maul & Schiereck, 2017).

Data

The transaction data for municipal bonds was collected from the MSRB and included every trade made through registered broker–dealers. Over the sample period from January 2005 to December 2020, the MSRB database contained 113,809,798 individual transactions involving 2,268,814 unique municipal securities, which are identified through a Committee on Uniform Security Identification Procedures (CUSIP) number, a unique identifying number assigned to all registered bonds in the United States and Canada. Because the MSRB database only contains very generic information about each security, the other characteristics for the municipal bonds traded in the sample were taken from Bloomberg LP.

The sample for this study included securities with a dated date between January 1, 2005, and December 31, 2020, yielding 2,268,814 unique CUSIP numbers. Isolating only bonds with a state issuer type reduced the sample to 63,437.

Regions or territories other than U.S. states were omitted, including the District of Columbia, American Samoa, Canal Zone, Guam, Trust Territories, other territories, Puerto Rico, and the Virgin Islands. These exclusions reduced the sample to 61,121 bonds. To isolate those CUSIPs associated with advance refunding, another filter was applied to include only refunded bonds. This reduced the sample size to 17,067.

Because this study was focused on state motivations and the impact of variables on their decision-making, the sample only included bonds that were backed by the full faith and taxing authority of the sovereign state governments, which excluded revenue bonds. The two main types of bonds issued by states are GO and revenue bonds. GO bonds are backed by the general credit and taxing power of the state issuing the bond, which implies that all sources of revenue, unless specifically limited, will be used to pay debt service on the bonds. Revenue bonds are used to finance a specific revenue-generating project and are secured solely from the revenues generated from that project (Vijayakumar, 1995, p. 215). Many states issue bonds for conduit entities that are not accountable to state taxpayers for repayment. For example, Alaska international airports issued refunding bonds via the state issuer; however, the fees and revenues generated by the airports would repay those bonds, not the Alaska state taxpayer. To accommodate for conduit issues, the issue type excluded revenue notes or revenue bonds as well as those that had a security type listed as unknown. This reduced the sample to 11,656 bonds.

Of those bonds, the fields collected from Bloomberg LP for each CUSIP included the issue date, municipal purpose (e.g., advance, current), issue price, yield on the issue date, tax status (e.g., federal or state tax-exempt, taxable), coupon rate, coupon type (e.g., fixed, original issue discount, adjustable), municipal issue type (e.g., GO) issue size,

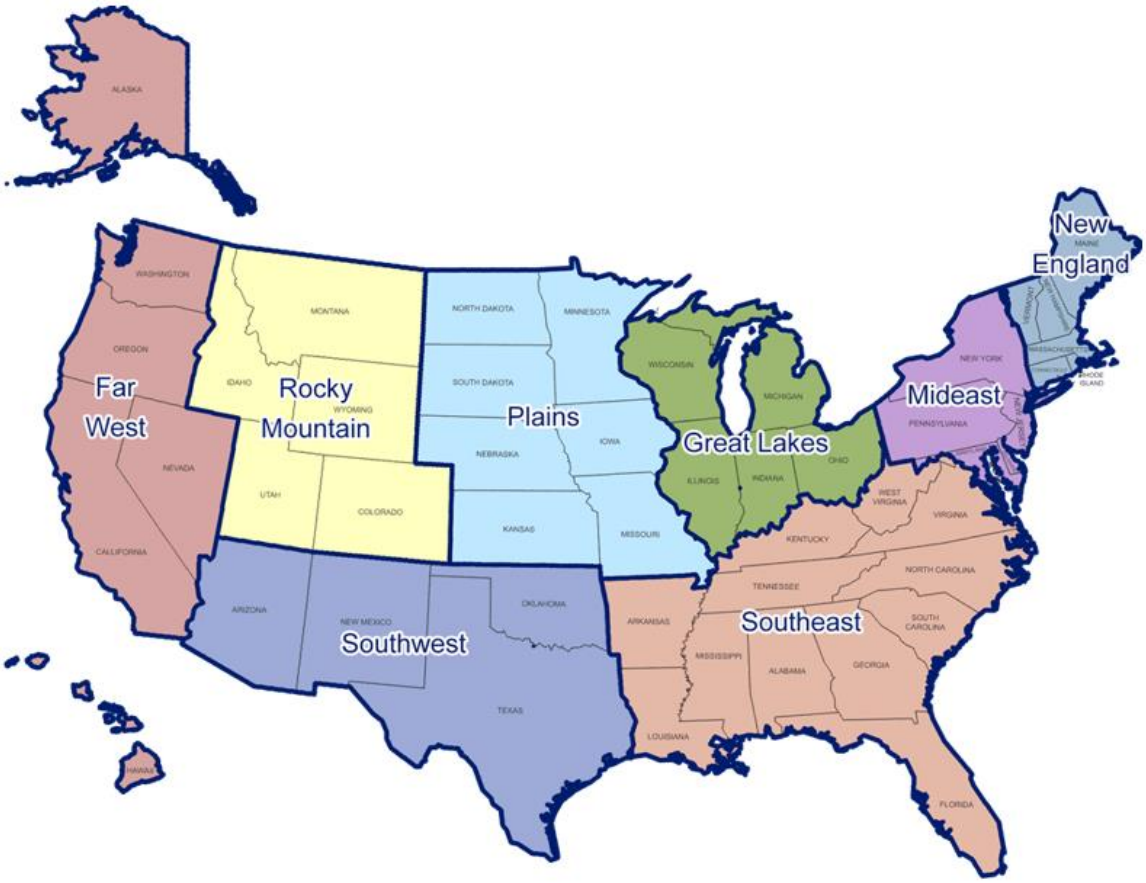
maturity date, and the short name.

The first applied filter included only those bonds considered an advance refunding. Bloomberg's labels for refunding securities yielded a list including advance refunding, crossover refunding, current refunding, economic defeasance, refunding bonds, and refunding notes. Both *crossover* and *defeasance* are considered a type of advance refunding (Dyl & Joehnk, 1976). Many of the CUSIPs labeled refunding bonds or notes were frequently issued in a series. This occurred when a single underwriting of refunding bonds included multiple CUSIPs (Ang et al., 2017). Bloomberg defined refunding bonds and notes as a pre-refunding bond that is issued to find another callable bond when the issuer decides to exercise its right to buy bonds back before the scheduled maturity date. Researchers in the refunding literature used this same definition; thus, all refunding securities were included except for those labeled current refunding, which yielded a sample size of 9,457 bonds.

Finally, the sample required all bonds to have no missing information, which yielded an ultimate sample of 8,716 bonds, or 75% of the original pool. The short name and the CUSIP were used to identify the state associated with the advance refunding, which produced data from 45 states that are actively trading. The other five states (i.e., Idaho, Kansas, Kentucky, North Dakota, and Wyoming) did not have any activity during the time frame. Each participating state's bonds were organized according to their respective BEA region. The variables used in the statistical models were separated based upon the eight BEA regions (see Figure 4) and aggregated by time using quarters of calendar years.

Figure 4

Bureau of Economic Analysis Regions in the United States



Note. BEA Regions Map produced by the United States Regional Economic Analysis Project, http://united-states.reaproject.org/. Reprinted with permission.

The eight BEA regions also served as variables. These appear in Table 1.

Table 1

List of Variables and Related Information

Variable	Label	Frequency	Source
Par value of deals (D)	Par value	Daily*	Bloomberg
Number of deals (D)	Par number	Daily*	Bloomberg
Time period (I)	Period	Quarterly	N/A
BEA regions (I)	Regions	N/A	U.S. Bureau of Economic Analysis
Bond Buyer 20-GO Index (I)	BB20 Index	Weekly*	Bond Buyer
State tax revenue (I)	Tax revenue	Quarterly	U.S. Census Bureau; Quarterly Summary of State & Local Revenue Tables
State GDP (I)	GDP	Quarterly	Bureau of Economic Analysis; GDP summary by state
State unemployment (I)	Unemployment	Quarterly	U.S. Bureau of Labor Statistics

Note. Dependent variables are labeled (D), and independent variables are labeled (I). GDP = Gross Domestic Product.
* Frequency is from the original data set and was converted into quarterly.

Reliability of Data Sample

A query from Refinitiv Thomson Reuters was conducted to confirm the accuracy of the low sample size compared to previous studies. Using the same dated date yielded 7,588 issues, limited to only states or state issuers and including only refunding. Given the difference in data reporting for each respective database, this study's final sample accurately represents state advance refunding activity during the time period. The reduced sample size compared to other studies in the literature is explained by limiting the sample to only state and state authorities.

Another supporting factor explaining the large difference between this and other studies' samples involves the MSRB's Electronic Municipal Market Access platform, which details the count of all municipal issuers according to government type. Across the 50 states, a total of 96,239 municipal issuers exist, yet only 3,268, or 3.4%, of those issuers, are at the state level, and 57.3% are at the city level (see Appendix A).

Variables

Variables from several sources were used in the regression for this study. This section provides descriptions of them that coincide with Table 1 for a more consolidated explanation of sources and methodology.

Time Period

The data in this study was divided into two time periods (i.e., before and after the imposition of TCJA). Having data from these different periods allowed analysis from an event perspective. The TCJA was enacted in late 2017 and went into full effect at the beginning of 2018. Consequently, the first time period included securities with a dated date between January 1, 2005, and December 31, 2017, and the other time period

included securities from January 1, 2018, to December 31, 2020.

Municipal Bonds (Par Value and Par Number)

Municipal bonds are typicaly issued in a series, meaning that in a single underwriting, bonds with a wide range of maturities are issued involving multiple CUSIPs from the same original series (Ang et al., 2017). Bonds that are from the same issuer on the same dates are referred to as a "deal." However, researchers in previous advance refunding literature rarely mentioned deals and typically measured these types of bonds by CUSIP or used a specific sample of individual bonds (Ang et al., 2013, 2017; Dzigbede, 2017; Moldogaziev & Luby, 2012; Orr & de la Nuez, 2014; Vijayakumar, 1995; Zhang & Li, 2005).

Because states have multiple advance refunded bonds outstanding, the literature supported the use of a bond-level approach. In this approach, each bond is treated as a separate observation (Maul & Schiereck, 2017). However, according to a personal interview with a managing director of PFM Financial Advisors, a firm specializing in municipal business, the proper way to measure a state's activity level regarding advance refunding is to measure in deals, not CUSIPs. Another personal interview with the chief financial officer of a state finance authority explained that proper measurement of the par value cannot simply involve sum the value of each CUSIP because multiple CUSIPs are associated with the same par value. Both of the individuals interviewed asked to remain anonymous. Their views were confirmed by Maul and Schiereck (2017) that identified clustering biases when taking a bond-level approach because of the "likely high correlation among bonds from the same firm, violating the assumption of independent observations and leading to an inflated t-statistic" (p. 767).

In an effort to contribute to the precedent set in previous literature while also accommodating applied practice, the independent variables were regressed against two different dependent variables (i.e., the number of deals and the par value of deals). State bond data were filtered to yield only series with a unique issue date, issue size, and issuer for each deal, returning a total of 875 deals with a par value of $409.6 billion. These deals and their respective par values were summed for each quarter during the time frame by state and then aggregated by region.

Previous literature did not include taxable advance refund bonds; however, according to the personal interviews with the managing director and chief financial officer, states have advance refunded municipal bonds into taxable status prior to TCJA for various reasons; thus, taxable bonds were included in this study. The data included 8,716 bonds, of which 785 were taxable, and 7,931 were tax-exempt.

Bond Buyer GO 20 Municipal Bond Index

Data on the Bond Buyer GO 20 Index was retrieved from *The Bond Buyer*, a daily newspaper covering the municipal bond market. This index is based on 20 state, city, and county GO bonds that mature in 20 years and have an average rating equivalent to Moody's Aa2 and Standard & Poor's AA (MSRB, 2017). The index reports weekly. In this study, the index was converted to a quarterly figure by averaging each week within each respective quarter of the time frame.

State Tax Revenue

Each state's total tax revenue was collected from the U.S. Census Bureau's quarterly summary of state and local government tax revenue tables. The data were reported in thousands of nominal dollars, and the numeric format was converted to show

all integers. Each state within the region with advance refunding activity was averaged for a single quarterly value.

State Gross Domestic Product

State Gross Domestic Product (GDP) was collected from the BEA's quarterly summary by state, which was last updated March 26, 2021, to include the fourth quarter of 2020. The data were reported in millions of chained 2012 dollars. Chained dollars are a calculated figure applying national chain-type price indexes to the current dollar values of GDP by state that adjusts it for inflation to allow a comparison of figures from different years. The numeric format of the data reported in chained dollars was then converted to show all integers. Each state within the region with advance refunding activity was averaged for a single quarterly value.

State Unemployment Rate

Data were collected from the U.S. Census Bureau's monthly employment status of the civilian noninstitutional population for states and selected areas. For use in this study, an average of the 3 months for each respective state and quarter was executed to provide a quarterly unemployment rate for each state during the time period. Each state within the region with advance refunding activity was averaged for a single quarterly value.

Limitations

Because the study's aim was to evaluate state municipal behavior, the data were organized first by each respective state. This limited the number of observations for several states, and the resulting low number of observations prevented a state-level panel analysis. For example, Florida had a total of 661 advance refund bonds issued within the

sample; however, once organized into a time-series format of quarters, the state yielded only 29 observations. When organized by each calendar year, the number of observations fell even lower (see Appendix B).

Because of the low number of observations, statistical significance at the state level could not be obtained. As a result, the data were organized into BEA regions. Although this format allowed regional business cycles to somewhat dilute each state's behavior, the model still provided insight into state advance refunding behavior.

Summary

Time-series regression models represent a well-established empirical approach to evaluating quantitative bond data. Using both the number of deals and the par value of deals issued by states within the eight BEA regions provided insight into the motivations and regional behavior divergences among the states. Chapter Four provides the study results and answers to the research questions while demonstrating that the methodology described in this chapter was followed.

CHAPTER FOUR: ANALYSIS AND RESULTS

Introduction

The purpose of this study was to evaluate the debt management decision made by BEA regions of U.S. states between 2005 and 2020 and see what primarily drove advance refunding and if the TCJA influenced decision-making in the states. This quantitative study took data from both proprietary databases, such as Bloomberg and Bond Buyer, as well as public databases, including those maintained by the U.S. Census Bureau and the BEA.

The main statistical models executed in this study focused on the eight BEA regions using the par value of deals (i.e., par value) and the number of deals (i.e., par number) as the two dependent variables. The study included two dependent variables because debt refinancing can be measured in one of two ways, either in the dollar amount or in the number of deals or transactions. The use of two dependent variables captured both measurements to show any divergence between them. The main statistical models used to answer the research questions included a hierarchical linear regression and a panel regression. Other statistical analytic tools were incorporated for moderation analysis.

The remainder of this chapter presents the preliminary inferential findings, including the descriptive statistics for the six variables. A clear understanding of the data, with further explanation of the limitations and data organization, proved each hypothesis with supporting statistics. Each of the three hypotheses was built upon the previous results because they were all interconnected.

Organization

The TCJA was enacted into law on December 22, 2017, and the provision related to advance refunding went into effect on January 1, 2018. Thus, in addition to a regional evaluation designed to illuminate geographic behaviors, the data were evaluated from an event perspective that involved comparing pre- and post-TCJA enactment. This was represented in the data as (a) before Quarter 1 (Q1) 2018 and (b) Q1 2018 and after, with the variable name period.

A total of 64 observations existed when the data were organized into calendar quarters, with 52 of those in the period prior to Q1 2018 and 12 in the period Q1 2018 and after. All data were evenly distributed by region, with each representing 12.5% of the data. However, each year prior to Q1 2018 respectively represented 7.69% of the data, while subsequent years represented 33% each. In addition, the quarterly time variable allowed the analysis to determine if states preferred one quarter over another for refinancing activity. Because state fiscal years mostly follow a July 1 to June 30 calendar,[1] a pattern was easily identified.

As mentioned in Chapter Three, the missing data were due to states having irregular advance refunding activity. To assess the impact and extent of the missing data, descriptive statistical techniques of frequencies and percentages were used in this study. The four independent variables for both periods (i.e., before Q1 2018 and Q1 2018 and after) were found to be 100% intact, reflecting no missing data and a frequency of 416 and 96, respectively. The dependent variables (i.e., par number and par value) reflected

[1] Those states not following the traditional fiscal year are New York (April 1), Texas (Sept. 1), and Alabama and Michigan (Oct. 1).

21.63% (*n* = 180) missing data in the period variable before Q1 2018, and 36.98% (*n* = 71) missing in the period variable Q1 2018 and after. The missing data for these variables in the Q1 2018 and after period was anticipated with the noticeable reduction in refunding issuances the municipal bond market experienced after TCJA implementation.

Preliminary Inferential Findings

The *t* test of independent means (see Table 2) showed a statistical significance for all variables (Field, 2018; Salkind & Frey, 2020). The wide divergence in standard deviations resulted in using Glass's delta to measure the effect size (Richardson, 1996), of which both dependent variables were very large. The range for tax revenue was expected to be large because there was no adjustment for inflationary growth.

Table 2

Independent and Dependent Variable Comparison by Time Frame

Variable/time frame	*n*	*M*	*SD*	*t*	*g*/Δ
Unemployment (before Q1 2018)	416	5.94	1.85	3.46***	.50
Unemployment (Q1 2018 & after)	96	4.93	2.74		
BB20 Index (before Q1 2018)	416	4.17	0.50	11.52***	1.68[a]
BB20 Index (Q1 2018 & after)	96	3.23	0.76		
Tax revenue (millions) (before Q1 2018)	416	4,318.71	2,365.27	4.35***	.59
Tax revenue (millions) (Q1 2018 & after)	96	5,802.20	3,140.84		
GDP (millions) (before Q1 2018)	416	347,895.07	16,6179.59	2.52**	.31
GDP (millions) (Q1 2018 & after)	96	401,859.24	194,122.13		
Par number (before Q1 2018)	236	3.53	3.85	5.41***	1.64[a]
Par number (Q1 2018 & after)	25	1.72	1.10		
Par value (millions) (before Q1 2018)	236	935.15	3,599.27	3.94***	1.51[a]
Par value (millions) (Q1 2018 & after)	25	214.28	478.05		

[a] Very large effect ($d \geq 1.20$).
**$p \leq .01$.
***$p \leq .001$.

Preliminary Predictive Analyses

Predicting Par Value and Par Number

To further confirm a behavioral change occurred, a simple linear regression statistical technique was used (Field, 2018; Salkind & Frey, 2020) to predict both the par value and par number by period. Par value statistics was reported in millions.

Period Predicting Par Value

The predictive model for par value was statistically significant (F[1,510] = 3.83, p = .05, R^2 = 0.01), indicating period explained 1.0% variation. The variable period was statistically significant in predicting the par value (B = -720.87; $t_{(510)}$ = -1.96; p = .05). Table 3 contains a summary of findings for the predictive model for par value.

Table 3

Predicting Par Value by Period

Variable	*B*	*SE*	95% CI	β	*t*	*p*
(Intercept)	935.15	159.51	[621.78, 1248.53]	0.00	5.86	< .001
Period 2018 Q1 & after	-720.87	368.37	[-1444.58, 2.83]	-0.09	-1.96	.05

Period Predicting Par Number

The predictive model was also statistically significant for par number (F[1,259] = 5.42, p = .021, R^2 = 0.02), indicating that period explained approximately 2% of the variance. The 2018 Q1 and after category of period was statistically significant in predicting the par number (B = -1.81, $t_{(259)}$ = -2.33, p = .02). This revealed that moving from pre- to post-TCJA, the mean value of par number decreased by 1.81 deals on average. Table 4 contains a summary of the predictive model for par number.

Table 4

Predicting Par Number by Period

Variable	*B*	*SE*	95% CI	β	*t*	*p*
(Intercept)	3.53	0.24	[3.05, 4.00]	0.00	14.70	< .001
Period 2018 Q1 & after	-1.81	0.78	[-3.33, -0.28]	-0.14	-2.33	.02

Effect of BEA Regions on Par Value

It was important to show if the differences between the period and region variables on par value were statistically significant differences or if they occurred randomly. A one-way analysis of variance (ANOVA) was conducted to identify any statistically significant differences in par value by region and study period (Field, 2018; Salkind & Frey, 2020).

Before Quarter 1 2018

The results of the ANOVA analysis were statistically significant ($F[7, 408] = 8.88$, $p < .001$), indicating significant differences in par value among the levels of region represented in the study (see Table 5). The proportion of the variance was 0.13, indicating the region variable explained approximately 13% of the variance in the par value of advance refunding deals. The means and standard deviations achieved in the ANOVA analysis appear in Table 6.

Table 5

Overall Effect of BEA Region Upon Par Value Before Q1 2018

Term	Sum of squares	*df*	*F*	*p*	η_p^2
Region	7.11×10^8	7	8.88	< .001	0.13
Residuals	4.67×10^9	408			

Table 6

Mean, Standard Deviation, and Sample Size for Par Value by Region Before Q1 2018

	For par value in millions		
Region combinations	*M*	*SD*	*n*
Far West	4,310.52	9,173.18	52
Great Lakes	789.67	2,087.00	52
Mideast	599.56	835.06	52
New England	452.83	557.57	52
Plains	299.25	742.78	52
Rocky Mountain	24.77	68.90	52
Southeast	889.19	1,140.05	52
Southwest	115.44	337.77	52

Quarter 1 2018 and After

The results of the ANOVA analysis were statistically significant ($F[7, 88] = 2.43$, $p = .03$), indicating significant differences in par value among the levels of BEA regions (see Table 7). The eta squared was 0.16, indicating breaking the data into BEA regions explained approximately 16% of the variance in par value. The means and standard deviations achieved in the ANOVA analysis appear in Table 8.

Table 7

Overall Effect of Region Par Value Q1 2018 and After

Term	*SS*	*df*	*F*	*p*	η_p^2
Region	3.52×10^6	7	2.43	.03	0.16
Residuals	1.82×10^7	88			

Table 8

Mean, Standard Deviation, and Sample Size for Par Value by Region Q1 2018 and After

	For par value in millions		
Region combinations	*M*	*SD*	*n*
Far West	676.75	891.45	12
Great Lakes	144.58	245.35	12
Mideast	103.58	267.10	12
New England	286.50	504.01	12
Plains	69.25	239.89	12
Rocky Mountain	28.17	97.57	12
Southeast	226.92	496.51	12
Southwest	178.50	399.86	12

Post Hoc Analysis

Paired *t* tests were used to assess differences between each pair of measurements to further examine the difference of par value by region. Tukey pairwise comparisons (i.e., Tukey's honest significance test) were conducted for all significant effects (Field, 2018).

For the main effect of region before Q1 2018, the mean for Far West par value was significantly greater than all the other regions ($p > .001$). For the main effect of region in the Q1 2018 and after period, the mean of par value for far West was significantly greater than for the plains region ($p = .031$) and significantly greater than for the Rocky Mountain region ($p = .016$). This was consistent with the level of activity in each of the respective regions during the sample time. The Far West region had the most activity in both advance refunding CUSIPS and dollar amounts of the eight BEA regions,

and the Plains and the Rocky Mountains had the least. No other significant effects manifested in the analyses.

Hypothesis 1

Hypothesis 1 stated: BEA regions will have a significant impact on advance refunding activity, both in predicting advance refunding par value and the number of issuances, and this activity will be unique across the eight regions of the United States.

Building upon the preliminary analysis that demonstrated the TCJA had a statistically significant impact on advance refunding activity, a 3-step hierarchical linear regression was conducted with both par value and par number as the dependent variables. This was done to control for the other variables and see if adding the subsequent variables improved the model's ability to predict either the par value or the par number of advance refunding deals. It also identified the relationship between the variables (Field, 2018).

Next, a multivariate analysis of the covariance (MANCOVA) and a univariate analysis of covariance (ANCOVA) were both performed to control for the respective effects of region and quarter on the period variable (Field, 2018; Pituch & Stevens, 2016; Tabachnick & Fidell, 2019). No other study in the literature had evaluated advance refunding behavior by geographic region, so it was extremely important to determine whether this activity occurred randomly or as a result of a repeatable trend. The analysis used to address Hypothesis 1 set the basis for the analysis used in the subsequent hypotheses.

Predicting Par Number

A 3-step hierarchical linear regression was conducted with both par value and par number as the dependent variables. For Step 1, the variable period was entered as a predictor variable into the unconstrained or baseline model. The study variable region was added as a predictor variable into the model at Step 2, and study variable quarter was added as a predictor variable into the model at Step 3.

All three steps proved statistically significant. The predictive model indicated that all steps helped explain part of the variation in the par number of state advance refunding deals, with period explaining 2.05% of the variation followed by region explaining 18.68%, and quarter explaining an additional 2.72% for an overall *R* squared of .2345, or 23.45% of the variance of par number explained. The results for the hierarchical predictive model for the dependent variable of par number appear in Table 9.

Table 9

Predicting Par Number by Period, Region, and Quarter

Model	R^2	df_{mod}	df_{res}	F	p	ΔR^2
Step 1	0.02	1	259	5.42	.02	0.02
Step 2	0.21	7	252	8.49	< .001	0.19
Step 3	0.23	3	249	2.95	.03	0.03

Note. Each step was compared to the previous model in the hierarchical regression analysis.

Model Finding Interpretation of Par Number of Advance Refunded Deals

Step 1 significantly predicted that moving from the before Q1 2018 period to the Q1 2018 and after period decreased the mean par number on average (B = -1.84, $t_{(249)}$ = -2.59, p = .01). This indicated that the TCJA event decreased the mean value of the par number of advance refunded deals by 1.84 on average.

However, Step 2 posted the highest R^2, indicating the geographical analysis of advance refunding explained 21% of the effect. The breakdown by region (see Table 10) addressed the latter part of Hypothesis 1, illustrating there was unique activity across the eight regions, and advance refunding activity was not uniform across the nation. The Southeast region posted the least change, and the Rocky Mountains had the largest difference in the par number of advance refunded deals on average.

Table 10

Predicting Par Number by Comparing the Far West to Other Regions

Region	*B*	$t_{(249)}$	*p*
Southeast	-1.80	-2.68	.008
Great Lakes	-2.79	-3.90	< .001
Plains	-3.60	-3.91	< .001
New England	-3.65	-5.11	< .001
Southwest	-4.24	-4.61	< .001
Mideast	-4.51	-5.99	< .001
Rocky Mountains	-4.89	-5.10	< .001

Step 3 introduced the measurement of quarters, which increased the effect by 2%. An analysis of movement between the first quarter to any of the others did not significantly predict the par number of advance refunded deals. Moving from first to second quarter resulted in a $p = .06$; moving from first to third yielded a $p = .36$, and finally, moving from first to the fourth quarter produced $p = .74$. This indicated that states did not prefer one quarter over another for advance refunding activity.

Predicting Par Value

The same 3-step hierarchical linear regression was conducted using par value as the dependent variable (see Table 11). The *F* test (Field, 2018) for Step 1 in the predictive model was statistically significant and indicated that adding period accounted for a significant amount of additional variation in par value (1%). Step 2 in the predictive model was also statistically significant, suggesting that BEA regions explained an additional 11.30% of the variation in par value. And finally, the *F* test for Step 3 of the predictive model was nonstatistically significant, showing that quarter did not account for a significant amount of additional variation in par value.

Table 11

Predicting Par Value by Period, Region, and Quarter

Model	R^2	df_{mod}	df_{res}	F	p	ΔR^2
Step 1	0.01	1	510	3.83	.05	0.01
Step 2	0.12	7	503	9.23	< .001	0.11
Step 3	0.12	3	500	0.73	.535	0.00

Predictive Model Interpretation (Par Value)

Step 1 significantly predicted par value of advance refunded deals (B = -720.87, $t_{(500)}$ = -2.06, p = .04), indicating that moving from the before Q1 2018 to the Q1 2018 and after category of period decreased the mean value of par value by $720.87 million on average. Step 2 posted the highest, R^2, indicating the geographical analysis of advance refunding explained 11% of the effect. The breakdown by region (see Table 12) addressed the latter part of Hypothesis 1, illustrating unique activity across the eight regions and showing that advance refunding activity was not uniform across the nation.

The Southeast region posted the least change, and the Rocky Mountains had the largest difference in the par value of advance refunded deals on average.

Table 12

Predicting Par Value by Comparing the Far West to Other Regions

	For par value in millions		
Region	*B*	$t_{(500)}$	*p*
Southeast	-2864.17	-5.25	< .001
Great Lakes	-2960.47	-5.43	.008
Mideast	-3122.62	-5.72	< .001
New England	-3207.55	-5.88	< .001
Plains	-3373.06	-6.18	< .001
Southwest	-3501.92	-6.42	< .001
Rocky Mountain	-3603.78	-6.61	< .001

Step 3 introduced the measurement of quarters, which did not significantly predict par value. When comparing a move from one quarter to another, there was no significance. Moving from first to second quarter resulted in a $p = .26$; moving from first to third yielded a $p = .80$, and finally, moving from first to the fourth quarter produced $p = .73$, indicating that no move between quarters significantly affected the mean of the par value of advance refunded deals.

Post Hoc Analysis

To further address Hypothesis 1, MANCOVA was conducted to assess if there were statistically significant differences in the linear combination of the dependent variables between the two levels of period when controlling for respective region and quarter. The main assumption associated with the use of MANCOVA (i.e., homogeneity

of regression slopes) was addressed first (Field, 2018; Pituch & Stevens, 2016; Tabachnick & Fidell, 2019).

The assumption for homogeneity of regression slopes was assessed by rerunning the MANCOVA to include interaction terms between each independent variable and covariate (Field, 2018). As a result, the model with covariate and independent variable interactions did not significantly explain more variance for either of the dependent variables than the original model (F[20, 478] = 0.42, p = .99). This indicated that neither of the region and quarter covariates interacted with the independent variable, and the assumption of homogeneity of regression slopes was met.

The main effect for period in the MANCOVA analysis was statistically significant, indicating that the linear combination of par number and par value was significantly different between the time frames in period while controlling for region and quarter. The covariate region was statistically significantly related to both dependent variables, and quarter was nonstatistically significantly related to par number and par value. Table 13 contains a summary of the results for the MANCOVA analysis.

Table 13

MANCOVA Finding: Par Number and Par Value by Period While Controlling for Region and Quarter

Variable	Pillai	*F*	*df*	Residual *df*	*p*	η_p^2
Period	0.03	3.52	2	248	.03	0.03
BEA region	0.25	5.10	14	498	< .001	0.13
Quarter	0.04	1.49	6	498	.18	0.02

Follow-Up Post Hoc Testing

To further examine the effects of the TCJA event upon the dependent variables while controlling for region and quarter, ANCOVA was conducted for each dependent variable (Field, 2018).

Par Number

The results of the ANCOVA analysis for the par number of advance refunded deals were statistically significant ($F[11, 249] = 6.94$, $p < .001$), indicating significant differences among the values of period when controlling for region and period (see Table 14). The eta squared was 0.03, suggesting that dividing the data by period to focus on the implementation of the TCJA explained approximately 3% of the variance in par number. The means and standard deviations appear in Table 15.

Table 14

Analysis of Variance Finding: Par Number by Period When Controlling for Region and Quarter

Term	*SS*	*df*	*F*	*p*	η_p^2
Period	74.15	1	6.72	.01	0.03
Region	671.60	7	8.69	< .001	0.20
Quarter	97.84	3	2.95	.03	0.03
Residuals	2,749.00	249			

Table 15

Marginal Means, Standard Error, and Sample Size for Par Number by Period Controlling for Region and Quarter

Combination	Marginal means	*SE*	*n*
Before 2018 Quarter 1	3.07	0.24	236
2018 Quarter 1 & after	1.23	0.68	25

Par Value

The results of the ANCOVA analysis were statistically significant ($F[11, 500] = 6.45$, $p < .001$), indicating significant differences among the values of period when controlling for region and quarter (see Table 16). The eta squared was 0.01, indicating period explained approximately 1% of the variance in par value. Table 17 shows that the marginal par value means decreased from 935.15 to 214.28 from before 2018 to 2018 and after while controlling for region, indicating both region and period had a statistical impact on the par value of advance refunding.

Table 16

Analysis of Variance Finding: Par Value by Period While Controlling for Region and Quarter

Term	*SS*	*df*	*F*	*p*	η_p^2
Period	4.05×10^7	1	4.26	.04	0.01
Region	6.14×10^8	7	9.21	< .001	0.11
Quarter	2.09×10^7	3	0.73	.54	0.00
Residuals	4.76×10^9	500			

Table 17

Marginal Means, Standard Error, and Sample Size for Par Value by Period Controlling for Region and Quarter

Combination	Marginal means	*SE*	*n*
Before 2018 Q1	935.15	151.32	416
2018 Q1 & after	214.28	315.00	96

Hypothesis 2

Using the findings from Hypothesis 1, Hypothesis 2 required a more focused and direct evaluation of the period variable and how that impacted both dependent variables. Hypothesis 2 stated: The TCJA event significantly changed states' behavior as it relates to using advance refunding for their municipal debt offerings, with states issuing less advance refunded bonds in both par value and in the number of deals.

To address the impact of the TCJA event, a linear discriminate analysis (LDA) was conducted to evaluate the degree of separation among the dependent variables by the study's primary variable of period, which illustrated the behavior of states pre- and post-TCJA implementation (Meyers et al., 2021). The analysis used in Hypothesis 1 showed a difference in both dependent variables when related to period. However, LDA disaggregates the linear combination in a more detailed manner than univariate ANOVA and ANCOVA (Field, 2018). The rationale for using LDA was to emphasize the most precise separation (i.e., discrimination) of the independent variable and dependent variables.

In MANOVA and MANCOVA, a set of outcome measures are predicted from a perioding variable. In LDA, however, the opposite occurs, predicting a perioding variable from a set of outcome or dependent measures. In MANOVA and MANCOVA, the

researcher focuses on identifying linear variates that best differentiate the periods. These linear variates represent the functions in LDA.

Results

The LDA was conducted and evaluated using the Wilk's Lambda test to show how well the independent variable, period, contributed to the model (Pituch & Stevens, 2016). The Wilk's Lambda test was statistically significant for par number (F[1, 259] = 5.43, p = .02), nonstatistically significant for par value (F[1, 259] = 0.78, p = .38), and statistically significant for the overall model (x^2(2) = 5.86, p = .05). These results indicated a significant separation between the levels of period for par number and par value.

Every component of the LDA has a standardized coefficient (i.e., standardized canonical discriminant function coefficient) and a correlation for each variable included in the analysis. The coefficients are the values used for the linear combinations to obtain the linear discriminant components. The standardized coefficients for each variable and linear discriminant component appear in Table 18.

Table 18

Standardized Canonical Discriminant Function Coefficients for Each Linear Discriminant Component

Variable	Linear Discriminant 1
Par number	1.19
Par value	-0.38

Correlation analyses were also conducted to determine which variables had a large ($r \geq .50$ or $r \leq .50$) or moderate ($r \geq .30$ or $r \leq .30$) contribution to the LDA components. Par number (r = 0.96) exerted a strong contribution and par value (r = 0.36)

exerted a moderate influence on the component. Variables that reflect large correlations for components that exhibit a significant percentage of trace (i.e., percentage of separation between the periods) contribute the most in separating the periods. The Pearson product-moment correlations for each variable and linear discriminant component appear in Table 19.

Table 19

Pearson Correlations Between Each Variable and Linear Discriminant Component

Variable	Linear Discriminant 1
Par number	0.96
Par value	0.36

Hypothesis 3

Hypothesis 3 built on the prior two hypotheses by involving a balanced panel regression analysis to explore the motivating variable for the change in behavior. This model was ideal because the dataset met the criteria of being balanced due to each panel (i.e., region) being observed every consecutive quarter from Q1 2005 to Q4 2020. The dataset also met the time-series requirement of this study (Torres-Reyna, 2007). Specifically, Hypothesis 3 stated: The primary driving factor for advance refunding post-TCJA is tax revenue.

Two major modeling approaches characterize and are commonly applied to panel regression analysis: fixed effects (FE) and random effects (RE). The FE modeling approach to panel regressions has been referred to as the preferred approach (Vaisey & Miles, 2017) and the gold standard (Schurer & Yong, 2012) for use in panel regression modeling. Moreover, Bell et al. (2019) noted FE is perhaps the most used and

recommended method of dealing with difference within and between effects in panel regression modeling (p. 1057).

The rationale for using the RE modeling approach, unlike the FE model, was that the variation across entities is assumed to be random and uncorrelated with the predictor or independent variables included in the model. Greene (2008) noted that the primary and critical distinction between FE and RE is whether the unobserved individual effect embodies elements that are correlated with the regressors in the model and not whether these effects are random in nature. Thus, Hypothesis 3 was addressed using both modeling techniques for comparative purposes with both dependent variables.

Par Number

The predictive models for par number using both FE and RE techniques were statistically significant (see Table 20). None of the independent predictor variables in the RE model manifested at the statistical significance level of $p \leq .05$. The variable of unemployment ($p = .07$) did, however, manifest at the more liberal threshold for statistical significance of $p < .10$. Two variables in the FE model manifested at statistically significant levels: unemployment ($p = .05$) and tax revenue ($p = .04$).

Table 20

Summary of Finding Table for Par Number: Fixed and Random Effects

Variables	Fixed effect (Standard errors)	Random effect (Standard errors)
Intercept	1.66 (1.97)	-0.75 (1.72)
Unemployment	0.22* (0.11)	0.22 (0.11)
Bonds	0.03 (0.45)	0.60 (0.38)
Tax revenue	0.00(1) * (0.00)	0.00(1) (0.00)
Gross Domestic Product	-4.98 (3.47)	-4.14 (3.49)
Model	$F(4, 255) = 2.56$; $p = .03$*	$X^2(4) = 9.63$; $p = .04$*

*$p \leq .05$.

Par Value

The predictive models for par value using both FE and RE techniques were statistically significant in predicting the dependent variable of par value (see Table 21). The independent variable of tax revenue represented the most robust, statistically significant predictor of par value within both the FE and RE models. The variable of GDP was statistically significantly predictive of par value within the FE model ($p = .04$).

Table 21

Summary of Finding Table for Par Value: Fixed and Random Effects

Variables	Fixed effect (Standard errors)	Random effect (Standard errors)
Intercept	-247.76 (1138.41)	-1703.41 (998.43)
Unemployment	47.81* (70.77)	82.69 (70.12)
Bonds	4.52 (254.40)	336.98 (221.55)
Tax revenue	0.49 *** (0.13)	0.43*** (0.14)
Gross Domestic Product	-0.01* (0.00)	0.00 (0.00)
Model	$F(4, 506) = 5.70$; $p < .001$***	$X^2(4) = 19.74$; $p < .001$***

*$p \leq .05$.
***$p \leq .001$.

Follow-Up Analyses

A follow-up analysis to confirm the findings from the balanced panel regression was also conducted. Both a MANCOVA and hierarchical regression, which are both fixed effects in nature, mirrored the findings achieved in the original panel regression analysis with FE modeling. In the MANCOVA analysis, the variables of unemployment and tax revenue were statistically significantly related to the linear combination of par number and par value.

Post hoc analyses using univariate ANCOVA analyses were also conducted for both dependent variables. The significance levels achieved in the post hoc ANCOVA yielded identical FE values for par number and par value when compared to the panel

regression model.

A second follow-up analysis using hierarchical linear regression for both dependent variables was also conducted for confirmation. The findings achieved in the analysis for both par number and par value at the fifth stage of the modeling process mirrored the findings of the ANCOVA analyses and the initial balanced panel regression analyses using an FE modeling approach.

Conclusion

This chapter presented the results of the statistical analysis in the context of the study's hypotheses. The purpose of this study was to evaluate the debt management decision made by BEA regions of the U.S. states between 2005 and 2020 and see what primarily drove advance refunding and if the TCJA influenced decision-making in the states. The TCJA event determined a clearly delineated timeline, allowing a complete analysis of behavior both before and after the event. Geographic analysis was conducted to evaluate the behavior in different BEA regions of U.S. states and to identify the primary driver for advance refunding at this level of municipal government.

The findings clearly showed that the three hypotheses built upon each other to give a complete picture of the total impact of TCJA on state decisions to advance refund their debt. This quantitative study used a variety of statistical techniques to assess the variables and evaluate their impact on both dependent variables (i.e., par value and par number). Chapter Five includes the summary for the critical analysis and discussion of the three hypotheses as well as of the implications for practical application.

CHAPTER FIVE: DISCUSSION, CONCLUSIONS, AND RECOMMENDATIONS

Introduction

Over the last half-century, the practice of refinancing municipal debt has grown frequent enough to draw regulatory attention from Congress. Historically, this type of debt has offered state and local governments a less expensive way to fund government infrastructure that would otherwise require other methods of financing, such as tax increases (GFOA, 2003). Although smaller reforms to tax-exempt refinancing tools have been the subject of federal legislation, the TCJA of 2017 represented one of the most substantial changes to date, eliminating the ability of municipals to issue tax-exempt advance refunded bonds (Bond Buyer, 2019; Kalotay, 2018).

Researchers in the academic literature agreed upon three primary motivators behind municipal advance refunding transactions; however, these authors published their views before passage of the TCJA. After passage, the frequency of advance refunding increased, even with record-low interest rates. Consequently, a need arose to evaluate the impact the law has had on municipal bonds.

The overall research question guiding this study was as follows: What is the impact of TCJA on states' advance refunding of debt? A subcomponent of this research question was: Do states operate in aggregate, or do unique fiscal or economic variables create unique refinancing behavior across different regions of the United States? Authors of public finance literature found that large states with lenient budget rules experience more volatile economic activity than other states (Krol & Svorny, 2007). Evaluation of this subproblem involved discriminate analyses and multiple regression models.

This study resulted in numerous contributions to the advance refunding literature.

This was the first study to address the frequency of advance refunding and the motivation behind it after the TCJA became law. In addition, many researchers investigating similar topics have not incorporated a geographic component into their analysis. At the time of this study, only three studies had relied on a limited sample based, two of which were on geography; however, none of these focused solely on states. This geographic distinction is important because state tax revenue sources differ greatly from other municipal levels of government, a difference that likely influences debt management decisions. Finally, the use of a new, variable tax revenue introduces a public finance measurement, shedding light on a new advance refunding motivator for municipals.

The remainder of this chapter addresses the study's findings by research hypotheses, followed by the major implications for practical application. The chapter concludes with recommendations for future research.

Findings by Research Hypothesis

Hypothesis 1

Hypothesis 1 stated: BEA regions will have a significant impact on advance refunding activity, both in predicting advance refunding par value and the number of issuances, and this activity will be unique across the eight regions of the United States. Academic researchers have described regional economies as volatile and subject to regional business cycles to which states respond with varying degrees of fiscal policy (Cornia & Nelson, 2010; Gupta et al., 2018; Krol & Svorny, 2007; Levinson, 1998; Owyang et al., 2005). Debt management (e.g., refinancing existing debt through an advance refunding) represents one form of fiscal policy action (NCSL, 2004).

The statistical analysis that included geography produced evidence that states

operate independently from nationwide trends, validating the hypothesis. The predictive model showed that each state's economic region accounted for 21% of the number of advance refunded bonds, also explaining 11% of the dollar value of advance refunded debt.

The Far West and New England states had more activity than the Plains and Rocky Mountains, which aligned with debt capacity limitations as well as regional economic fluctuations during the sample period. When accounting for time periods pre- and post-TCJA, advance refunding in the Southeast states experienced the least impact, and the Rocky Mountains experienced the most in both the number of advance refundings and the dollar value. The means for both measurements of advance refunding decreased for time periods pre- and post-TCJA while controlling for region. This showed the TCJA had a statistically significant impact on advance refunding while controlling for region.

Hypothesis 2

The analysis used in Hypothesis 1 revealed a difference in state behavior when evaluating it according to period (i.e., pre- and post-TCJA implementation), but this finding required more in-depth analysis to confirm it. Hypothesis 2 stated: The TCJA event significantly changed states' behavior as it relates to using advance refunding for their municipal debt offerings, with states issuing less advance refunded bonds in both par value and in the number of deals.

Both the par number and the par value of advance refunded state debt were significantly influenced when evaluated by the time variable. In aggregate, the TCJA reduced advance refunding activity by 1.84 deals on average, or $720.87 million, when

comparing pre- and post-TCJA activity. This finding validated Hypothesis 2.

The findings associated with this hypothesis are consistent with both academic and trade literature that identified a significant behavior shift after TCJA implementation (Bond Buyer, 2019; Kalotay, 2018; Wallwork, 2018). The par number of bonds showed a stronger influence from the event than the par value. This is reasonable because the legislation was intended to eliminate advance refunding into tax-exempt debt; however, it placed no limit on the value of the debt if the decision to advance refund into taxable debt was carried out.

Hypothesis 3

The third and most telling hypothesis addressed the motivators behind state advance refunding activity. Corporate literature showed that the economic environment directly impacted the call decision, especially with lower rated debt (Alderson et al., 2017; Booth et al., 2014; Kerins, 2001; King & Maurer, 2000; McDonald & Van de Gucht, 1999). Thus, it was important to determine if similar economic variables had the same impact on a municipal's decision or if another explanation could be identified. Hypothesis 3 stated: The primary driving factor for advance refunding post-TCJA is tax revenue.

The analysis revealed both unemployment and tax revenue significantly affected the advance refunding decision when predicting the number of bonds. When evaluated by the dollar value of advance refunding, GDP and tax revenue were both significant. In each case, tax revenue was found to be the stronger and better predictor. This finding supported Hypothesis 3.

Major Implications for Practical Application

Evidence showing tax revenue as the primary driving variable is not surprising if evaluated from a public finance perspective. States differ substantially in their incomes, tax bases, and levels of spending, and each is uniquely impacted by its respective business cycle and other macroeconomic conditions directly influencing their debt management practices (Cornia & Nelson, 2010; Poterba & Rueben, 1999). In addition, states are bound by balanced budget requirements and debt capacity limits (NCSL, 2004). Identifying tax revenue as a major driver also expands upon research by Ang et al. (2017), showing "strong evidence that advance refunding activity increases when states and local governments experience declines in current tax revenues or budget deficits" (p. 1679).

The knowledge that state tax revenue drives state advance refunding decisions benefits practitioners who must avoid hasty decisions made to meet immediate cash flow needs rather than serve the state taxpayer's best interest. In addition, a misuse of data has existed in the municipal debt literature because researchers have aggregated both state and local debt. It was the goal of this research to introduce a methodology for separately evaluating different levels of government.

One approach that will help separate state and local debt research involves incorporating more public finance analysis into what has traditionally been a very corporate approach. Trade publications and analysts have historically taken a mathematical approach to evaluating municipal bonds; however, similar to the corporate bond industry, multiple factors not directly associated with financials influence a firm's decision-making process. Because municipal levels of government ultimately answer to

the taxpayer with varying degrees of regulatory pressures, financial decisions differ vastly from the private sector and warrant a different approach. Such things as tax revenue elasticities, constraints on revenue generation, constitutional and statutory regulations, and sophistication of debt management methods all represent important considerations for those in the municipal bond market.

Practitioners no longer prefer the method of evaluating advance refunding solely by valuing the call option, and under the new tax law, this approach should be updated (Brooks, 1999; Brown, 2011; Kalotay et al., 2007; Orr & de la Nuez, 2013; Zhang & Li, 2005). According to the personal interviews referenced in Chapter 3, practitioners have already moved toward a focus on breakeven analysis. However, researchers in the most recent literature on this topic still focused on the value of the call option (Chen et al., 2021; Kalotay, 2021), and others have continued to use complicated mathematical explanations for public debt management decisions (Lewin & Sardy, 2020). Practitioners must work with elected officials and government bureaucrats who are unwilling to consider lengthy mathematical equations before making debt management decisions. Researchers must acknowledge this and try to adopt more public finance approaches that can be put into practice.

Recommendations for Future Research

A need exists for more research on appropriate measurement techniques for municipal bonds. Researchers have historically analyzed bonds on an individual or CUSIP basis, while practitioners issue and measure municipal debt in deals. Clarifying this will help future researchers categorize debt so that there is less skew in models evaluating refinancing frequency.

Another area ripe for study is the application of the same statistical approach used in this study while isolating different levels of local governments to determine their motivations. Cities, counties, and school districts all operate differently across the 50 states, which impacts their debt management decisions. For example, local governments that are funded primarily with property taxes with strict limitations will make vastly different debt management decisions than those with more generous property tax limitations or additional taxing authority, such as a local-option sales tax or a local income tax. Future research on local governments should be done at the state level to account for the homogeneity of regulatory environments.

Following up on one of the limitations experienced in this study, more research should be conducted at the individual state level. Given that certain regions have more advance refunding activity than others, it would be valuable to take a deeper dive into specific states to see if the motivations for advance refunding are unique to states with certain tax structures. For example, researchers could explore whether California is still motivated by tax revenue or by another public finance motivation when evaluated in isolation from the other Far West region states. Some states, due to their debt capacity limits, will never have enough advance refunding activity for a state-level analysis, but they might be prime candidates for city or state analysis. Conducting state-level analyses of municipal governments would also introduce more niche public finance variables to explore other possible motivating factors not yet identified in the current literature.

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APPENDICES

APPENDIX A

Count of all Municipal Bond Issuers by State and Level of Government

State	State	City	County	Other	All Issuers
Alabama	75	1,537	555	9	2,176
Alaska	40	106	0	1	147
Arizona	60	738	528	10	1,336
Arkansas	56	1,111	418	3	1,588
California	302	7,459	1,284	54	9,099
Colorado	70	1,998	680	10	2,758
Connecticut	65	382	3	4	454
Delaware	30	89	31	14	164
Florida	84	62	1,287	2,321	3,754
Georgia	42	684	1,030	238	1,994
Hawaii	28	16	26	0	70
Idaho	32	291	199	1	523
Illinois	113	3,131	1,484	14	4,742
Indiana	80	3,226	764	16	4,086
Iowa	79	2,230	258	5	2,572
Kansas	40	1,485	764	7	2,296
Kentucky	87	605	1,027	251	1,970
Louisiana	61	1,387	1	296	1,745
Maine	47	281	12	24	364
Maryland	76	151	211	31	469
Massachusetts	126	745	19	8	898
Michigan	66	2,893	716	15	3,690
Minnesota	54	3,177	398	3	3,632
Mississippi	47	760	500	0	1,307
Missouri	89	1,717	1,288	569	3,663
Montana	34	281	475	5	795
Nebraska	63	1,372	1,054	3	2,492
Nevada	16	155	100	1	272
New Hampshire	43	10	11	231	295
New Jersey	94	113	289	1,542	2,038
New Mexico	44	42	143	431	660
New York	112	220	354	2,965	3,651
North Carolina	57	39	427	564	1,087
North Dakota	32	32	122	685	871
Ohio	105	2,441	847	25	3,418
Oklahoma	97	705	929	1	1,732

Oregon	28	740	419	15	1,202
Pennsylvania	56	1,921	1,000	1,327	4,304
Rhode Island	51	2	3	124	180
South Carolina	69	6	384	408	867
South Dakota	36	34	54	458	582
Tennessee	19	836	491	2	1,348
Texas	130	4,887	1,863	16	6,896
Utah	43	642	182	1	868
Vermont	36	52	4	24	116
Virginia	62	475	546	136	1,219
Washington	69	950	797	20	1,836
West Virginia	49	7	341	323	720
Wisconsin	57	2,780	135	11	2,983
Wyoming	17	130	163	0	310
Sum of Total	3,268	55,133	24,616	13,222	96,239

APPENDIX B

Municipal Bond Data by State and Associated Quarters

State	CUSIPs	Quarters
Alabama	53	4
Alaska	39	4
Arizona	90	4
Arkansas	89	6
California	1,006	33
Colorado	85	7
Connecticut	238	16
Delaware	76	6
Florida	661	29
Georgia	159	12
Hawaii	274	14
Illinois	95	4
Indiana	15	1
Iowa	14	1
Louisiana	167	11
Maine	56	4
Maryland	102	14
Massachusetts	272	16
Michigan	109	7
Minnesota	257	11
Mississippi	165	7
Missouri	88	5
Montana	84	7
Nebraska	8	2
Nevada	309	10
New Hampshire	108	8
New Jersey	80	6
New Mexico	13	2
New York	114	5
North Carolina	116	9
Ohio	462	18
Oklahoma	13	1
Oregon	587	16
Pennsylvania	134	12
Rhode Island	258	13
South Carolina	218	7
South Dakota	14	2
Tennessee	505	26

Texas	240	12
Utah	15	3
Vermont	102	7
Virginia	105	7
Washington	614	20
West Virginia	91	5
Wisconsin	416	25