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Developing an Economic Value Model for Delinquent Tax Auctions in South Carolina

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This is to certify that the doctoral dissertation by

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has been found to be complete and satisfactory in all respects,
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Abstract

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Dissertation Submitted in Partial Fulfillment

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Abstract

Government-administered public auctions of private property to recoup unpaid taxes represent a common tool to collect funds while representing an investment vehicle for tax sale attendees. The problem was that factors such as starting bids, high bids, redemption timing, taxes due from prior years, possible interest earned, assessed land value, property structures, and possible economic gain were not widely understood by tax sale participants. The purpose of this correlational study was to examine the existence of relationships between or among the aforementioned attributes and the interest earned by a bidder or the odds of acquiring a tax deed. Quantitative theory, affords a precise and unbiased evaluation of decision-making with multiple inputs and variables, provided the foundation for secondary source data analysis via the 2017 Florence County, South Carolina, delinquent tax sale. A multiple linear regression analysis of 586 properties showed a statistically significant association between interest earned from the starting bid, highest bid, and days elapsed until the property was redeemed ($F = 625$, $p < .001$). A multiple binary logistic regression analysis of 676 properties showed if taxes were due in prior years, a positive relationship of more than six-fold ($p < .05$, Exp (B) = 6.064, 95% CI [1.637, 22.469]) existed with receiving a tax deed. The results indicate that if a structure was present, the estimated odds ratio showed a decrease of receiving a tax deed of nearly 58% ($p < .05$, Exp (B) = .426, 95% CI [0.197, 0.919]). The social change implications were that investors may utilize these results to enhance their strategies when attending delinquent tax sales. Positive social change may increase by providing marginalized groups investing options.

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Dedication

My research study is dedicated to my wife, Lisa, our daughters Alexis and Jillian, and my mom and dad, “Joanie and Jackie.” All of you have inspired me in different ways, at different times, but with the same outcome: A completed dissertation. This was certainly a long journey, starting before Alexis and Jillian were born, and ending after Jackie had passed.

Lisa, you have always been the academic professional in our family. From those late nights at SUNY Albany when you would be studying psychology and I would be out studying “chemistry” rather than physics 36 years ago this month, to earning your Ph.D. when you were only 28, you were and have been an excellent influence on me. Without you, I certainly would not have accomplished my first graduate degree, never mind a terminal degree. How you have put up with me over the years is more of an amazing feat than adding a Ph.D. after my name. I love you dear!

Alexis and Jillian, thank you for being a better student than I was at your age as well for being more mature. I enjoyed the fact that the three of us were completing three different university degrees, at three different levels, at the same time, as the co-misery was helpful and grounding. You have grown into two wonderful, independent, and driven individuals. Thank you for your support and encouragement. I love you both.

To Joanie and Jackie, thank you for providing a wonderful home to grow up in, where you fostered tolerance and support. I love you both. From your humble beginnings and educational background, you provided an incredible environment for me to go from a “first gen.” college student to earning a doctorate. Many times during this journey I have

recalled Jackie saying “Just get that shingle and they can never take it away it away from you.” Now I can finally respond with “Shingle earned and received, carry on airman.”

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First, I would like to acknowledge the support and direction provided by my dissertation committee during my doctoral journey. Thank you Dr. Holly Rick (Chair), Dr. Mohammad Sharifzadeh (SCM), and Dr. Raghu Korrapati (URR). I especially thank the chair of my committee, Dr. Holly Rick, for her tireless work in getting me "across the finish line." Without Dr. Rick and her excellent guidance, I would still be collecting data that equates to 25 times the size of what this research study ultimately entailed. Dr. Rick has been motivating but personable, rare character traits found in leaders.

Second, my sincere appreciation and gratitude go to the Florence County Treasurer's Office, specifically Florence County Treasurer, Laurie Walsh-Carpenter and (now retired) Florence County Deputy Treasurer, Paige Holsapple, who managed the delinquent tax sale process. Without the support of these employees and the office in which they work, this study could not have been possible.

Finally, I would like to recognize Coker University and the administration's decision to hire me as "ABD", trusting that I would complete a doctorate degree. I am fortunate to work at this institution and with my peers in the School of Business.

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Chapter 1: Introduction to the Study

The topic of this quantitative, nonexperimental, explanatory correlational study was to develop an optimum model to be used by delinquent tax auction attendees to determine what influences the amount of interest earned, and the likelihood of receiving a tax deed, should they be a lienholder via high bid at a delinquent tax sale. Pellegrino & Allocca (1996) affirmed that tax sales were an area of law that was not well known. This statement can be applied not only to those employed within the legal field but also to investors who partake in the auction process. Having better and more accessible data could potentially give way to an investor bidding on the property the first year of the auction, avoiding being carried over year after year.

Current literature fails to demonstrate the trends and relationships between the amount of economic investment needed to be a successful high bidder as well as the relationships that have led to receiving a tax title or having it redeemed by the original owner during the redemption period, which resulted in interest earned by the high bidder. Positive social change could be realized by an explanation of the delinquent sale process and providing data that can be understood by all possible attendees to a delinquent tax sale, not only those with significant discretionary income. Bidders at lower income levels who may not have participated in these events could be more inclined to invest funds to earn interest as a lienholders or to obtain real estate once the auction participants understand the revenue-generating options in the form of interest earned, property ownership, or capital gains, by taking title to a property. Persons of a lower

socioeconomic status (SES) may also become owners of real estate, including residential homes, at a price point far below the market value of the property.

Within Chapter 1, I provide the background of the study, exploring the primary drivers of why this research is important, further clarified by the problem statement and purpose. Two research questions proposed the benefits of properties that are redeemed by the original owner, yielding interest to the high bidder, and those not redeemed, whereby the high bidder will take title to the property. A discussion of modern management theory, which serves as the theoretical foundation, is followed by the nature of the study, along with key definitions and assumptions. The 2017 delinquent tax sale in Florence County, South Carolina, administered by the Florence County Treasurer's Office, represents the focus of the study. Chapter 1 ends with why this study was significant in terms of theory, practice, and social change.

Background of the Study

There was no common, statewide database of real property tax information at a county level. Only a portion of the results from the auctions are available to the State of South Carolina and the general public via electronic means outside of the County Treasurer's office (Ruple, personal communication, May 27, 2020). While publicly available by South Carolina state law, data such as the starting bid at the time of the auction, when a property was redeemed, and the highest bid for a property if it was not redeemed are only available at the courthouse of each county. There was a lack of easily available government data specific to these variables, which hinders potential investors as well as property owners. The reduced accessibility to these drivers, particularly in a

digital format that can be exported via batch processing and manipulated, significantly hinders insight and understanding of delinquent tax sale processes and resulting metrics. This was not a unique issue and remains largely unchanged from the 19th century when properties with past-due taxes were advertised for up to one month in the local paper and then auctioned to the highest bidder "on the courthouse steps" (Swierenga, 1974). Technology improvements over the last two centuries have allowed the process for potential bidders to research information to be more expansive and detailed via internet searches, aerial maps, and methods of transportation for viewing the physical location and assessing potential worth. Though the improvements are numerous, not all data have been available remotely, which requires a visit to where the records are held and individual, manual inspection of the data. Some courts are starting to address this issue and identify that not using technology may represent an impact on due process for the public (Inman, 2017). A gap in performing a detailed analysis of delinquent tax sales to establish trending data and bidding strategies has been evident at the county, state, and even national levels (Ruple, personal communication, May 27, 2020). Generating and examining these data as part of this study has reduced this gap, enabling academics, investors, property owners, and government officials to better understand delinquent tax sale analytics and dynamics.

The results of this study have yielded an objective ranking of characteristics and redemption rates of properties at the 2017 delinquent tax sale in Florence, South Carolina, relying on a correlational approach given a large amount of data and ratios. The findings of this study have also led to a dynamic model that prioritizes drivers of

delinquent tax sale auctions, reflecting decision-management fundamentals as well as practical results for the real estate investor and local communities. From a theory perspective, modern management techniques requiring mathematical relationships have eliminated the tendency for excessive guesswork and assumption (Harwood & Mayer, 2016). From a practical aspect, each county in South Carolina could have increased its revenue due to more knowledgeable bidders, whereby the cost to hold such auctions would have been reduced, potentially lessening the fees required from the owner to retain the property. This aspect of delinquent tax sales could also be true of other lienholder states that do not readily allow digital, remote access to their public databases. Reducing the barriers to understanding and attending delinquent tax sales could also impact racially dispossessed minorities as they would be afforded the opportunity to take title to real estate that was once their families' property (Franzen & Bascomb, 2021).

Much of the existing literature has focused on the negative aspects of tax sales such as eviction and the impact on people being displaced by not paying their taxes and forfeiting their real estate. Bartell (2019) argued that the process of having a tax sale was actually a fraudulent transfer of funds and those delinquent taxpayers should be paid the fair equivalent of the property that was being forfeited. Seymour and Akers (2021) evaluated how major tax sale investors take advantage of low-income and credit-challenged individuals. These marginalized persons have also been impacted by a high degree of insecurity regarding the potential loss of their homes, which reduces their quality of life (Seymour & Akers, 2021). Additional literature overwhelmingly has concentrated on the negative impact on communities rather than having a focus on how

people within the same community could have benefited by understanding and participating in the delinquent process for financial gain. Ownership by local residents of areas that were impoverished or have high crime rates would have decreased the overall level of crime should vacant land have been purchased by people within the community (Stern & Lester, 2020). Current literature does not specifically address how impoverished communities could have benefited if some of the populous became owners of the property, nor what information potential investors required to realize a financial benefit. The process of how investors achieved a title at prices below market value, such as through a tax sale, was not specifically researched by most bidders at county government property auctions (Walsh-Carpenter, personal communication, December 14, 2021). Optimizing this process would have allowed a higher number of delinquent taxpayers to retain their property while still providing additional tax dollars from increased attendance during the annual delinquent tax auction. These incremental tax dollars could have been reinvested in county projects for the collective good of the communities being served.

Problem Statement

The process of real property, such as vacant land, residential, and commercial buildings being auctioned to the highest bidder via county-level government delinquent tax sales in South Carolina has represented a needed yet generally poorly understood mechanism (Walsh-Carpenter, personal communication, December 14, 2021). In the fiscal year 2016, 72% of all local taxes came from levied property taxes (“Census of Government,” 2018). In 2018, Florence County, South Carolina, alone had 922 properties required to be auctioned to the highest bidder at the time of the auction (Florence County

Delinquent Tax Office, 2018). In October 2021, the Florence County delinquent tax sale was the largest in the history of Florence County, with 480 bidders and total collections of more than $10.8 million in bid money (Walsh-Carpenter, personal communication, December 14, 2021). While attendees of these annual auctions have had the opportunity to earn ownership of forfeited property, a significant amount of risk, including financial loss, may be incurred by the lienholder. A general administrative and management problem was that fewer attendees may have been present for past auctions due to unpreparedness and lack of available analytics of the auction process, thereby reducing the amount of funds being recouped by a municipality in the process. The specific management problem was not having a model available to maximize the potential of interest earned or receiving a tax deed at county-level delinquent tax sales. Most of the delinquent tax sales in South Carolina take place between September 1 and December 15 each year, which has restricted the real estate investor from attending all of the tax sales. Creating a model based on county-specific data would assist the investor in determining which auctions to attend based on their goals and be more proficient in attaining their objectives with an understanding of what variables are significant predictors of economic value.

Purpose of the Study

The purpose of this quantitative, nonexperimental, explanatory correlational study was to develop an optimum model to be used by delinquent tax sale attendees, which would have resulted in an increased interest rate of return to the lienholder, increased the likelihood of receiving a tax deed, or both. The study utilized information from

government secondary data sources garnered via county tax rolls. Public records from 2017 via Florence County Delinquent Tax office were the basis for data collection. The study's design was to obtain all records of properties that were to be part of the 2017 Florence, South Carolina, delinquent tax sale, mobile homes excepted. From these records, 100% of the subset that was part of the actual auction would be evaluated by correlating data, ratios, and trends, in preparation of a model to optimize tax deed acquisition and interest yield via predictive analytics. Data gathered at the Florence County Complex, located in Florence, South Carolina, included direct data gathering for variables such as starting bid, high bid, no-bids, redemption dates, assessed land value, assessed structure value, taxes due in the current year, and taxes due in the previous years. As well, calculations were required to determine the return on investment (ROI), interest earned, the percentage of the bids resulting in receiving a tax title from the auction, and property market value, which represents the actual selling price to a new owner once the high bidder receives the tax deed.

Research Questions and Hypotheses

The problem under study in this research was addressed through the following two research questions and hypotheses using a multiple linear regression model.

Redeemed Properties: Interest Earned by High Bidder (RQ1)

RQ1: Do relationships exist between or among the amount of interest earned for redeemed tax sale properties in Florence County, South Carolina, and the starting bid, highest bid, and time elapsed until the property was redeemed?

H_0: There is no relationship between the independent variables of starting bid (IV_1), highest bid (IV_2), and the time elapsed until the property was redeemed (IV_3) and the dependent variable of the amount of interest earned for redeemed tax sale properties (DV): $\beta_1 = \beta_2 = \beta_3 = 0$.

H_a: At least one of the independent variables of starting bid (IV_1), highest bid (IV_2), and the time elapsed until the property was redeemed (IV_3) are useful in explaining and/or predicting relationships with the amount of interest earned for redeemed tax sale properties (DV). At least one of these inequalities is true: $\beta_1 \neq 0$, $\beta_2 \neq 0$, $\beta_3 \neq 0$.

$H_0$1: There is no relationship between the independent variable of starting bid (IV_1) and the dependent variable of interest earned for redeemed tax sale properties (DV): $\beta_1 = 0$.

H_a1: The independent variable of starting bid (IV_1) is useful in explaining and/or predicting relationships with interest earned for redeemed tax sale properties (DV): $\beta_1 \neq 0$.

$H_0$2: There is no relationship between the independent variable of high bid (IV_2) and the dependent variable of interest earned for redeemed tax sale properties (DV): $\beta_2 = 0$.

H_a2: The independent variable of high bid (IV_2) is useful in explaining and/or predicting relationships with interest earned for redeemed tax sale properties (DV): $\beta_2 \neq 0$.

$H_0$3: There is no relationship between the independent variable of the time elapsed until the property was redeemed (IV_3) and the dependent variable of interest earned for redeemed tax sale properties (DV): $\beta_3 = 0$.

H_a3: The independent variable of the time elapsed until the property was redeemed (IV_3) is useful in explaining and/or predicting relationships with interest earned for redeemed tax sale properties (DV): $\beta_3 \neq 0$.

Nonredeemed Properties: Tax Deed Earned by High Bidder (RQ2)

RQ2: Do relationships exist between or among receiving a tax deed in Florence County, South Carolina, and the highest bid, assessed value, and the market value of sold property by the new owner?

H_0: There is no relationship between the independent variables of high bid (IV_1), assessed value (IV_2), and market value of sold property by the new owner (IV_3) and the dependent variable of receiving a tax deed (DV): $\beta_1 = \beta_2 = \beta_3 = 0$.

H_a: At least one of the independent variables of high bid (IV_1), assessed value (IV_2), and market value of sold property by the new owner (IV_3) are useful in explaining and/or predicting relationships with the receiving a tax deed (DV). At least one of these inequalities is true: $\beta_1 \neq 0$, $\beta_2 \neq 0$, $\beta_3 \neq 0$.

$H_0$1: There is no relationship between the independent variable of high bid (IV_1) and the dependent variable of receiving a tax deed (DV): $\beta_1 = 0$.

H_a1: The independent variable of high bid (IV_1) is useful in explaining and/or predicting relationships with receiving a tax deed (DV): $\beta_1 \neq 0$.

$H_0$2: There is no relationship between the independent variable of assessed value (IV_2) and the dependent variable of receiving a tax deed (DV): $\beta_2 = 0$.

H_a2: The independent variable of assessed value (IV_2) is useful in explaining and/or predicting relationships with receiving a tax deed (DV): $\beta_2 \neq 0$.

$H_0$3: There is no relationship between the independent variable of the market value of sold property by the new owner (IV_3) and the dependent variable of receiving a tax deed (DV): $\beta_3 = 0$.

H_a3: The independent variable of the market value of sold property by the new owner (IV_3) is useful in explaining and/or predicting relationships with receiving a tax deed (DV): $\beta_3 \neq 0$.

Theoretical Foundation

In this study, the theoretical framework chosen was modern management theory, specifically, quantitative theory. The classical era of management gave way to neoclassical management through the works of Taylor with scientific management, Weber with bureaucratic theory, and Fayol with an administrative approach (Yahaya & Haruna, 2018). Seminal work by Fayol in the late 19th and early 20th centuries centered on efficiencies and effectiveness driven by planning, organizing, leading, and controlling (Kongsong et al., 2021). Many of Fayol's pioneering 14 points of management, such as division of work, equity, order, and direction, have been and continue to be embraced by today's leading organizations, whereas others have fallen out of favor, such as authority, discipline, and stability of employee tenure (Parker & Ritson, 2005). The neoclassical management time period from 1930 to 1950 focused less on autocratic leadership

compared to the classical management era, and more on human interaction (Yahaya & Haruna, 2018). Modern management, beginning in the early 1950s, broadened the focus to include more emphasis on the use of technology and information systems (Hamel, 2007; Yahaya & Haruna, 2018). Data from production runs, sampling, quality initiatives, as well as the implementation of lean systems to reduce waste and six-sigma to reduce variability, helped drive the efficiencies and effectiveness using mathematical modeling and predictive analytics. Modern management theory consists of systems theory, contingency theory, and quantitative theory (Luthans, 1973).

Quantitative theory, also known as mathematical theory and classical management theory, affords a precise and unbiased evaluation of decision-making with multiple inputs and variables (Ahlstrom, 2014). I used quantitative theory in this study by collecting numeric data from public records to evaluate potential correlations between data sets and inputs. The resulting data were an extension of game theory, which takes place between multiple bidders during a tax sale. Bidders compete against each other and the choice each bidder makes depends on those of others, as the last participant keeping their bidder number raised will earn the deed to the property after the waiting period has elapsed or interest earned (Marden & Shamma, 2018). Delinquent tax sales have not only been about recouping taxes and fees due but also doing so with high efficiency and speed due to the number of properties presented for auction.

For this study, I used secondary sources in which data from the delinquent tax sale were initially recorded and compiled in a database for evaluation. Initial theorists' work was highly focused on primary data, taking on the role of present-day industrial

engineers by timing how long it takes workers to complete tasks, creating standard processing times, and evaluating defects first-hand. Secondary source data became more prevalent in the 1950s due to the advent of computers and electronic data collection methods (Chow, 1967). Greater quantitative data can be gathered, stored, and retrieved using digital means, yielding a more complete data set to be analyzed compared to historic physical records. These data can be manipulated via descriptive analytics driving results that could not be possible in the same time frame by earlier researchers, practitioners of quantitative theory, as well as decision-makers (Lawton, 2019). Data analytics combined with technology has continued to evolve. Society has been experiencing its 4th industrial revolution referred to as I4.0 (Rilantiana, et al., 2020). Digital connectivity via the Internet of Things (IoT) enables organizations to maximize potential efficiencies throughout their value chain (Rilantiana, et al., 2020). Optimization of environmental sustainability, an organization's business model, labor, systems, operational excellence, management of risk, and customer relationship management being driven by IoT, artificial intelligence (AI), and Big Data are being embraced by forward-thinking organizations (Lardo, et al., 2020; Rabah, 2018).

Not all digital data have been readily available for manipulation using quantitative theory. Specific to this study, multiple inputs were used from different source documents that contain information such as the market price of delinquent tax property sold at auction, starting bid price, final bid price, and the interest earned by the high bidder of a redeemed property, assessed property values, prior years of delinquent taxes, administrative fees, dates of redemption, and dates of when deeds were received by

lienholders. Although these government-held digital data were not restricted, these types of data have been difficult to obtain as access has been controlled by the local municipality. Data sources such as county-level reports from delinquent tax sales have been important tools in trend analysis, decision making, and providing insight into the financial health of organizations as well as the stakeholders that they serve (Gephart, 2007; Short et al., 2010). Using quantitative theory and applications, potential relationships have been explored between the independent and dependent variables. Being quantitative and solely numeric, the results should present a precise, minimally biased representation of the research questions. The secondary source data can further be analyzed to generate mathematical relationships that could provide insight to investors' best use of financial resources to acquire, hold, and/or sell properties that were bid upon (Mainous, & Hueston, 1997).

Outcomes of complex relationships have been best attained by mathematical modeling utilizing logic and large amounts of data (Rana et al., 2016). These results have allowed managers to quickly determine the optimum prioritization of critical tasks and allocation of resources based on quantitative data rather than inclination (Eyisi, 2016). For this study, I conducted a systematic analysis of the data gathered from the Florence County Treasurer's Office specific to delinquent tax sales to evaluate the potential benefit to investors, administrators, and the community. Results were achieved via the use of data modeling, statistics, and visual representations of the population resulting in the identification of key predictors to determine optimum economic value.

Using quantitative methods within modern management theory, the study was justified based upon input variables leading to a mathematical model and numerical outputs. The problem builds upon previous mathematical models and data correlation techniques to maximize constrained resources: money and time (Hamel, 2007). In addition to constrained resources, management theory has also been used to illustrate how to maximize wealth creation by a disciplined unbiased approach, which in turn drives better decision-making ending with increased economic benefits.

Nature of the Study

The nature of this study was quantitative, nonexperimental, and explanatory correlational. Data analysis including descriptive statistics was used to evaluate the data and draw general conclusions. Statistical modeling was performed with IBM's Statistical Package for the Social Sciences (SPSS) Version 28.0.1.0. (142). I used multiple linear regression testing to evaluate whether a relationship exists between the dependent and independent variables associated with redeemed and nonredeemed properties (Riley et al., 2000). Modeling statistics has a direct impact on the practicality of an economic model, particularly if causality was found to exist (Holland, 1986). Secondary data sources were the primary method of data gathering. The source for all data required was available through the Florence County Treasurer's Office. Online access to the resources served was possible for some of the data, but other required material was only available by a physical visit to the Florence County Complex to obtain the source documents. Electronic data for property values, for example, was available via online resources that could be collected via remote means. Other data, such as the initial starting bid at a

delinquent tax sale, was only available through the Florence County Delinquent Tax office and physical tax rolls. There was no statewide database and tax roll repositories vary from county to county within South Carolina. One year of delinquent tax data was expected to be collected from Florence County, South Carolina, with up to 1,000 or more individual records with multiple variables for each property that went to auction (Walsh-Carpenter, personal communication, December 14, 2021). An email was planned and sent to the Florence County treasurer to document their knowledge and consent of the planned research along with the methodology and goals of this study, satisfying Institutional Review Board (IRB) requirements. This was not a formal consent form as all of the data requested were in the public domain.

The design of this study used a correlational approach to assess data from secondary source public records. The quantitative data were evaluated using descriptive statistics with relationships between variables noted in magnitude and effect on the dependent variables. The design was chosen based on its capability to uncover relationships between variables as well as predict future outcomes from past data, particularly when large sample sizes are used. A correlational approach shows specific cause and effect interactions between and among variables while eliminating extraneous variables, which was well-suited for this study (Busenbark et al., 2022).

Dependent and independent variables were formed into two groups. One group was for properties that were redeemed in which the tax deed was not earned by the high bidder, only interest was earned. The other group of dependent and independent variables are associated with properties that are not redeemed. Properties not redeemed are those in

which the owner did not pay past-due taxes and associated fees within 1 year and 1 day of the auction. After the redemption period ended, the title to the real property, called a *tax title* or a *tax deed*, was transferred to all high bidders of properties not redeemed by the original owner. For properties that the high bidder earned interest on, the dependent variable was the interest earned during the redemption period while the independent variables included the initial bid at the tax sale, the highest bid at the tax sale, and the number of days after the completed tax sale the original owner redeemed the property. For properties not redeemed by the owner, the dependent variable was receiving a tax title from a delinquent tax sale while the independent variables included the highest bid at the tax sale, property market value as calculated by the Florence County Tax Assessor, and the actual property market value based on the reselling of the property from the new owner.

Data collection methodology involved the use of data from secondary sources, specifically county government records from Florence County, South Carolina. The records were retained by the Florence County Treasurer's Office in the Florence County Complex in Florence, South Carolina. The Map/Block/Parcel number was used as the primary record identifier for each property auctioned at the tax sale, mobile homes excepted. Data available via internet were searched and retrieved virtually rather than physically visiting the Florence County Complex to review the public records. All other records required a physical review at the Florence County Complex.

Definitions

Definitions of important or frequently used terms in this study are as follows:

Delinquent tax: Annual property tax that has not been paid by the real property owner to the county government. Owners of real property with delinquent tax payments are subject to forfeiture by the county of their property to pay for past-due taxes (Enright, 2020).

Delinquent tax sale: Annual public auction "on the courthouse steps" administered by the country treasurer to collect annual past-due taxes from the property owner taxes (Enright, 2020).

Receiving a tax deed from a delinquent tax sale: Dependent variable. Awarded to the highest bidder during the previous year's delinquent tax sale, whereby a year and a day had passed since the completion of the auction with the property not being redeemed by the original property owner (Bartell, 2019).

Florence County Complex: The location where all delinquent tax sales are held for Florence County, South Carolina, 180 N. Irby Street, Florence, South Carolina 29501 ("Florence County," n.d.).

Florence County Treasurer: The county government employee responsible for the delinquent tax process, sale, collection of funds, and awarding of deeds to the highest bidder for the real property auctioned ("Florence County," n.d.).

High bidder: The bidder (person or company) who was willing to pay the highest amount for the property being offered. Being the high bidder does not guarantee a tax deed will be received, as the property can be redeemed by the original owner of the property by paying the past-due taxes and associated penalties (South Carolina Code of Laws, Title 12, Taxation, n.d.).

Highest bid at tax sale: Dependent variable. The highest amount paid at the Delinquent Tax Sale for the real property being auctioned (South Carolina Code of Laws, Title 12, Taxation, n.d.). This is also known as a final bid.

Initial bid at tax sale: Dependent variable. The initial bid is equal to the current year's taxes, the next year's taxes, and associated fees from penalties. This was the starting point for competitive bidding. Should no bid be offered at this price, the real property was transferred to South Carolina's Forfeited Land Commission for processing. There was no ceiling regarding how high the bids could go for properties that are part of the annual auction (South Carolina Code of Laws, Title 12, Taxation, n.d.). The initial bid is also known as the starting bid.

Interest earned on the tax deed: Dependent variable. The dollar amount earned is based upon the required interest rate established by the State of South Carolina when the property was redeemed. The total dollar amount was a function of the interest rate and the final/highest bid, not to exceed the value of the initial bid (South Carolina Code of Laws, Title 12, Taxation, n.d.).

Interest rate: The amount of interest as a percentage of the highest bid, not to exceed the starting bid, set by the State of South Carolina. If the property owner redeems the real estate within the redemption window of a year and a day from the date of the auction, the high bidder will receive the money from their winning bid back plus earn 3% of their bid if redeemed during the first 3 months after the delinquent tax sale, 6% of the bid amount if redeemed in months 4, 5, or 6, 9% of the bid amount if redeemed in months 7, 8, or 9, and 12% if redeemed in months 10, 11, or 12 (South Carolina Code of Laws,

Title 12, Taxation, n.d.). Total interest paid by the Treasurer's office cannot exceed the initial bid price.

Nonredeemed property: When the past-due taxes and fees are not paid by the original property owner and the redemption has expired, the tax deed will be awarded to the high bidder (Fuji, 2020).

Number of months after tax sale owner redeems property: Independent Variable. Used in the calculation of the interest rate which will be awarded to the high bidder in addition to their bid price. The amount of interest paid cannot exceed the initial bid at tax sale value (South Carolina Code of Laws, Title 12, Taxation, n.d.).

Property market value (by Florence County Tax Assessor): Independent Variable: The market value assigned to all real property in Florence County, South Carolina, based upon the Tax Assessor's findings ("Property Tax Payments," n.d.).

Property owner: The owner of the real property that may lose their asset at the tax sale via county foreclosure due to the lack of payment (Atuahene & Berry, 2019).

Real property: Real estate in the form of land, structure(s), or both that was taxable and can be subject to auction at a delinquent tax sale should the annual taxes not be paid by the property owner (Kahrl, 2017a).

Socioeconomic status: The varying degree of the social standing of the actual or possible bidders at a delinquent tax sale (Zuberi & Teixeira, 2021). Abbreviated as SES.

Tax deed: Also known as a tax title. The legal instrument that conveys ownership of real property to the high bidder. This type of deed was a type of limited warranty deed and was not a general warranty deed. The tax deed was considered to have legal defects

and typically cannot be covered by title insurance, thus more difficult to sell by a new owner compared to a general warranty deed (Adams, 2017; Clifford, 2018).

Assumptions

Assumptions are taken to be truthful, but cannot demonstrate validity (Haradhan, 2017). These ideas and beliefs required an understanding before any research was performed. The conclusions drawn from certain cause-and-effect scenarios cannot be verified, so a researcher may assume, with proper justification, that they are valid (Jenson et al., 2013). Given the use of secondary source data collected by government employees in real-time and undergoing accounting checks and audits, the number of assumptions in this study are few.

I must assume that the data being collected from the government employees were accurate. This was a requirement shared by all of the dependent and independent variables. Data in the form of high bids, the person bidding, the initial, starting bid, and the bidder's number, are captured by a Florence County administrative assistant and recorded via computer. Although entry errors may exist, it is likely they would be found by the bidder paying for the property or during an audit of the hard copies of the worksheets used to document the final bid during the sale.

The market value of the properties was assumed to be valid (Dong & Sing, 2016). This was based upon the county tax assessor's judgment on the market value of the real property, although the property was assessed once every 5 years in Florence County unless sold within that time frame. A more accurate assessment would be to evaluate comparable properties that have sold for each property that has been bid on, but this task

would have caused excessive delays due to the time involved in collecting the data as well as being more subjective compared to using the county-employed assessor.

The notification to the real property owners, potential bidders, and auction processes are assumed to have been executed properly. Tax sale procedures may not have been correctly followed by the county when contacting property owners if their property taxes are delinquent, ultimately having the possibility of being sold at auction. Notices sent to property owners from the county must include the taxes that are past-due, penalties associated with late payment, additional assessments as well as any other costs (South Carolina Code of Laws, Title 12, Taxation," n.d.). The notice must also include information regarding the property being advertised and sold to the highest bidder to recover these fees (South Carolina Code of Laws, Title 12, Taxation, n.d.). Potential bidders must be notified of the sale via a local newspaper within the county of the sale for 3 consecutive weeks before the public auction (South Carolina Code of Laws, Title 12, Taxation, n.d.). An argument against using physical or digital newspapers was that fewer newspapers are in circulation and with fewer subscribers, Abernathy (2018) noted that between 2009 and 2018, 600 of the 1,800 newspapers in the United States were no longer in business. This raises the question if newspapers are still the optimum way to communicate the property list to the public. Providing the information via digital means may also alienate bidders that are of lower income should they have no internet access. The auction process itself may vary significantly from county to county within South Carolina, but this was also assumed to be fair and equitable between the bidders. These processes, while assumed to be correct, must go through a verification procedure by the

county attorney for all properties that were not redeemed, before a title to the real estate is provided to the highest bidder (Holsapple, personal communication, December 22, 2021). Given the amount of processing, use of different departments, businesses, and employees, there are many circumstances where the proper process might not be followed. For any properties that did not go through the specified notice, advertising, and auction process, the county treasurer would have canceled the sale, should an abnormality become known.

Scope and Delimitations

The scope of this quantitative, nonexperimental, explanatory correlational study was to develop an optimum model to be used by delinquent tax auction attendees to either increase the probability of receiving a tax deed, maximize the rate of return in the form of interest to the high bidder, or both. Two primary delimitations of the study included using Florence County, South Carolina, as well as tax year 2017 only. Although the delinquent tax sale in Florence County was held in October of 2017, it would take until October 2018 before the redemption period of the real property expired. After the expiration, a tax deed would not confer to the high bidder for several months should the original owner not redeem the property. The tax deed would have been received sometime in 2019, the year before the COVID-19 outbreak. Using delinquent tax sales after 2017, the process would extend into 2020 or later, with COVID-19 possibly skewing the data and relationships. Additional delimitations of the research study included the research questions and the dependent and independent variables. These variables were restricted to Florence County, South Carolina, where the full auction

population was the sample. Assessing the full population of the auction increases validity, particularly when all available records related to the 2017 tax sale were evaluated. Validity could have been increased by sampling additional years as well as additional counties within South Carolina, but this was beyond the scope of this study. The findings from Florence County should be generalizable to similarly-sized counties within the state of South Carolina, bound by the similar economic vitality of the area.

Limitations

Although access to data was somewhat impeded due to its manual nature, the amount of data to be collected for this study could have been modeled much faster if it could have been collected by 100% electronic means and with less data entry errors. Without access to county databases, only one county was of focus, Florence County, South Carolina, rather than additional counties that make up the 46 of South Carolina. The increased manual data entry also caused an undetermined amount of data entry errors. Even with sampling and digital data collection, the amount of data, files, and the time required to travel to each county courthouse to retrieve the information would have been significant. Thus, a smaller sample size of only one county was selected and a goal of reviewing 100% of the properties that were auctioned in the 2017 tax sale was realized. The county treasurer was agreeable to this study, which determined access to the databases. Should the county treasure not have been agreeable, a Freedom of Information Act (FOIA) request would have been initiated. Individual tax records were aggregated, eliminating the need to store personal information that can be traced back to the individual taxpayer. Taxpayer names and delinquent properties owned by them are a

matter of public record, so there was no expectation of privacy during this study. Personal information was not retained, but tax map numbers could have been correlated to individuals or businesses. This limitation of one county, Florence County, may have yielded different results compared to other counties. With the selection of only one state, South Carolina, the results were expected to be different compared to other states, reducing generalizability. South Carolina is a lienholder state, whereas some other states, such as North Carolina, are deed states. In a tax lien state, the property owner cannot sell or finance the property until the lien placed upon the property by the taxing authorities is paid. If the taxes and penalties are not paid after a period of time, the lienholder, who was the high bidder from the tax sale, will assume the deed to the property (Loftis, 2007). A tax deed state is one where no lien is placed on the property and the taxing authorities sell the property outright to the highest bidder (Loftis, 2007).

Significance of the Study

This study was expected to advance the understanding of delinquent tax sales by the general public and investors. The research examined the data, trends, and conclusions drawn from the 2017 delinquent tax sale held in Florence, South Carolina. These data can then be used by participants in the delinquent tax process to prepare and execute a strategy to optimize funds allocated to the tax sale through the realization of financial gain in the short term of less than a year via interest earned or the longer term from obtaining a tax deed.

Significance to Theory

The study resulted in an objective and statistical characterization of redemption rates and deed acquisitions of properties at delinquent tax auctions across time in South Carolina. A correlational approach benefited from the amount of data from secondary sources. The findings of this study helped lead to a dynamic model that prioritizes certain predictor variables within a delinquent tax sale, aiding in decision-management fundamentals as well as practical results for the real estate investor and local communities. From a theoretical perspective, modern management techniques requiring mathematical relationships, formed as a result of this data, eliminated the tendency for guesswork and assumption from the quantitative output (Harwood & Mayer, 2016). From a practical aspect, the county may increase its revenue due to more knowledgeable bidders after this study is in the public domain, whereby the cost to hold such auctions would be reduced, potentially lessening the fees required from the owner to retain the property. Increased knowledge of the auction process should allow a higher number of delinquent taxpayers to retain their property while still providing additional tax dollars (via more bidders) on properties that go to auction. These incremental tax dollars could be reinvested in county projects for the collective good of the communities being served.

Significance to Practice

This study was expected to advance the understanding of delinquent tax sales by the general public and investors. For this research, I examined the data, trends, and conclusions drawn from the 2017 Delinquent Tax Sale held in Florence, South Carolina. Upon completion of the study, data can then be used by participants in the delinquent tax

process to prepare and execute a strategy to optimize funds allocated to the tax sale through the realization of financial gain in the short term of less than 1 year via interest earned or the longer term from obtaining a tax deed. Since the tax laws in all South Carolina counties are identical but may be executed differently, the results of this study should have direct implications for delinquent tax sales in other South Carolina counties besides Florence County (South Carolina Code of Laws, Title 12, Taxation, n.d.). A research requirement was to access different databases at the Florence County Treasurer's Office to retrieve information specific to the 2017 tax sale. Understanding how data were shared and stored at the county level was of interest to the South Carolina Department of Revenue, given their oversight of the 46 counties (Ruple, personal communication, May 27, 2020).

Significance to Social Change

Although the purpose of this study and positive social change may appear to be mutually exclusive as it related to individuals that could potentially benefit, this was not the expected result. The real estate investor seeks profit at the expense of the taxpayer, who has forfeited real property due to nonpayment of taxes, whereas the recipients of positive social change may represent groups of people who have been marginalized in the past. Common ground can be found between the two by expanding the body of knowledge learned from this study to all groups, although the perceived contradiction was significant (Sharma & Good, 2013). The lack of clear change mechanisms to close the gap between the two sides has created another barrier that needed to be overcome (Stephan et al., 2016). A deeper evaluation of the planned research yielded important

information that could be used by those with a lower SES, in which both intrinsic and material rewards can be realized. This was particularly true with the various descriptive statistics that characterized the dataset. With a complete model that represented a change mechanism using interrelationships between key variables at a county delinquent tax sale, individuals without significant monetary resources, such as those with a lower SES, could still invest and earn a return of up to 12% APR in the form of interest on their principal (South Carolina Code of Laws, n.d.). An individual may even take ownership of real estate that could have been used as a home. Initial investments could have been as little as approximately 200 USD. Serving the underserved by explaining how tax sales were and are executed could allow some families to stop paying monthly rent and transition into homeownership. The economic model created should be easy to understand by clearly expressing what variables were the most influential at a delinquent tax sale. With hundreds of properties reaching Florence County's delinquent tax sale each year, there was no issue with the supply of real estate, but sometimes a lack of demand at an auction exists (Dardick, 2020). An example of this is when mobile homes are sold at auction for nonpayment of taxes. Typically, there are fewer than five active bidders at the Florence County, South Carolina, tax sale for mobile homes, reducing overall compensation and reducing the final bid price. Stimulating demand for properties could have been realized by educating bidders on the process, costs, risks, and rewards of tax sale investing, which was described in this study. The education of the bidder was available through the Florence County delinquent tax sale website, but many attendees do not view the information.

A final positive impact on the community was via gentrification (Elder, et al., 2010). Housing that exhibits deferred maintenance over many years will pose safety risks as well as devalue surrounding properties. Vacant property also has a higher tendency for illicit drug use compared to areas that have undergone a restorative process (Kondo et al., 2018). In New Orleans, for example, drug crimes decreased by 6.4% in areas that were remediated (Kondo et al., 2018). Reducing the number of vacant buildings and creating functional greenspace by investors or the government also has a positive impact on the community suffering from urban blight and on 73% of studies evaluated by Sivak et al. (2021), the physical health of area residents was improved. Typical ailments exhibited by residents of an area with a large number of vacant buildings include higher rates of gun violence, pollution, mental stress, and a need for medical services (Sivak et al., 2021). Reducing the number of homes that are not bid on at the tax sale auctions will likely increase the number of homes that will be repaired, repurposed, and ultimately sold, benefiting the community (Alm et al., 2016). A community experiencing gentrification will also incur an increase in property taxes, increasing the burden on the homeowner. This burden should be offset by the increase in the market value of their real property (Ding & Hwang, 2020).

Summary and Transition

For as long as taxes have been paid by owners of real property, governing bodies have struggled with the timely collection of funds from assessed taxes. Auctioning property to the public continues to be a way the government recoups the money owed to them for unpaid taxes. Delinquent tax sales provide an opportunity for the auction

participant to have access to properties at a significant discount to market value as well as be paid interest up to ten times current bank rates within South Carolina. This study intended to fill a gap in bidder's available information on delinquent tax sales by collecting source documents from Florence County, South Carolina, and evaluating relationships that may lead to increasing the odds ratio of successfully receiving a tax deed to real estate, earning interest as a lienholder for up to a year, or both. The literature pertinent to the creation of an economic model based on the results of a past delinquent tax sale to enable investors to maximize their investments was reviewed in Chapter 2 of this quantitative, nonexperimental, explanatory correlational study.

Chapter 2: Literature Review

The purpose of this quantitative, nonexperimental, explanatory correlational study was to develop an optimum model to be used by the delinquent tax auction attendee to yield a higher probability of receiving a tax deed, maximize the rate of return to the lienholder of interest incurred or both. This study required seven core themes to be explored via a literature review: (a) history of government-mandated delinquent property tax collection, (b) auction methods, (c) auction strategies, (d) government revenue from tax sales, (e) statutory requirements of the State of South Carolina for collection of property tax, (f) South Carolina county-specific tax sale procedures, and (g) mathematical modeling.

In South Carolina, should a property not receive an initial bid, it will then be transferred and overseen by the South Carolina Forfeited Land Commission. These properties may be auctioned the next year or prior, but at a higher starting bid due to the additional penalties and tax in addition to the previous amount owed. Since the property did not receive a bid previously, it would be unlikely that a new initial bid would occur in future years as the starting bid that was required continued to increase. State laws charge county-level governments with the collection of past-due property tax payments and allow for high-yielding returns to attract investors to the bidding process (Kahrl, 2017b; Pellegrino & Allocca, 1996). Although the potential returns may be attractive, many investors suffer from a lack of legal knowledge as well as access to data from past auctions to formulate trends and create actionable strategies. Most people who have attended delinquent tax sales have not reviewed the data explaining the process as well as

key metrics regarding how to be successful (Walsh-Carpenter, personal communication, December 14, 2021).

The 2021 Florence County, South Carolina, delinquent tax sale, held on October 4–6, 2021, yielded approximately 50% of the attendees with no previous experience in the tax auction process (Yonce, personal communication, October 5, 2021). Experienced attendees were more knowledgeable about the process but were also time-constrained to physically view each of the 1,000+ properties and mobile homes that were presented at the auction. Each county within the State of South Carolina administers delinquent tax sales differently, abiding by general rules are set by the State of South Carolina (Ruple, personal communication, May 27, 2020). Although Barazandeh (2004) indicated that research was key for the tax lien investor, he did not explain what research needs to be performed nor how the data should be gathered. Loftis (2007) also stated how the investor should perform their due diligence before investing but did not address how the research should be conducted when a large number of properties are being auctioned. Northcott (2014) stated several variables the investor should consider, such as types of risk and properties that have no value, but failed to give examples of how certain data can be researched. Evaluating assessed property values was proposed by Northcott, but there was no discussion on how the information could be retrieved online, such as through the website qPublic.net or via the county's database. Recent journal articles have not addressed the issue of how investors who participate in tax sales can become more educated, what data should be used, and how the data can be generated. Adams (2017) acknowledged that bidders should be aware of the perils associated with tax sale

investing but fails to address how more accurate information can be obtained. Risk can be minimized with a low final bid compared to the starting bid as well as earning interest and not a tax title, but the methodology how to accomplish this was not covered by Adams (2017). Bartell (2019) and Clifford (2018) argued that tax sales should be abolished and did not review the benefits of taking vacant or neglected real estate and having its value increased by investors who see potential from a risk/reward perspective based on market value. Berawi et al. (2018) performed simulations but did not use actual data from auctions to verify their results or use the actual information to examine current and past trends. Dardick (2020) showed how some urban areas have not benefited from tax sales because of the failure to attract a large contingency of bidders.

Most aspects of the delinquent sale process have been well documented in the literature, such as the history of governments' tax collection on real property, efforts to recoup lost revenue from property owners that do not pay property tax, the auction process itself, and individual state statutes, which dictate what reasonable measures states' county treasurers can take to attach liens on delinquent tax properties (Milgrom, 2004). Less documented are the processes regarding counties' implementation of state mandates to recover lost tax revenue, as shown by the wide variation of county-level delinquent tax sale mechanisms within the 46 counties of South Carolina (VanStory, 2015). Since the behavior of taxpayers who have past-due taxes has not been well understood by researchers, limited peer-reviewed sources are available (Miller & Nikaj, 2016). The existence of predictor variables that show relationships in terms of statistical significance to earning a tax deed or interest on a tax deed does not appear in any of the

literature that was reviewed. Building a mathematical model for an investor to either obtain proceeds via interest or a tax deed to the property was not found in the literature, as it relies upon both the tax sale process within each state/county, the delinquent taxpayers themselves, and the key variables within an auction.

Literature Search Strategy

The literature search strategy for this study involved collecting reference material from books, dissertations, federal, state, and county government publications, professional journals, personal interviews with tax attorneys at the South Carolina Department of Revenue, the Florence County, South Carolina, Treasurer, and Florence County, South Carolina, Deputy Treasurer. Most publications were peer reviewed and all of the interviews were within the last 5 years. Several sources are older than 5 years given the historical pretext of government-mandated property tax collection and auction origins, types, and strategies as well as seminal work in the field of modern management. Research on relevant sources for this study yielded a total of 223 references, 151 of which were published between 2017 and 2022, and the remaining sources published from the 1920s through 2016. As shown in Table 1, I used 115 references for the literature review, 71 of which were published within the last 5 years. Peer-reviewed journal articles comprised 80.9% of the references used in the literature review. A moderate number of sources, 9.4% for the final study and 13.9% for the literature review, did not have a publication date listed. These references predominantly came from government websites at the county level, which maintain delinquent tax sale processes and guidance yet do not have revision dates nor individual authors specified.

Table 1

Sources

	Year								
Location	2022	2021	2020	2019	2018	2017	Prior to 2017	No date	Total
Literature review	2	16	14	14	12	13	28	16	115
Full study	8	28	26	34	28	27	51	21	223

Note. Includes five interviews (personal communication) from 2021 and 2020.

Primary electronic databases to obtain these sources included EBSCOhost, Google, Google Scholar, ResearchGate, and ProQuest, predominantly through Walden University's and Coker University's digital libraries. The primary website used for South Carolina State and County policies on alternate procedures for property tax collection, the South Carolina Department of Revenue tax collection methods, the federal tax lien registration act, and forfeited land was the South Carolina Code of Laws Title 12-Taxation. Key search terms included *auction, auction strategy, assessment, debt, deed, delinquent tax, delinquent tax sale, forfeited land, game theory, lien, lienholder, mathematical model, modern management theory, property tax, quantitative management theory, SES financial literacy, South Carolina Tax, tax, taxpayer, tax auction, tax sale, warranty,* and *deed.*

Theoretical Foundation

Chapter 1 briefly introduced quantitative and game theory that relates to the field of this study. Chapter 2 built upon these theories and how they specifically related to the research problem. Using research techniques that are quantitative, nonexperimental, explanatory, and correlational, the theory of modern management and a subset thereof, quantitative theory, were used to determine potential relationships between auction-

related predictor variables and response variables of earning interest or taking possession of a deed to real property within Florence County, South Carolina. Mathematical modeling was the final component of the literature review as it represented the final steps of the analytics associated with the study's auction-related variables.

Quantitative management theory was derived from Fredrick W. Taylor's scientific management theory in the late 1880s (Hamid et al., 2019). Initially focused on labor productivity, it expanded to other aspects of management that were based less on social norms and more on economics and quantitative data (Ahlstrom, 2014). The period between 1856 and 1890 was known as the systematic period of management, giving way to rapidly improving management practices and concepts based on science (Pardaev, 2019). Global events forced the evolution of quantitative management theory to mature rapidly in the early 20th century, as illustrated by the First World War, whereby massive amounts of material were required to be produced, packaged, and shipped from North America to Europe with high efficiency and effectiveness (Ahlstrom, 2014).

Modern management practices, as they are referred to today, took shape at the end of the 19th century through the early 20th century (Pardaev, 2019). Production techniques in industry, standardized processes of labor, and supply chain management became more formalized, using mathematics and technology such as rudimentary mechanical computers followed by analog computers to achieve higher efficiencies such as resource utilization, output, quality, and timeliness (Pardaev, 2019; Rilantiana et al., 2020). A pioneer of data-driven management during the years 1910–1915 was Henry Gantt, the creator of the Gantt chart for project planning, fusing both business and industrialization

(Robles, 2018). Opinions and individual bias often encountered within management continued to be overshadowed by an increase in defined, formal strategies based upon data, which minimized conjuncture and reflected new governance of the modern age within organizations (Harwood & Mayer, 2016). A key advantage of this type of data-driven management included a reduction of bias in decision-making by the converging of quantitative data and relationships generating a high degree of validity. A focus on numeric values can yield trends that may be projected, while statistics from sampling can be used to describe large populations, yielding a deeper understanding of cause-and-effect relationships for business processes.

Management practice and research continued to evolve from the mid-1940s using mathematical modeling and system theory paired with machine control and automation, otherwise known as cybernetics (Pardaev, 2019). This was the beginning of the quantitative methods in managerial science as the era of digital computing became widespread in the 1950s through the present (Pardaev, 2019). The United States government sponsored several large-scale projects during these early years of the Cold War, as a massive amount of computing power and quantitative data were needed (Cortada, 2018). IBM, in particular, was the recipient of large research and development grants, enabling the company to become a long-standing world leader in computing technology and rapid technological advancement with their mainframe computers (Mengxi, 2021).

Many companies in today's workplace have access to "big data" and use it to prove/disprove theories, calculate abstract trends, and drive business strategy (Simsek et

al., 2019). In Davenport and Bean's (2018) survey of companies that utilized big data, 99% of the respondents agreed that they are trying to embrace a data-driven culture, whereas only about one third of the organizations have come to fully realize this initiative. This illustrates how companies can have data available, such as secondary source data from tax sales in this study, but fail to properly examine and process the information to enhance desired results. New business structures must be created for organizations as technology develops to remain competitive (Ferreira, et al., 2020).

Understanding mathematical relationships and statistical analysis of the delinquent tax sale process can give an investor an advantage over auction participants by determining and adjusting realistic goals based on the data available. Basic, nonstatistical information, such as the number of properties that are typically part of a tax sale, the percentage redeemed, how much interest was earned per property, and the amount of no-bids received, represent a first step in creating a model for an in-depth examination of potential relationships, outcome expectations, and efficiency improvement (Kaur et al., 2018). Creating a strategy and optimizing it using data and repetition will allow investors and organizations to use resources more effectively while creating a sustainable competitive advantage relative to peers (Ferreira, et al., 2020). As research and strategy execution become fine-tuned, realistic goal-setting will follow, along with a high probability of achieving stated objectives (Pardaev, 2019).

For delinquent tax sales in Florence County, South Carolina, a significant amount of data exist regarding delinquent tax sales, both quantitative in the form of 1,000 or more records held by the county-level government well as statutes and regulations that

county treasurers must follow during the delinquent tax reconciliation process as required by the State of South Carolina. Using modern management theory to evaluate these data resulted in an understandable model of how specific variables impact the outcome of an auction relative to a higher bidder receiving a tax deed or earning interest of up to 1 year and 1 day, potentially yielding a 12% return on their investment. Tong (2021) demonstrated that senior management of corporations with a low-risk tolerance correlated to an enterprise that lacked innovation. Higher levels of uncertainty and ambiguity drive risk, as illustrated by the financial markets when debt was extended over a period of time, typically demanding higher interest rates due to the increased risk from uncertainty. By analyzing data from delinquent tax sales using modern management theory, ambiguity and uncertainty have been diminished based upon the descriptive statistics and correlations drawn from the models created from the research questions presented.

An outcome of secondary source data being analyzed and summarized combined with a summary of the delinquent tax sale process allows for additional bidders that have a lower tolerance to risk to participate in the delinquent tax sale process for investment purposes with tools to reduce ambiguity. The addition of this investment strategy, particularly for investors of a lower SES, is similar to senior executives becoming less risk-averse and embracing innovation to realize a company's stated goals and enhance profitability based on data-driven processes (Tong, 2021). Developing successful investment strategies typically follows structured process management systems, which increases efficiencies and profitability as the investor becomes more skillful through the repetitive experiences of evaluating data (Pardaev, 2019). Attending tax sales frequently

allows the investor to better understand the auction process and evaluate the success of possible economic outcomes of their strategy from the research and bidding process.

Efficiencies gained via modern management techniques are not just production-related, but also impact financing, scheduling, and new product development (Rilantiana, et al., 2020). Financing is critical to the investor as all properties in which they were the high bidder must be paid on the day of the sale with certified funds. Scheduling is critical as the delinquent property list is only provided 3 weeks before the auction. This results in an investor planning to physically visit a potential investment property across the 800 square miles that make up Florence County, South Carolina, prior to the auction date ("Census of Government," 2018). Having a defined strategy will also ensure that the bidder is in alignment with the goals that they previously set forth or with the organization in which they are employed/represent (Baudry & Chassagnon, 2010).

Although not considered Big Data, a list of 1,583 delinquent properties in Florence County, South Carolina, was initially published for the 2017 tax sale. Of these properties, 740 properties were redeemed by their owner before the sale, which left 843 slated for the October 2-3, 2017 auction. In 2019, the number of properties that were part of the delinquent tax sale in Florence, South Carolina, increased by 47.2% over 2017 based on 1,241 properties having liens at the time of the annual auction (Florence County Delinquent Tax Office, 2019). The State of South Carolina's overall population was approximately 37 times that of Florence County (U.S. Census Bureau, 2021). By extrapolating the number of people who live in Florence compared to the rest of the state, it can be expected that 31,000–46,000 properties are part of South Carolina's tax sales

annually, as Florence County represents approximately 2.7% of the state's population (U.S. Census Bureau, 2021).

This dataset evaluated consisted of 843 tax map numbers, one for each property that was part of the auction, representing a 100% sampling rate of the population's records. A 100% sampling rate was used for the dependent variables of interest earned and acquiring a deed as an investor as well as all independent variables such as the initial starting bid, high bid, redemption period, assessed and actual market value of the property. With South Carolina county auctions occurring annually, the informed bidder should decide, based upon this information, which counties represent the highest value as a function of time and money spent as well as the likelihood of earning interest or a property deed based upon quantitative management theory (Hamel, 2007).

Literature Review

Results from this study will add to these under-researched topics and add to the body of knowledge of current literature. There are several key journal articles and government data that are of critical importance to this study. Secondary source data in the form of a county government publication was the publication of all properties and owners of real estate that would be auctioned off at the county-level tax sale. The 2018 Delinquent Tax Sale Real Property List (Florence County Delinquent Tax Office, 2018), Census of Government (2018), and South Carolina Code of Laws, Title 12, Taxation (n.d.) provided statewide specific guidelines and data as they result in how delinquent tax sales must be administered in South Carolina. Ahlstrom (2014), Pryor and Taneja, S (2010), Hamel (2007), Olum (2004), Rana et al. (2016) defined modern management

concepts and examples of how data can be used to make rational decisions. Alm et al. (2016) and Elder et al. (2010) commented on how there can be an impact on the community based on delinquent tax policies. Cappello (2017) and Harwood and Mayer (2016) described the tradeoff between publicly available data that were used by the government and the lack of privacy it affords to individuals as well as how the data can be best utilized. Chirico et al. (2019), Hereford (2017), and Miller (2012) explained the high government cost of tax sales and how the number of properties auctioned at county-run delinquent tax sales can be reduced. Kahrl (2017a) reviewed techniques of how investors take advantage of tax-stressed properties as well as the property owners before property is lost at tax sale. Kuhnen and Miu (2017) reviewed financial illiteracy as it relates to low SES. Sharma and Good (2013) and Stephan et al. (2016) commented on how for-profit businesses are instrumental in creating positive social change.

History of Government-Mandated Delinquent Property Tax Collection

The earliest form of a formal taxation system dates back 8,000 years to modern-day Iraq (Carlson, 2005). Taxes predominantly applied to land, livestock, and food as farming was the most common profession for thousands of years. It was not until approximately 500 BC that the earliest form of an auction took place (Jiang, 2021). These were not tax-related auctions but instead involved the auctioning of daughters within a family that would become men's wives starting from a high price and proceeding lower, ending when the first bid was received (Wilson, 2019). This type of exchange became known as a Dutch Auction. During the time of the Roman Empire, the first combination of property tax collection mated with an auction became evident (Gutiérrez & Martínez-

Esteller, 2021). The system was different compared to today in that the Roman government held an auction for third parties known as tax farmers or *publicani*, to have the right to collect taxes on property in the Roman provinces (Gutiérrez & Martínez-Esteller, 2021; Jiang, 2021). The result would be that private individuals, given authority from the Roman state would then collect taxes. This outsourcing sometimes led to opportunism, corruption, and collusion between the publicani and the local governors, while Rome took no action as they had already received their money through the bidding process (Jiang, 2021; Morcillo, 2021). A common characteristic that has carried over in the collection of property taxes from Roman times to the present has been the decentralization aspect of the process (King et al., 2019b).

In the United States, each state yields authority to the local municipalities to collect property taxes levied on individuals and organizations. A key difference is that the United States federal government and state government does not benefit from these sales, as the receipts stay within the local counties and parishes. During the Medieval period, the valuation of property became based upon British and European royalty whereby the property tax levied corresponded to the property's annual rental value (Fisher, n.d.) These taxes were used to perform public works, closely resembling today's use of funds such as building roads and creating water systems but with less of a focus on public education.

In colonial times, taxes were not levied evenly throughout the American colony, varying from what would become state to state. Combating issues that consisted of inequality and lack of uniformity, property taxes were initially applied to any assets an individual had (all wealth). This general property tax fell out of favor in the 1800s and

separated the property from overall wealth. During the mid-18th century in the United States, consideration was given to a national property tax, brought about by Alexander Hamilton, but opposed by Thomas Jefferson (Carlson, 2005). The philosophy of Jefferson was established whereby taxpayers would be assessed on the real property they owned, although the assessment could vary widely between assessors and municipalities. Early in the 1900s, The National Tax Association proposed that real property be assessed by trained professionals, ultimately called assessors. They also proposed that different classes of property have different rates, a process that has now become commonplace.

Various rates and classes existed in different forms in each state with little commonality until 1934 when the present-day International Association of Assessing Officers was created. This body had trained and certified assessors in standard assessment methods. Today's homestead exemptions trace their roots to the Great Depression, where property tax delinquency was common. Governments restricted maximum property tax rates and exempted homes that were occupied by their owners. An example of this uniformity was the use of mills or millage rates. This rate corresponds to the tax rate that must be paid by the property owner for every $1,000 of assessed property value.

Assessing properties today does not always entail an actual government employee visiting the site. With the use of GPS, Google Earth, computer-assisted mass appraisal systems, statistics from adjacent properties and recent selling prices, the appraisal of the property can be completed remotely in many instances. Changes to the millage rate due to events such as special referendums and increased public education costs are

commonplace. Different classes of property still exist along with exemptions. Common property use includes owner-occupied, agriculture, commercial, industrial, and non-owner occupied, such as vacation or rental properties.

With a basic infrastructure common across local governments in the United States to assess and levy taxes, enforcing the payment of taxes when they become delinquent still varied considerably between counties and states. Every state has laws that allow governments, typically at the county level, to sell taxpayer real property via a tax lien foreclosure process should the owner not pay their annual taxes as well as their utilities in certain instances (Enright, 2020; Langrehr, 2020). As of 2020, 28 states allow tax liens to be sold to third parties (Enright, 2020). Allen (2017) has noted a surge in property tax delinquency that was central to urban areas that include Baltimore, Cleveland, Detroit, and Philadelphia. Complete abandonment of the properties was commonplace, not simply the owner forgetting to pay the tax or not having the funds to do so. This gives incentives for governments to auction the delinquent tax property to the highest bidder and benefit from any improvements made to the property by the new owner by having increased valuations and higher tax assessments.

South Carolina has been a tax lien state (Miller & Nikaj, 2016). Each county within South Carolina has the mandate to place a lien against the property should the owner fail to pay the full tax. In times of economic hardship for county-level government, the municipality will likely attempt to increase nontax revenue through additional fees, charges, fines, and forfeitures (Park, 2017). Millage rates, expressed in mills, may also increase, indirectly increasing the property taxes on land and buildings, which will lead to

higher levels of property forfeiture. South Carolina was also a legislative state where the power to tax property was at the county level (Ruple, personal communication, May 27, 2020). South Carolina continues to operate under the same state constitution adopted in the 1860s, the post-Civil War period where counties have significant authority regarding property tax assessment, collection, and measures to combat delinquency. This independence at the county level leads to the 46 counties of South Carolina executing their property tax programs differently. There was no central database at the state level that monitors property taxation, and there exists a mistrust between county government and centralized power and authority at the state level (Ruple, personal communication, May 27, 2020). The institutional knowledge at the county and state levels was very high regarding delinquent property taxes and subsequent tax sales due to the lack of standardization and commonality between municipalities (Ruple, personal communication, May 27, 2020). For all counties within South Carolina, after approximately 9-12 months, a tax lien sale was initiated for all delinquent properties. County governments in South Carolina will retain all funds from the tax sale, including the difference between the starting bid (taxes owed) and the final, high bid.

Although it was the responsibility of the taxpayer to pay and the local government to collect property taxes, few states and counties have the necessary safeguards in place to protect individuals in society that have been marginalized, or of lower SES, are elderly, disabled, or ill, representing difficult policymaking for the collection of taxes (Enright, 2020; Miller & Nikaj, 2016). Property tax delinquency has a significant impact on communities (Kahrl, 2017b). In Milwaukee, Wisconsin, for example, municipalities

will receive less revenue from tax levies when taxes go unpaid, and neighborhoods can expect to have home sales prices decrease by $1,085 for every tax delinquent property within 250 meters of the house being sold (Carroll & Goodman, 2017).

Auction Methods

Significant leeway in executing the sale of property exists for each county within South Carolina. Without a specific mandate by the South Carolina state government, county treasurers may use a variety of auction methods to recover taxes that are in default by the owner (Ruple, personal communication, May 27, 2020). The goal of the auction was only to recoup past-due taxes and fees. As long as there was an opening bid equal to or above the fees that are due, the county was guaranteed to recoup past-due taxes and fees. The opening bid was determined by the taxes owed for the previous year, as they are paid in arrears as well as the current year, plus penalties. Starting bids could be very low, less than 200 USD to 10's of thousands of dollars depending on the valuation of the property and the classification such as farmland, residential, commercial, or industrial. Municipalities in South Carolina do not vary the value of the starting bid: rather, it was the summation of the aforementioned values. If the ability to set lower starting bids were available to the municipalities, then more bidders would participate (Bland et al., 2005). Unlike auctions of other physical products, counties in South Carolina do not evaluate the marginal cost of the property directly; instead, their value was based on the tax assessor's estimation relative to market value (Stetter et al., 2020). The property will be "sold" for that amount to the bidder should the property owner not redeem the property after 1 year and 1 day. In all cases, there was a single seller, the county, with multiple bidders in a

live, in-seat experience. Given the impact of the COVID-19 pandemic, it was increasingly likely that future auctions may be held virtually, using Business-to-Business software, known as electronic auctions, or e-auctions (Friedrich & Ignatov, 2019). Not all auction methods are conducive to the sale of property for maximum value, such as Dutch auctions.

Dutch auctions are open descending-bid auctions where the bid is purposely set very high and the auctioneer gradually reduces the price until a bidder accepts the bid (Ganguly & Chakraborty, 2008). Bids are attempted to be maximized by the auctioneers by slowing decreasing the bid, tempting participants to offer the first bid and accepting the stated price, ending the auction. This method was not well suited for tax sales as the county was primarily focused on recouping past-due charges.

Vickrey auctions are not used in South Carolina either. A Vickrey auction maintains anonymity between bidders and was a sealed-bid auction. Bidders submit written bids and the highest bidder wins, but only pays the price of the bid that was second highest (Ganguly & Chakraborty, 2008). Since all tax sales are open to the public, there was no need for sealed bids as it would also add significant processing time.

An absolute auction was not well suited for a tax sale either. While an absolute auction will guarantee that the property will be sold to the highest bidder, there cannot be a reserve price (Ganguly & Chakraborty, 2008). The counties within the State of South Carolina use a modified version of the absolute auction in which there was no reserve but there was a starting minimum bid (taxes and penalties owed for the current and next

year). Whoever bid the highest during the auction will take title to the property, after the redemption time has expired.

An English auction was and is the common type of auction used in South Carolina delinquent tax sales. With a low starting price equal to the taxes and fees due, the price of the property, or lien to be more specific, gradually increases until there was only one bidder left, commanding the highest bid (Ganguly & Chakraborty, 2008). Should no initial bid be received, the property was turned over to the South Carolina Forfeited Land Commission.

Although an English auction was most common, each county may carry out the process differently. For example, in 2018 Horry County's Treasurer started the bidding with a minimum bid and then bidders would bid against each other, unguided, until all bidding had stopped, with the property being awarded to the final bidder. In 2018 and 2019, both Darlington and Florence counties employed professional auctioneers to assist with the process. Florence County utilized a system where all bidders that wanted to bid on property were required to keep their bid numbers up so they could be seen by the auctioneer, and as the price went up, potential buyers simply put their bid numbers down. Once a bidder put their number down, they could not bid on that property anymore. Each property had a typical duration of 20 and 40 seconds, including reading the tax map number, the location of the property, the current owner, the size of the lot or acreage, and the starting bid price. The last bidder to keep their number up was deemed the winner. Darlington County's auctions are held in a similar fashion, an exception being that bidders can bid at any time during the auctioning of a property. The auctioneer would

only read the current owner, tax map number, and the size of the lot on occasion. Most properties were auctioned off in about 15-30 seconds. Since a sale was guaranteed once the starting bid was met, the participation rate among potential buyers was increased (Ganguly & Chakraborty, 2008).

Auctions in Florence and Darlington Counties of South Carolina employ professional auctioneers to facilitate the sale of a property at the annual tax sale. Other counties, such as Horry, use county employees to facilitate the process and require bidders to bid against each other, which adds confusion and delays to the event. None of the counties in South Carolina conduct the tax sale completely online, with the aforementioned counties requiring bidders to be present or have a proxy to bid on their behalf.

The use of digital technology was extremely limited at the actual auction itself. It was apparent that the delinquent tax process has not kept up with existing technological breakthroughs and was still conducted in much the same way it has been done for centuries (Milgrom, 2019). Embracing technology may also reduce the burdens on the administrators of the tax sales and help meet the state's requirements for due process (Inman, 2017). Online auctions have never been used in Florence County, Horry County, and Darlington County, which was typical of the other 43 counties in South Carolina. In the early 2000s auctions were projected to represent 30% of all e-commerce (Vakrat & Seidmann, 2000). The reluctance for municipalities to have their auctions in the digital space may be due to lack of technology, lack of equipment, initial cost, and a preference for the local community to partake in the sale rather than individuals from outside of the

area. Due to COVID-19, many general auctions outside of delinquent tax sales have been required to move from a live in-seat experience to digital. Companies such as eBay and HiBID.com were well prepared as their operations were focused on the digital space. Auction houses Christie's, Sotheby's, and Phillips saw their aggregate revenue decline by 79% from Q2 2019 to Q2 2020 (Bourron, 2021). Using large auction houses as an example of organizations that pivoted well in the face of COVID-19, these companies grew their revenue from online auctions from $126 million in 2019 to over $1 billion, representing over a seven-fold increase in sales (Bourron, 2021). In Q1 2017, only 4% of auctions from auction houses Christie's, Sotheby's, and Phillips were 100% online(Bourron, 2021). This moved to 74% 3 years later in Q1 2020 (Bourron, 2021). County governments did not react with as much urgency as corporations. During the 2020 COVID-19 pandemic, some counties opted to still hold the auctions with safeguards outlined by the Center for Disease Control (CDC) in place while others opted to cancel the auction for that year and have all properties carried over to 2021 instead. The 2020 Florence County Tax Sale was canceled due to the pandemic while Darlington County, South Carolina, for example, held its tax sale in the Darlington Middle School in December of 2020, but with a facemask requirement, limited seating due to increased spacing, and only allowing registered bidders to enter. In October 2021, the Florence County Tax Sale proceeded over the course of 3 days in the parking lot of the City Complex in Florence, South Carolina while Darlington County once again held its tax sale in the Darlington Middle School auditorium, without increased spacing and allowing individuals to enter that were not registered to bid. While large auction companies such

as Sotheby's started efforts as early as 1999 to enter the online marketplace via a partnership with Amazon that did not materialize, counties within South Carolina have yet to embrace online auction alternatives (Bourron, 2021).

Auction Strategies

Auction strategies employed by the bidders at an auction are dependent upon the goals each potential buyer was attempting to realize. Strategies specific to English auctions are most important as this was the type of auction that each county in South Carolina uses for the tax sale. Jiang (2021) noted that the three most common strategies for bidders participating in an English auction include "(a) personal valuation, (b) prior assessment of rival valuations, and (c) new information obtained from the bidding process." Bidders/buyers that are investors will be focused on a positive return based on the capital used, a form of personal valuation. These bidders may wish to earn interest payable in increments of up to 3%, 6%, 9%, and 12% if redeemed in the first, second, third, or fourth quarter after the delinquent tax sale, respectively (South Carolina Code of Laws, Title 12, Taxation, n.d.). This goal would require the property to be redeemed by the property owner within 1 year and 1 day after the sale takes place. Care would need to be taken by this type of investor to not bid so high as the target payout could not be realized, as the maximum interest paid by the County will only be up to the dollar amount of the initial bid, regardless of the magnitude of the final bid on the property (South Carolina Code of Laws, Title 12, Taxation, n.d.). The other type of investor/bidder has a more speculative approach, in which their bidding strategy was based upon the property owner not redeeming the property. This approach involves a longer-term investment

where interest earned was not the focus, thus the bidder hopes that the property was not redeemed, and the investor can take the title to the property. Should the title be received, after 1 year and 1 day, (South Carolina Code of Laws, Title 12, Taxation, n.d.), the bidder will hold a Tax Title for the real estate which can be kept for personal use or resold. The payback for reselling the real estate could be an order of magnitude higher than the purchase price, or more.

Some bidders have a strong aversion to loss, which drives their strategy in not bidding above the maximum interest payout (Foster, 2020). Bidders with this type of strategy will understand that 12% of the maximum price of the final bid must be equal to or less than the initial starting bid, which also reflects the maximum payout if redeemed. For English auctions, such as the delinquent tax sales in South Carolina, a very strong starting bid in the form of jump bidding to a higher value signals strength and intimidation to other participants, increasing the odds of obtaining the property for the initial bidder (Sønstebø et al., 2021). Auction attendees who have researched the delinquent properties, reviewed the county-specific tax sale process, have frequented tax sale auctions previously, and demonstrated an understanding of behavioral economics will have an advantage over their peers given the reduction in uncertainty (Morcillo, 2021). The prepared investor that attends a tax sale will demonstrate an increased likelihood of realizing their goals (Morcillo, 2021). Other bidders, who are willing to accept a loss if the bid was higher should the property be redeemed are more speculative. These bidders are focused on acquiring the property, planning that it was not redeemed.

Occasionally bidders in this environment will incorporate jump bidding, whereby a bidder surpasses the current bid by more than one increment. This will signal to other bidders they are prepared to pay a higher premium and that bidders may also wish to speed up the auction (Dodonova & Khoroshilov, 2019). Jump bidding has been shown to reduce the number of active bidders (Hungria-Gunnelin, 2018). While signaling a higher bid premium reduces competition, the bidder also may overpay depending on how early in the process they perform a jump bid (Dodonova & Khoroshilov, 2019). Jump bidding was positively correlated to winning an auction (Sommervoll, 2020). The duration of each parcel of real estate being auctioned was not an issue, taking 20 and 30 seconds from the start of the process to the acceptance of the highest bid, depending on the county's auction rules, the number of bidders, and the number of bids. The duration of and between properties at auction during the tax sale was short, leading to the auction progressing rapidly. Hungria-Gunnelin (2018) noted that auctions that move quickly have been positively correlated to an increase in the number of bidders as well as a higher selling price due to what was known as "auction fever."

Bidders may also find themselves bidding higher than the actual market value of the property. McGee and Levin (2019) showed that the satisfaction of winning may supersede the higher economic cost being incurred by the buyer. This strategy, if repeated, also signals to competitors that the bidder will bid as high as it takes to be the winner, with the bidder anticipating that their competition will drop out earlier, thus winning the property at a lower price if this strategy was employed (McGee & Levin, 2019). After successive wins by overbidding, users of this strategy may feel that they will

have a net economic gain over their rivals as the auction continues, but the variation in the drop out prices and perceived value of the product being auctioned has shown not to be significant (McGee & Levin, 2019). As the venues of auctions move to accommodate remote bidders via digital means, strategies when participating in online auctions can be different compared to in-seat auctions. For example, body language cannot be determined, bid jumping cannot be shouted out by participants, and the number of active bidders may not be readily determined.

Government Revenue From Tax Sales

During the times of the Roman Empire, tax revenue accounted for about 22% of the overall government budget from 200 to 157 BC (Gutiérrez & Martínez-Esteller, 2021). For the next 300 years, Roman citizens did not have to pay taxes as the expansion of the Roman Empire was so great and profitable, collections from foreign lands were all that was required by the government (Gutiérrez & Martínez-Esteller, 2021). In modern times, such as in the early 1900s, property taxes supplied 45% of the general revenue of state governments' operating budgets (Fisher, n.d.). By the end of the century, property taxes collected by the United States were down to less than 2%. County and local level local governments charged with the levying, collection, and spending of these funds have increased their dependency on these funds up to 85.2% in 1932 down to 44.6% in 1999 (Fisher, n.d.). In 2016, the percentage of own-source revenue further dropped to 1% for states that collected property taxes at the state level with 14 not collecting any taxes (Tax Policy Center, n.d.).

Operating budgets for county governments have become less dependent upon local taxation because the federal government has taken over more local/county functions and has also increased its aid to these municipalities. In 2016, local governments received $487 billion from levies made in the form of property tax (Tax Policy Center, n.d.). This equates to about 50% of the general revenue that they raise, not including aid from the federal government. The percentage of own-source revenue can vary significantly from state to state. Combined state and local tax dependency were highest in New Hampshire, with a total of 47% (Tax Policy Center, n.d.). At the local level, New England states had more than 75% of their own-source revenue from property taxes with Alabama being the lowest with 19% in 2016 (Tax Policy Center, n.d.). Property tax rates vary widely from state to state depending on how the property was assessed. The highest and best use of a property could cause the taxes to be significantly higher for a parcel of vacant farmland, whereas some governments could allow it to be zoned agriculture. The difference could vary from a few dollars per acre in tax to $10,000's in assessment. Differences in residential homes exist as well. Upon purchasing a home in California, the tax does not increase for as long as the owner stays there, in certain counties. California tax rates are limited to an increase of 1% annually ("Proposition 13 and Real Property Assessments," n.d.). New homeowners in California can expect to pay significantly more in property taxes compared to previous owners who may have held the property for many years. This creates an additional burden on the new homeowner and increases the likelihood of failure to pay the taxes after the property was first acquired (Tax Policy Center, n.d.).

Changes in housing values do not significantly change the property tax collected by municipalities (Chirico et al., 2019; Goodman, 2018). Many states have reassessment rules that will only value property every 5 years (or similar). A lag of increase or decrease in revenue will therefore be present, even if the market value of a property changes significantly up or down (Goodman, 2018). Should there be a large change in property values over time, the millage rates would be adjusted proportionally higher or lower to make up for the shortfall, or to reduce the amount collected to balance the municipalities' budgets.

Property taxes remain a significant source of revenue at the county level. Local Government in Massachusetts, for example, collected an excess of $56 million above what was owed for real property taxes for more than they are owed in delinquent taxes per year over the last decade, resulting in over $42 for every delinquent tax dollar (Enright, 2020). Competitive bidding helps drive these profits higher for municipalities (Wu, 2020). Without such funds, emergency services, and education systems could not operate. Government must forecast the revenue received from all taxes levied on the population they serve, but forecasting revenue from a tax sale was particularly problematic given the variability in the property being auctioned as well as the number and quality of bidders. With some type of model for this revenue, the maximum potential for developmental projects cannot be realized (Streimikiene et al., 2018). A tax auction not only recovers taxes that are expected to be paid but also represents a significant amount of indirect taxes collected as the county will retain the full amount of a high bid on the property that was not redeemed, even if it was far more than the taxes owed

(Streimikiene et al., 2018). Examples of revenue generated at tax sales by Florence County, South Carolina, can be illustrated by two cases from the 2019 Florence, South Carolina County tax sale held on October 7th and 8th, 2019, at the City Complex in Florence, South Carolina. The first example was one lot without any structures, located in a planned development in which the developer went bankrupt. The parcel, Florence County tax map number (Map-Block-Parcel), 00046-03-145, went to the highest bidder for a total price of $392.00, which was equal to the 2018 taxes and penalties that were not paid ($209.34), the pending 2019 taxes ($121.70), and a Land Mortgage Search ($60.00) before the auction. The assessed market value of the parcel was $6,550.00. Since Florence County recovered the taxes that were due plus the administrative cost associated with forfeiture of the property, this revenue would be in line with forecasts and expectations, without a significant surplus.

The second example demonstrates when Florence County did earn significant funds during the delinquent tax process. The property, approximately 30 acres of farmland with a building present, just outside the City of Florence, Florence County tax map number (Map-Block-Parcel), 00127-01-026, went to the highest bidder for a total price of $12,000.00, above the starting bid by $10,197. The starting bid was equal to the 2018 taxes and penalties that were not paid ($963.24), the pending 2019 taxes ($779.37), and a Land Mortgage Search ($60.00) before the auction totaling approximately $1,803, which was the starting bid. The assessed market value of the property was approximately $63,019. Thus, Florence County realized and retained approximately 6.7 times the

starting bid of the property while the high bidder paid about 19 cents on the dollar for the real estate, compared to the assessed market value, and earned a tax deed.

A third example of the amount of funds the Florence County government can generate as well as the benefit to the investor can be shown via my experience in the 2017 Florence County Delinquent Tax Sale. On Monday, October 3, 2016, Bill Yonce Auctioneers, acting as an agent for the Florence County, South Carolina, Treasurer Dean Fowler, executed the tax sale of tax map number 00107-01-006. This 16.79-acre parcel of vacant land located on Pygatt Road, Effingham, Florence County, South Carolina, was taxed at a value of $54.56. The $54.56 bill was sent to the property owners on 19 September 2015 to be paid by the first week of January 2016. This bill remained unpaid and was subjected to the following taxes, credits, and fees: county tax of $61.87, county property tax credit of $7.55, tax penalty of $8.15, administrative costs of $160.00, auction fee of $25.00 for a total of $222.47 total tax due and $247.47 with the auction fee. The starting bid price was $302.03 to cover the taxes from 2015 and 2016. I was high bid on this property with a final bid price of $3,800.00. The property was not redeemed by the owner during the one-year and one-day redemption period. On April 19, 2018, a Tax Title to Real Estate was fully executed to Argent Noir, LLC, my company (“Florence County Recording Page,” n.d.). This tax title was not a marketable title, such as a General Warranty Deed, and poses issues when attempting to sell the property should a mortgage be required (Caraway, 2018). The gain to Florence County, South Carolina, was $3,497.97 ($3,800.00 - $302.03), representing a price that was 12.6 times the amount owed when penalties, fees, and additional costs are included. For the 2015 and 2016 tax

years where taxes totaled $109.12 ($54.67 + $54.67), the resulting premium over the actual taxes owed was $3,690.88, representing 38.8 times the actual taxes that were owed for these years. This same property was sold for $65,000 in December 2021 by me to a private party. Due to the large profits involved by government and private investors, critics of the delinquent tax sale process feel that marginalized people such as the elderly, unfamiliar with legal proceedings, disabled, or of a low SES are at high risk of having their home or other real property forcibly and legally taken from them (Enright, 2020). A fair question was why the municipalities receive the additional funds over what was actually due to them from the taxed property compared to having the original owner receive the proceeds since they were the actual owners of the real estate. Delinquent tax sales have been shown to raise significantly more money for county governments than the fees that impact the municipalities such as increased costs to notify property owners they are past-due, penalties, interest paid on the outstanding balance, and the administrative and legal aspects of transferring the tax deed (Miller & Nikaj, 2016).

Such revenue was critical to South Carolina as a whole. The State, for example, uses approximately 46% of all county-levied property taxes for education (Property Taxes, n.d.). Sternlieb and Lake (1976) examined urban areas during the mid-1970 and the significant amount of lost revenue to local operation budgets due to the failure of property owners to make payments. In 1974 alone, New York City, New York lost $191.3 million in uncollected taxes while Pittsburgh, Pennsylvania was forced to seize 11,000 parcels to recoup delinquent tax (Sternlieb & Lake, 1976). The process of acquiring property due to lack of owner payment was costly to many urban governments,

as well as the disposal of the properties. Some counties are not well suited to sell these properties as their administrative functions are not properly set up to do so (Sternlieb & Lake, 1976). The purpose of county-level tax sales is to recoup property taxes owed by the owner. Government administrators are in a unique position compared to private companies to only recover the reserve value, which was the starting bid reflecting the property taxes, fees, and penalties owed. Administrators do not focus on maximizing the total dollar amount, although all funds above the initial bid are retained by the county. Country Treasurers only want to recover what was owed (Holsapple, personal communication, June 3, 2022).

South Carolina Statutory Requirements for Collection of Property Tax

Taxation legal requirements are specified in South Carolina across 41 chapters with seven of these applying to delinquent tax collection and sales (South Carolina Code of Laws, Title 12, Taxation, n.d.). While these chapters are clear in what was required by the State of South Carolina, they provide considerable flexibility in how the delinquent tax process was carried out within each county by the County Treasurer or Deputy Treasurer in charge of the annual delinquent tax sale. This flexibility for each South Carolina County increases the ambiguity of the tax sale and process for participants given the variation in execution between counties. An example of this was Chapter 54 of the South Carolina Code of Laws, Title 12, Taxation (n.d.), titled “Uniform method of Collection and Enforcement of Taxes Levied and Assessed by South Carolina Department of Revenue.” This statute provides 28 pages of rules that must be followed by each county in the administration of the collection of delinquent taxes, but there was a

significant lack of dates and penalty values in United States Dollars. As Fox (2019) noted, laypeople who do not have an understanding of legal verbiage struggle with their interpretation and are more likely to follow guidance from perceived experts. It was unlikely that individuals that wish to participate in delinquent tax sales as an investment vehicle will review and comprehend the entire statutory requirements surrounding the delinquent tax process given the scope and the technical wording. This study can offer a summary of actual results which possible tax sale participants can review and decide if this type of potential investment was worthy of their consideration. Chapters relating to the delinquent tax process in South Carolina are found in the document South Carolina Code of Laws, Title 12, Taxation, (n.d.) and are summarized here:

- Chapter 51 - Alternate Procedure for Collection of Property Taxes
- Chapter 53 - Tax Collection by Department of Revenue
- Chapter 54 - Uniform Method of Collection and Enforcement of Taxes Levied and Assessed by South Carolina Department of Revenue
- Chapter 55 - Overdue Tax Debt Collection Act
- Chapter 56 - Setoff Debt Collection Act
- Chapter 57 - Uniform Federal Tax Lien Registration Act
- Chapter 58 - South Carolina Taxpayers' Bill of Rights
- Chapter 59 - Forfeited Lands

The focus on legal jargon and specificity can be considered problematic for laypeople who are not accustomed to this writing style. To offer a detailed yet easier-to-understand overview and explanation of South Carolina property taxes, VanStory (2015)

compiled a document through the South Carolina Department of Revenue that focused on property taxes which includes definitions and citations, classification and valuation of property, assessment procedures, assessment practices by taxpayers, the appeal of tax assessment, exemption from taxation, and other analysis. In my interview with VanStory (VanStory, personal communication, May 17, 2020), she noted that the State of South Carolina lacks depth and clarity regarding delinquent tax sale procedures, both pre-and post-auction. Further, VanStory has invited me to possibly assist with the creation of a section in the next South Carolina Property Tax overview document to better meet the needs of potential bidders, as well as add insight to avert properties ultimately becoming delinquent and sold to the highest bidder, upon completion and university acceptance of this study. Where there was a wealth of information on property taxes such as types of property that are taxable, valuation methods, and recourse to taxpayers via the appeal procedure, there was not a single mention of the "delinquent" or "property sale" within this work. While not a gap in academic literature, this example does show a gap in government data which hinders potential investors as well as property owners due to a potential lack of understanding of the delinquent tax sale process. Government data that was difficult to analyze on a large scale include the likelihood of receiving a tax deed, property redemption by the owner, final high bid price, and how average interest earned can affect an economic value model maximizing overall investment return relative to the goals of the bidder. Specific insight for each South Carolina county on how their real property assessment, auditing, and delinquent tax collection processes are conducted can

be gained by contacting the relevant officials via their mailing address, email, and phone number, as noted by VanStory (2015).

South Carolina County Specific Tax Sale Procedures

All counties in South Carolina are mandated by state law to have real property taxes due between 13 September and 15 January every year (South Carolina Code of Laws, Title 12, Taxation, n.d.). While specific protocols from the South Carolina government dictate due process for the collection of past-due taxes, such as requirements for public advertising of property that will be sold, fees for advertising, and interest earned on the property for the high bidder if not redeemed, each county has significant flexibility on how and when the tax sale auctions take place. The use of technology, a foundation within modern management theory, varies from county to county. Innovations and advances in technology do not always enable managers, investors, or communities to advance as sometimes the technology, while available, was not learned or used by the responsible parties (Alshammari, 2020). Florence County, South Carolina, for example, provides web-based digital tools such as GIS visualization via qPublic.net, property cards, tax assessor's records, clerk of court records, Google Streetview, and Pictometry. Other digital means such as using Zillow, Realtor.com, or Trulia can yield the last sales date and price, if the property was on the market, and potentially a description of the property. Unfortunately, those that do not know how to access these tools or cannot access them due to a lack of a smartphone, tablet, or computer, are at a significant disadvantage compared to other auction attendees due to the lack of data being reviewed. All states, including South Carolina, have statutory rights of redemption which end with

the property being retained by the owner, or the passage of a specific amount of time, as noted in each state's laws (Langrehr, 2020). Some states, such as Oklahoma, require that municipalities must follow up with a second communication to the delinquent property owner if the government was aware that the original notice did not reach them, but the sale of the property was still valid even if the notice was not received by the property owner (Inman, 2017).

South Carolina counties have flexibility in when they hold the tax sales, the venue of the tax sale, how the actual sale of properties was conducted, and the types of funds required as payment. Each county in South Carolina operates some type of competitive bidding scenario for its tax sales. From 2009-2019 the number of competitive bids received for municipal securities has increased from 4.4 to 5.7, a 29.5% increase (Wu, 2020). Having a higher number of bids per sale increases profit margin, which was likely to occur in tax sales given the similarities of the bidding process (Wu, 2020). For most counties in South Carolina, the timing of the tax sale was the first Monday of October, November, or December of the year that property taxes are due, following a deadline of when taxes were due and payable: January 15 of the assessment year. Although attendance to tax sales has been seen to be increasing over the last decade, as shown by the number of recorded bidders, the location of most auctions takes place in a municipal complex or local community and performing arts centers. Government offices are city-county complexes, courthouses, magistrate's buildings, or similar county-level buildings. The actual process of the auction varies from county to county. Certain counties require pre-registration of bidders up until the last business day before the auction, the day of the

auction, or only registration on the day of the auction. Certain counties will employ a professional auctioneer to speed the process of the auction, others will only state the starting bid and allow bidders to bid against each other without any set increments. The description of the property being auctioned will always include the tax map number as well as the current owner. Additionally, the address of the property may be given along with the acreage as well as the number of lots and permanent structures on the property. Most auctions require the high bidder to pay in full with certified funds that include cash, cashier's checks, certified funds, or money order. No personal or business checks are allowed. Funds are payable on the same day of the auction. Penalties that exist for nonpayment are equal to 500 USD per tax map number for Florence County. For 2019, examples of county-specific requirements during the delinquent tax sale process are as follows:

- Barnwell County, South Carolina: Date of sale and location not specified on the county website (Barnwell County, n.d.).
- Charleston County, South Carolina: Date of sale was 2nd. Monday of December, North Charleston Coliseum (Charleston County, n.d.)
- Chester County, South Carolina: Date of sale and location not specified on the county website (Chester County, n.d.)
- Chesterfield County, South Carolina: Date of sale and location not specified on the county website (Chesterfield County, n.d.)
- Clarendon County, South Carolina: Date of sale and location not specified on the county website (Clarendon County, n.d.).

- Darlington County, South Carolina: Date of sale was 2nd. Monday of December, Darlington County Courthouse Courtroom, professional auctioneer (Darlington County, n.d.).
- Florence County, South Carolina: Date of sale was 1st. Monday of October, Florence County Complex, professional auctioneer (Florence County, n.d.).
- Greenville County, South Carolina: Date of sale not specified on the county website. The location of the sale was the Greenville County Council Chamber (Greenville County ,"n.d.)
- Horry County, South Carolina: Date of sale was 1st. Monday of December, Horry County Governmental and Judicial Center, bidders bid against each other without professional facilitation (Horry County, n.d.).
- McCormick County, South Carolina: Date of sale was 1st. Monday of October. The location of the sale was not given on the county website (McCormick County, n.d.).
- Pickens County, South Carolina: Date of sale was 3rd. Tuesday of November, Pickens County Performing Arts Center (Pickens County, n.d.)
- Richland County, South Carolina: Date of sale was 2nd. Monday of December, Township Auditorium (Richland County, n.d.)
- Sumter County, South Carolina: Date of sale was 1st. Monday of November, Sumter County Council Chambers in the Administration Building (Sumter County, n.d.).

Mathematical Modeling

Two mathematical models will be developed, focusing on the outcomes of the tax sale: Properties that are redeemed along with the corresponding interest rates earned and those that are not redeemed. For properties that are redeemed, average income earned will be evaluated based on starting bid, highest bid, and when the property was redeemed by the original owner. For properties that are not redeemed, the predicted profitability will be evaluated based on market value, and final bid price. The models being generated within this study focus on the highest bidder as well as the original property owner, should they redeem the property or not. Considerations not included in the model consist of the county government's internal data of how often the property owner was contacted after the auction, county website hits, and spending on advertising (Simchi-Levi & Wu, 2018).

The top factors assumed to influence the outcome of auctions will be focused on, but these should only be considered assumptions until they are tested for statistical significance (Cheng, 2020). When bidders show up to an auction they do not plan on bidding on all offerings; rather, they typically will be focused on a small subset that was of interest (Hendricks & Sorensen, 2018). While the reason behind each bidder being present at a tax sale may vary from investment purposes, reclamation of family land, purchasing of nearby property, to pure entertainment, most are considered to be investors who put in some amount of due diligence for capital appreciation and speculation (Campbell-White, 2021). By understanding a mathematical model for interest earned for a property redeemed or the overall profit of a property that was not redeemed (through

resale, rent, or land use value), the predictors can be analyzed, characterized, and examined (Cheng, 2020). Modern management's focus on effectiveness via quantitative data was easily overlooked by first-time or even experienced auction attendees, as not all of the costs associated with the acquisition of a property deed may be realized, nor the fact the tax deed and not a general warranty deed (Gold et al., 2001). A result will be less economic benefit to the high bidder that earns a tax deed as the property will be valued less than similarly assessed properties that do not have a defect associated with the deed. Researchers within the retail industry study data, analytics, and automation to provide insight into how the consumer places value on different items (Simchi-Levi & Wu, 2018). Bidders use similar methods to calculate the economic value of a property, although the emotional aspect of property was harder to quantify. An acquisition premium might be incurred by the high bidder because of a sentimental issue with a property, such as having a deceased family member previously owning it. In other cases, an investor may pay closer to or above market value because of the property's proximity to current operations by a business operated by the investor. The type of property may influence the investor. Commercial real estate has a significantly different profit model compared to residential real estate (Yin, 2017). The type of real property is not described at the time of the auction, requiring the investor to retrieve information specific to the property in advance. Determining the type of property can be done by entering the Florence County, South Carolina website, entering a taxes inquiry, and then viewing the property card supported by the Florence County Tax Assessor which provides the assessment information and value, owner, addresses, and land class. The land class

designates the type of property such as farm, residential, industrial, commercial, improved, and/or vacant. Data can be gathered on properties that will be auctioned via county websites, in the courthouse, physically inspecting the property as well as using computer applications that include Google Earth. Once an investor has available data as well as the list of properties to be auctioned, an analytical examination can take place based on market value, maximum interest earned, location, and other relevant factors. The maximum interest rate earned cannot be larger than the original starting bid in the State of South Carolina, regardless of the final bid price and when the property was redeemed. The process of evaluating and analyzing the data could be automated via calculations in software such as Excel or more advanced computing algorithms, based on the desired outcomes of the investor. Instituting an economic-mathematical model could give the investor a competitive advantage over the competition at the auctions (Kurakova & Khomyak, 2016).

Game theory can be used to help predict the actions of one's opponents (Kurakova & Khomyak, 2016). Mathematical models and calculations combined with logic can yield a viable strategy for auctions (Chen, 2022). Auctions, in general, are competitive where bidders are forbidden to collude. Delinquent tax sales include a significant amount of incomplete information unless the bidder has physically visited each possible location and completed thorough research about the property to be sold at auction. Ambiguity and noncooperation are key aspects of game theory (Morcillo, 2021).

An important part of game theory was to understand the basis of why participants behave how they do based on the strategies they have adopted (Kurakova & Khomyak,

2016). All auctions are a type of game in which participants that have viable strategies mated with information about the auction process and property being bid on are more likely to benefit economically (Josheski & Karamazova, 2021). The benefits that lead to successful auctions are grounded in the three fundamentals of game theory consisting of the bidders, the economic or personal value of the property, and the strategies employed by the participants (Lin, 2022). These benefits are not just monetary in the form of interest earned from a redeemed property or the proceeds from the sale of property in which a deed was earned, while the prepared bidder will also limit their overall spending on properties that have the desired ROI.

The creation of a model and the resulting analysis will provide insight into the behavior of the high bidders, leading to strategies that may maximize overall returns, either from interest or taking possession of property. The resulting relationships and regression model will be used to investigate primary factors that impact high bid values for properties that are redeemed as well as not redeemed (Berawi et al., 2018). A more detailed account that could be used for a regression analysis would be to evaluate the unique characteristics specific to each property. This would include the type, quality, number of structures, condition of the property, access to paved roads, availability of utilities, and a host of other subjective attributes (Berawi et al., 2018). These characteristics are summed up in the Market Value calculation, as determined by the county assessor and made available to the public via county records located at each county's courthouse. The records are available through each county's website. Having a formal appraisal of the property shortly before the auction represents the closest

assessment to actual market value, but it was too timely and costly to be performed on many properties for a possible investor, given that the list of properties set to go to auction was published 3 weeks before the sale date. Of the initial list, approximately 50% can be redeemed before the auction. Without using a timely appraisal of the property using either a cost, income, or market-comparison approach, the model that was created uses the best information available, but is not necessarily the most accurate due to the amount of time that has lapsed between the tax assessor's valuation and the tax sale (Chen et al., 2017).

The maximum price paid for each property may not always take into account past pricing from previous sales, but will be considered by veteran participants that have attended the tax sale in earlier years (Sirghi et al., 2016). The value of land was determined by the relationship between supply and demand in the land market and the land's location, physical structure, and surrounding area (Berawi et al., 2018). In Florence County, over the last five auctions held, the auctioneer will ask how many people are present for the first time at most events. In general, approximately 1/3 to 1/2 are attending for the first time, which will impact their bidding due to the lack of knowledge from past demand pricing and how the auction was conducted (Sirghi et al., 2016). First-time bidders, being more inexperienced at auctions than those that participate frequently, are more likely to suffer a "winner's curse," a form of cognitive dissonance, should they be the high bidder of a property (Jiang, 2021). New bidders during an English auction, such as what was conducted in South Carolina, may feel this way as

their final, high bid, exceeds all other bidders that have more experience with auctions, property assessments, and the formulation of strategies.

A key consideration of investors was the relationship between the market value of the land only as well as those of the existing assets physically located on the property (Mangialardo & Micelli, 2020). Without adequate background, many potential investors may not realize the risks involved when participating in a tax sale. While investors may understand the marketability of the property, the restrictions of a tax deed compared to a General Warranty Deed, having funds on the day of the sale equal to their high bid, waiting a year and a day to earn the tax deed, and earning interest only to the amount of the initial bid, there may be risks that they are not familiar with. For example, Greenspan (2019) discusses the scenario in which a property owner files for bankruptcy before the conclusion of the redemption period. Courts in Illinois have upheld that should the homeowner file for bankruptcy projection the tax deed will not immediately pass to the high bidder (Greenspan, 2019). While the likelihood of this occurring may be low, the projection it affords the homeowner and the possible financial impact assumed by the high bidder was significant. A review of the 2019 delinquent tax sale for Florence County, South Carolina, shows that in a small urban area of approximately 0.5 square miles, the majority of the city blocks had one or more properties with a structure on it being auctioned at the 2019 tax sale. In this area of the city, many of the buildings represented a liability to the potential investor due to the severe deferred maintenance and even collapse of the roof, walls, or floor previously being part of a residential building. Thus, the investor would correctly model the value or lack of value placed upon the

existing structures, which in some instances would include the cost of demolition and removal of the debris. Demolition was not only costly but also impacts the environment where 20% of all toxic waste comes from buildings being razed (Mangialardo & Micelli, 2020). Given the cost to repair a structure versus the value of the property, which includes its location in an economically depressed area, the real estate may have a very low or negative economic value after all factors are considered. Developing a model that quantifies a relationship between the property market value and the assets located on the parcel was a key factor when calculating the overall value of the property and the maximum bid price for the investor (Inman, 2017; Mangialardo & Micelli, 2020). The model created in this study was not all-inclusive. For example, transaction costs associated with the redemption of property obtained at the tax sale or the selling of the property have not been included and may not always be taken into account when creating a strategy (Baudry & Chassagnon, 2010). Examples of transaction costs, both implicit and explicit, that are pertinent to this study can be defined as those leading up to the auction and the auction itself as well as after the auction has been completed. Implicit transaction costs leading up to the auction and at the auction include the time reviewing weekly lists of properties to be auctioned, physically visiting different locations, time away from work to attend the auction, typically two days. Explicit transaction costs include the cost of fuel to visit properties, cost of fuel to go to the auction site, cost to acquire a bidder number. Once the auction has been finalized, implicit transaction costs include the time to return to courthouse and record-keeping for all bids in which the investor had the highest bid. Explicit transaction costs examples are the value of the

highest bid, recording fees, state fee, county fee, taxes for the current year, fuel cost to return to courthouse, marketing and selling of the property with realtor and attorney fees, or for sale by owner.

Summary and Conclusions

Chapter 2 of this quantitative, nonexperimental, explanatory correlational research study included a description of the major study themes and their relevance. Creating an optimum model to create economic value from the delinquent tax sale process in South Carolina was shown to require many inputs for different investors, but with common themes shared by all bidders. Understanding the history of government-mandated auctions provides a framework of how and why the State of South Carolina carries out its public and fiscal duties of confiscating private real estate for taxes owed but does not retain an interest in the property unless there are no bids (South Carolina Code of Laws, Title 12, Taxation, n.d.). For a model to be created, the type of auction method used must be understood so the proper variables can be introduced. Auction strategies vary with the type of auction, but also with the end goal as a focus. Bidding strategies are shown to differ should the investor want a large payout, potentially bidding higher but with the risk of the original property owner redeeming, thus being left with a return/interest rate less than the maximum offered by the county. The calculation for the maximum bid (Bid_{max}) for an investor wanting the maximum payout on a tax sale property expected to be redeemed was calculated by having the maximum bid price equal to:

$$Bid_{max} = Bid_{start} / 0.12$$

This would allow for the maximum interest to be earned as the maximum bid's interest at a 12% payout would not exceed the starting bid. The maximum interest earned can be shown as follows:

$$Int_{max} = Bid_{start}$$

By understanding the why and how funds are received by local and state governments, the investor can better understand the process of the auction itself. As well, the statutory requirements prescribed by the State for all counties to abide by, but there can be significant differences as to how each county executes the process. Although each investor may have a specific strategy, the way the auction was conducted at the local level may influence the final strategy implemented. Several types of variables may be part of the mathematical model, such as continuous or dichotomous, all of which potentially influencing how real estate investors may evaluate a property with respect to its highest and best use (Mangialardo & Micelli, 2020). If all of the variables were to be included in a Hedonic model, it was unlikely the investor would be able to process the full dataset for properties to be auctioned since the county will only advertise the properties for one to two weeks before the sale. A small subset of variables common to what an average investor may require was the focus of the study. The rationale and research method used for this study are discussed next, in Chapter 3.

Chapter 3: Research Method

The purpose of this quantitative, nonexperimental, explanatory correlational research study was to investigate the effect of the predictor variables on the response variables of interest earned and the likelihood of receiving a tax deed at a delinquent tax sale. The gap in research is largely due to the lack of easily accessible government data characterizing tax sales, as well as the focus on the effects of tax sales on communities, not drives of investor success when attending these types of municipality auctions. Data generated at the time of a tax sale and subsequent redemption period also was not easily available through the county government from a bulk downloading, digital aspect. Interested parties have limited remedies for lack of procedural awareness, which directly impacts the problems of how potential investors can benefit from the process. Property owners attempting to retain their real property also suffer from the same lack of information and clear guidance on completion of the tax sale through the redemption period. The gap in research has been identified by how the likelihood of receiving a tax deed, property redemption by the owner, the final high bid price, and average interest earned can affect an economic value model maximizing overall investment return relative to the goals of the bidder. The manual nature of data gathering for these variables hinders potential investors as well as property owners due to the possible lack of understanding of the delinquent tax sale processes and outcomes. The study focused on one sample county, Florence County, South Carolina, using source data from an actual delinquent tax sale auction that took place in 2017. The resulting data were then analyzed to address which predictor variables had a significant influence on the proceeds from interest earned

should the property be redeemed by the original owner or the high bidder receive a tax deed if the property was not redeemed during the required timeline.

Research Design and Rationale

For this study, I used a quantitative, nonexperimental, explanatory correlational research design to identify and quantify causal relationships between variables. There are two outcome variables explored in this research. These two dependent variables focus on investors who are the high bid for property being auctioned at a delinquent tax sale. Specifically, they are the likelihood of receiving a tax deed by the high bidder and the likelihood of receiving a tax deed at a delinquent tax sale. These two variables are mutually exclusive and also represent a zero-sum outcome: Every high bidder will either earn interest (varying amount) or will earn the deed to the property they are high bid on should the property not be redeemed by the original owner 1 year and 1 day after the auction was completed, assuming the sale of the property was not canceled by the county.

Each of the two dependent variables has three predictor variables. The independent variables for the amount of interest earned by the high bidder include the starting bid for the property, the final high bid on the property, and when the property was redeemed by the owner within the 12 months and 1 day following the auction. The independent variables for the likelihood of receiving a tax deed at a delinquent tax sale include the final high bid of the property, the market value as determined by the Florence County tax assessor, and the market value of the property after the new owner has acquired it, based on the new owner's resale price. The secondary data sources and resulting analysis represent a nonexperimental evaluation of the dependent variables'

consequences relative to the independent variables' influence. These represent important factors in optimal research design, whereby thousands of public records can be accessed during sampling, such as within this study.

The nonexperimental design of this study illustrated independent and dependent variable relationships based on a significant amount of data, initially anticipated to be over 1,000 records with multiple dependent variables. This design was advantageous over all other designs because of the available data and restrictive nature of the auctions to conduct descriptive, experimental, and observational studies. Utilizing a descriptive design by conducting a case study or survey would induce bias due to misrepresentation of monetary values due to inaccuracies from memory or being purposeful as well as reduce sample size due to a return rate of less than 100%. Contacting each participant of the auction for feedback either before, during, or after the would be extremely time-consuming and unrealistic should the entire population intend to be sampled. Correlational design was used as part of the regression analysis, but not in the form of a case-control study or observation. The results from the actual auction event were used, supplying specific data regardless of what was observed during the sale itself. Other studies that may involve emotions, bid strategy, attire, or some other qualitative factor may benefit from this type of design. Conducting a field experiment was also not optimal, given the primary reason that the bidders would not be using their own money and that the organizer of the experiment would not be able to grant the actual tax deed for any type of simulation. While the auction scenario could be reproduced, the outcome would likely be different if the bidders could suffer actual economic benefit or loss compared to

an exercise utilizing game theory. Using nonexperimental secondary source data reduced bias in the research and promote both validity and reliability given that all the data were captured by government employees at the time of the auction, cross-checked against existing records, and in the case of a tax deed being earned by the high bidder, reviewed by an attorney as well. The requirement to re-examine internal and external validity and reliability was still required, although the likelihood of determining errors was problematic as the reference set of data, such as the high bid, was not available. High levels of transparency and lack of bias were evident in this dataset (Haradhan, 2017).

The data analyzed were from the 2017 tax year. Property owners in Florence County, South Carolina, who had not paid their taxes in full by January 2017 were considered delinquent with their property subject to a lien. In March of 2017, delinquent tax notices were sent to each property owner of record who had a past-due balance, with a 20 USD fee. In April 2017, a notification of a levy was sent to each delinquent property owner, being notified by certified mail, incurring another 25 USD fee. In June 2017, the personal levy was applied, with another 35 USD fee. The advertisement cost of 20 USD for the delinquent tax sale was applied to the fees owed and the owner was notified by mail. The last week of September 2017 had a land mortgage fee assessed and the property owner charged 60 USD with the auction to sell their property commencing the following week. The property owners who did not pay past taxes and fees within 1 year and 1 day from the October 2017 auction lost title to their property, resulting in the beginning of the deed transmission to the high bidder of the property. The Florence County attorneys would then ensure that the deed was transferrable and complete the paperwork, typically

taking about 4 to 6 months. Secondary source data from the auction taking place in October 2017, the status of each property in October 2018, and the selling price of the property through June 2022 (if sold by the new owner) represented the key data components and the timeline for the study, notwithstanding the deviation from the research plan discussed in Chapter 4. Data from recent auctions exist, but given the significant changes in the economy due to COVID-19, the year-and-a-day redemption timeline, the delay for Florence County attorneys to create and issue a new deed as well as allowing sufficient time for the property to be sold by the new owner, the 2017 Florence County delinquent tax sale was the most recent date that allowed for these data to be collected without the shock of COVID-19.

The research design selected allowed quantitative data to be gathered from county government secondary sources, which would address the planned research questions (see Appendix A). A quantitative research approach was selected over qualitative due to the type of data available as well as the real or perceived results when conducting a qualitative study on secondary data sources. The secondary sources that are available to the general public and the process in which these data were collected reduced stakeholder concerns about possible methodological or ethical issues while increasing rigor compared to a qualitative investigation (Ruggiano & Perry, 2019).

Evaluating the different forms of qualitative design all involved additional resources and time commitment to complete this study, compared to a quantitative approach. If one-on-one interviews had been selected, appointments would have to be made with each bidder, the same questions would have to be asked of different bidders,

and participant information would have to be cross-checked against government records, yielding a smaller sample size than the full population proposed in the study. Should a focus group have been selected, the makeup of the group would have to be decided upon and justified. This group could be made up of past bidders, nonbidders, or those that may have lost property in the delinquent sale process. More than one focus group would likely have been needed for balance, taking additional time and increasing validity concerns. Other types of qualitative research such as an ethnographic approach, case study, or observation would have yielded similar resource constraint issues as well as increased the length of time to complete the study due to scheduling and gathering of historical data, while also reducing the sample size compared to the proposed quantitative study. This research was completed using a large amount of publicly available quantitative data and did not address why bidders responded or behaved in a certain fashion, eliminating the qualitative design approach from being the optimal research methodology.

The secondary sources generated enough data to address the research questions which led to justifiable correlations and statistical results. Outcomes led to an economic value model of statistically significant predictor variables that should better prepare the investor for delinquent tax sales. The data were collected by visiting the Florence County Complex in Florence, South Carolina, and physically collecting the required data by reviewing government records. These quantitative data were available to the public, but access is checked. Although some of the data were available online, the complete set of public data was stored at the Florence County Complex. Permission to access the files from the current Florence County Treasurer, Laurie Walsh-Carpenter, was sought. A

master spreadsheet was created in Microsoft Excel to manually enter the data captured in real-time by county employees from the 2017 tax sale as well as to manually enter data available through means of the internet. If the manual entry to my computer from the Treasurer's database was excessive, photographs would have been taken of the data with the information uploaded after the hours of operation of the Florence County Complex.

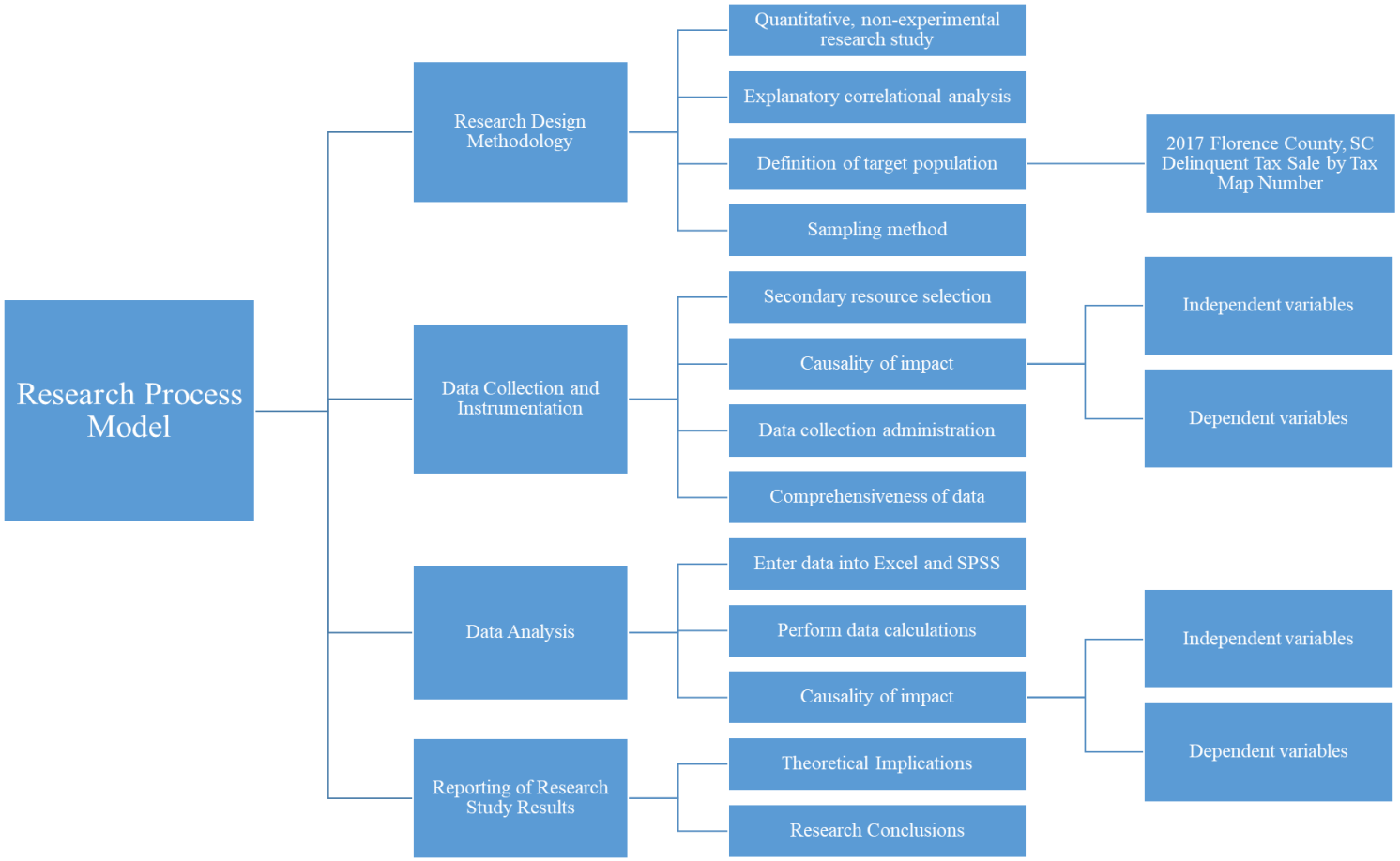
Archival data were a requirement for this study in the form of secondary data sources compiled by the Florence County Treasurer's Office. Several resource constraints were planned to be encountered. The most important was the current situation regarding COVID-19 and the impact on the general public being allowed into the Florence County Complex. The general public was not allowed into the facility for several months, jeopardizing access to required records. If the public continued to be denied access to the facility, an FOIA petition would have been completed, adding significant delays to the data collection (Florence County, 2017).

The amount of time to collect over 1,000 individual records for each unique independent, predictor variable was significant as the digital transfer was not available, regardless of whether the hours of operation of the facility had been reduced or eliminated. To overcome these constraints, I was prepared to vary the hours of research as agreed upon by the county treasurer, a nondisclosure agreement could have been signed to protect against any nonpublic information, and a negative COVID test could have been produced to minimize the transfer of the virus. Constraints that were out of my control included data that were entered in the county database incorrectly, lost records, and properties acquired by the investor that they did not resell before June 2022,

eliminating the possibility for a post-sale analysis. The potential economic gap between the Florence County Tax Assessor and actual market value may vary considerably if there have not been many comparable sales in the area, if the property has not been appraised within the last several years, or due to a lack of accuracy of the actual appraisal itself by the Florence County Tax Assessor. A visual representation of this research process described for this study, showing key requirements and interdependencies, is shown in Figure 1.

Figure 1

Research Process Model



Methodology

The methods used in this study have been determined based on the dataset being used, where the data can be found, the integrity of the data, and the model that will be used to analyze the data. These methods, which also include the population, sampling, sampling procedure, and data collection must all align the raw data being used with the research questions being explored. Future researchers studying the same topic should be able to replicate the findings of this study and can also draw comparisons to other years of data with Florence County, South Carolina, other counties within South Carolina, and other county-level government tax sales within lienholder states.

This research study includes county government data from the Florence County delinquent tax sale that was held on Monday and Tuesday, October 2-3, 2017 during the hours of 10:00 a.m. and 4:00 p.m. The auction was held at the Florence County Complex, room 803 on both days. The process of the auction included professional auctioneers working with Florence County Deputy Treasurer Paige Holsapple, who manages the delinquent tax sales. The starting bid, which was a requirement for this study, was predetermined and recorded by Florence County. The high bid, or in some circumstances, a no-bid, was also recorded by Florence County. These data were tracked by tax map number and for 1 year and 1 day, the treasurer's database was updated should the original owner redeem the property by paying the past-due taxes and penalties in full. This was also a key part of the dataset required for this study, as the redemption determines whether the investor will earn interest on the property or earn a tax deed. All data required were collected for the 2017 delinquent tax sale by tax map number for this study

and were physically located at the Florence County Complex, 180 N. Irby Street., Florence, South Carolina 29501 or were accessed remotely if digitally available with open access. The integrity of the data was expected to be excellent as they were cross-checked by county employees and possibly the original owner and high bidder. Data entry errors could exist when the information was put into the spreadsheet, which is discussed in more detail within the Limitations section of Chapter 5. Due to the large size and good control over the available data, errors such as these appear not to have impacted the overall integrity of the dataset and the resulting analysis, particularly after being checked for outliers.

Population

There are two target groups within this study's population. The first group was the owners of the properties that were being auctioned to the highest bidder as part of the tax sale. Most of the data involved this population, an example of which is shown in Appendix B. Appendix B shows that the property owners included individuals, partners, families, corporations, and life estates for the 2017 Delinquent Tax Sale in South Carolina. Most were residents of Florence County but can live elsewhere, rent the property, hold it for speculation, or use it for a business. A randomized selection of 20 owners out of the first 100 listed for the 2017 Delinquent Tax Sale showed 50% having a Florence, South Carolina, address, 85% living in Florence County, 90% living in the state of South Carolina, and 100% within the USA ("Florence County Tax Inquiry," n.d.). Florence County was selected as it was the 13th largest county out of 46 in South Carolina by population, was 60% urban, and represented a good cross-section of the 46 counties

within the state (South Carolina Counties by Population, n.d.). The county of Florence has approximately 138,000 people with a median household income of about $47,000 as of 2019 (U.S. Census Bureau, 2021). The owners of the delinquent property were primarily used for reference only as they aided in the cross-checking of tax map numbers for each property. The second, more important group, was the bidders/investors who were active participants in the auction process. Similar to the first group, these investors/bidders were likely to live in or near Florence County, but also represented out-of-state investors, small firms that wanted to "flip" houses, outdoors people searching for a recreational property below market value, or family members of the owner trying to keep the property from going to someone outside the family.

Sampling and Sampling Procedures

This quantitative, nonexperimental, explanatory correlational research study included a sampling strategy that was nonrandom, purposeful, and inclusive of the entire population. The study evaluated all data relevant to the research questions that were collected during the 2017 Florence County, South Carolina, delinquent tax sale. A 100% sampling rate used all 843 records, maximizing the integrity of the sampling plan.

Researchers are in general agreement that a random sampling strategy is a preferred method of gathering data (Sweetland, 1972). This is particularly true when populations are extremely large as it reduces bias from the researcher and because mathematical theorems remain valid when applied to smaller sampling sizes, should certain assumptions about the sample prove valid. Nonprobability sampling methods are used when the availability/accessibility of the data/subjects are not readily available thus

convenience sampling may be used, but could negatively impact the generalizability of the results relative to the entire population (Elfil & Negida, 2017). The study of delinquent tax records in Florence County was not a random sample and was not a convenience sample as it was a full inventory of the tax sale population for 2017. While sampling would have been advantageous in terms of resource constraints, such as the time it took to collect and input the data, creating a database that consists of the full population of 843 records was a manageable yet time-consuming task when it came to collecting the required information (Turner, 2020). The speed of collecting these data was challenging but there were no associated costs except for time as an opportunity cost. In many studies attempting to collect 100% of the data, the time to do so as well as resource availability represent key constraints for the researchers, which was valid in this study as well (Turner, 2020). All data collected resided within the Florence County Delinquent Tax Office in Florence, South Carolina, which allowed for repetitive data collection. Consent from property owners with past-due tax payments and documentation thereof to Walden University's IRB was not needed to access this secondary data source as the resulting high bid, redemption time, market value/assessment, and transfer of deed are all a matter of public record. There was no expectation of privacy regarding these public records except for payment account numbers, which were not accessed nor available. A summary of the payment methods was part of the bidder receipt journal which summarized the total amount paid by all high bidders in terms of checks or cash (Florence County Delinquent Tax Office, 2022a). The situation of publicly available data

vs. personal privacy is analogous to county records that document how much a person or organization paid for a dwelling if there was a mortgage or legal proceedings.

The sampling size for this research was the entire population of auctioned properties for the 2017 tax year 843 records. While a smaller sample size could be used, the full population can be used to maximize the confidence of the models that were created, surpassing the minimum of a 95% confidence interval and 80% power, the expectation in most quantitative research (Hazra, 2017). Without using 100% of the population, a researcher can never be 100% confident the results are valid (Lakens, 2022).

This study used G*Power version 3.1.9.7 to calculate a sampling strategy in the event the full population could not be utilized (Faul et al., 2009). Achieving or approaching 843 records greatly surpasses $N = 498$, when data start to stabilize and correlations start to become measurement-error-free (Kretzschmar & Gignac, 2019). Each of the two response variables has three predictor variables. By evaluating each of the dependent variables using a 95% confidence interval with a maximum significance level, alpha, of 5%, and one response variable, the resulting sample size of 33 records was required. This sample size would detect an effect size of 0.35. An effect size of 0.12 was low, 0.15, was medium, and 0.35 was considered high per the G*Power version 3.1.9.7 output shown in Table 2. Decreasing the significance level or increasing the confidence level will increase the samples required to detect the same effect sizes found with a 95% confidence level. The G*Power analysis illustrates that using a confidence interval of 99.9%, a significance level of .005, and an effect size of 0.065 will result in a

required sample size of 498. It was expected and realized that the samples collected would exceed the G*Power minimums upon completion of the data entry and modeling, reaching a value of more than 500 records.

Table 2

Sample Size Required Based on Confidence Level, Significance Level, and Effect Size

Confidence interval	Significance level	Effect size (f^2)	Effect size class	Critical t test	Sample size (total)
.95	.05	Low	0.12	1.6623	92
.95	.05	Medium	0.15	1.6669	74
.95	.05	High	0.35	1.6691	33
.95	.025	Low	0.12	1.9824	111
.95	.025	Medium	0.15	1.9882	89
.95	.025	High	0.35	2.0281	40
.99	.05	Low	0.12	1.6568	133
.99	.05	Medium	0.15	1.6598	107
.99	.05	High	0.35	1.6811	47
.99	.025	Low	0.12	1.9757	156
.99	.025	Medium	0.15	1.9798	125
.99	.025	High	0.35	2.0076	55
.999	.05	Low	0.12	1.6531	189
.999	.05	Medium	0.15	1.6553	151
.999	.05	High	0.35	1.6698	66
.999	.025	Low	0.12	1.9713	215
.999	.025	Medium	0.15	1.9741	173
.999	.025	High	0.35	1.9939	75
.999	.005	Very Low	0.065	2.5858	498

Procedures for Recruitment, Participation, and Data Collection

The data collection of this secondary source, public data was recorded in Excel one record at a time and was accessed through online sources from the Florence County government website as well as physically retrieving it from Florence County Treasury records at the Florence County Complex in Florence, South Carolina. Full consent was given by the Florence County Treasurer and Deputy Treasurer to access and later clarify discrepancies within the dataset. There were no primary data collected in the form of

surveys, interviews, or focus groups, minimizing concerns from Walden University's IRB regarding the safeguarding of rights, welfare, and health of human subjects. Emails from and meetings with the Florence County Treasurer and Deputy Treasurer also served to legitimize and explain the research, including its purpose, which was being conducted within their department.

Instrumentation and Operationalization of Constructs

The planned research was to study the causal relationship between two groups of three independent variables and one dependent variable for each group. Government data from Florence County, South Carolina, provided the basis for responding to the questions within this research study. This secondary source data was compiled by the Deputy Treasurer of Florence County, South Carolina, and her staff on October 2-3, 2017, during the Florence County Delinquent Tax Sale made available to the public. While some of the data were available through the internet and the Florence County website, most of the information required to be physically present at the Florence County Complex to access the data or to document the information in real-time during the auction. There was no way of knowing how many different databases or programs were required to access these data at the Florence County Complex until I physically started to retrieve information. The material contained within the county databases addressed all of the independent and dependent variables as they relate to properties that have been redeemed (interest earned by the high bidder) and properties that are not redeemed by the original owner (tax deed earned by the high bidder). The only research instrument used in this study was the secondary sources available through the Florence County government databases.

The first group of research questions was based on the dependent variable of how much interest was earned by the high bidder on a tax deed from a delinquent tax sale. The independent variables were the initial bid at tax sale, the highest bid at tax sale, and the number of months after the tax sale has completed when original owner redeemed the property. It was expected that all information for RQ1 was to be available online, which included the initial bid at the tax sale as well as the number of months between the tax sale and the redemption. The price the property was auctioned for was not available online but available through county records. If a report could be generated at the Florence County Delinquent Tax Office to show this output for all properties from the auction, it would allow for easier access and transfer to an Excel spreadsheet. If not, the data would be pulled manually by property tax number. All three independent variables were of numeric values. Appendix E shows a screenshot of a random page from the journal that captured the successful bids made showing all the starting bids for properties that were bid upon (Florence County Delinquent Tax Office, 2022a). This record excludes properties that did not receive a bid (no-bid). Appendix D shows a screenshot of a random page from the properties that were redeemed, obtained from the Florence County Treasurer (Florence County Delinquent Tax Office, 2022b). The independent variables of the high bid were found in this document along with when the property was redeemed by the owner. The interest earned was then calculated to see how many days after the auction the property was redeemed, correlating to a 3%, 6%, 9%, or 12% payout depending on how many quarters had elapsed or where in progress. This is how the dependent variable's interest earned was calculated unless the interest exceeded the

starting bid. If the interest to be earned was greater than the starting bid, the interest was capped at the starting bid value.

The second group of research questions was based on the response variable of taking possession of a tax deed from a delinquent tax sale, RQ2. The independent variables were the highest bid for the property at tax sale, the property market value by Florence County Tax Assessor, and property market value representing the actual selling price by a new owner. The independent variables were planned to be examined similarly to the first group. Existing, public information available online was a source for the property market value via the Florence County Tax Assessor web page, and property market value. New sales were expected to be examined through June 2022, although there were delays from when the sales transaction occurred to when the data were posted for public viewing. The final price of the property at auction, the highest bid, was not available online but was available through county records as shown in Appendix C (Florence County Delinquent Tax Office, 2022a). A single report could not be generated at the Delinquent Tax office to show the output for all properties required for RQ2, which would have allowed for easier access and transfer to an Excel spreadsheet. The data, as expected, had to be pulled manually by property tax number. All three independent variables were expected to be of numeric values. A specific printout or file did not show the properties that were not redeemed and a new owner was provided a tax deed after the redemption period. The properties that were not redeemed, leading to a transfer of title, were calculated by taking the number of starting bids from the bidder receipt journal and subtracting the number of properties that had been redeemed from the 2017 delinquent

tax sale and properties that did not receive a bid, thus not having a winning bid (Florence County Delinquent Tax Office, 2022a; Florence County Delinquent Tax Office, 2022b; Florence County Delinquent Tax Office, 2022c). Examples of these unpublished datasets are found in the Appendix. These remaining properties represented the total number of properties that had the deeds transferred to the high bidder.

Data Analysis Plan

The data analysis plan for this study was focused on research data preparation, investigation, analysis, analysis representation, and outcome interpretation (Stout, 2006). While a quantitative data collection strategy may focus on surveys and questionnaires, physical measurements, or statistics, this study used pre-existing, government-collected data (Pal, 2017). Using secondary source data has been a commonly accepted technique for quantitative analysis and is not unique to this study (Williams & Shepherd, 2017).

The data preparation phase involved creating an Excel spreadsheet to gather the data, then transferring it to SPSS Version 28.0.1.0. (142) for analysis. Although the data compiled by the Florence County, South Carolina, government were for the collection of past-due taxes, this secondary analysis of data was valid for this research study as well ("Sources of Data for Research," 2014). Researchers often use existing data sets, such as these, to answer important research questions (Clarke & Cossette, 2000; Doolan & Froelicher, 2009; Magee, et al., 2006). The quality of the data as it relates to this research study was high while the potential for bias was low given how the data were generated via county government workers (McCaston, 2005). Prior to the processing of the data, it needed to be cleaned, transformed, and reduced (duplicates removed) (Critical Data,

MIT, 2016). Data were also evaluated for obvious incorrect outliers, and totals from source documents were cross-checked with each other to verify correct quantities.

The primary source data that were used for this secondary analysis continues to be generated in the same fashion on an annual basis, thus the collection methods have not changed with the government workers and the Florence County Treasurer, which adds to the integrity of these data (Johnston, 2017). The analytic needs of this study were consistent with the data collected by the Florence County, South Carolina, Treasurer's office as all variables were documented, accounted for, and cross-checked to other source documents as found in Appendices C, D, and E (Pienta et al., 2011). Having an understanding of the data required for this research and the format in which it exists before starting the data collection allowed for a proper evaluation of the data, alignment and feasibility of the research questions, how the data would be managed, generation and calculation of power, and how the results would be reported (Doolan & Froelicher, 2009).

Before the approval to collect data had been granted by Walden University's IRB, the data were generated by Florence County, South Carolina, and therefore, deemed valid ("Sources of Data for Research," 2014). The only alternative to using the records from Florence County, South Carolina, would be to attend the annual auction and record the entire proceedings, resulting in primary data but not a complete dataset. The event could have been recorded with the relevant data extracted, but additional data, such as if the properties were redeemed the following year and their timing of redemption for interest calculations, would still have been required. Using secondary data analysis can save the researcher time by making use of the available data and reducing errors with persons not

specifically trained in collecting data (Doolan & Froelicher, 2009; McCaston, 2005; Williams & Shepherd, 2017). It was critical that the researcher using secondary source material be knowledgeable about how the primary data were collected and the methodology used (Johnston, 2017). This was satisfied given the experience of the county workers and their job of collecting the primary data as well as me being familiar with the secondary data from attending delinquent tax sales in Florence County from 2015 – 2022, inclusive, with 2020 excepted due to it being canceled from the COVID-19 pandemic. I have bid on properties, had properties redeemed, received tax deeds, and sold properties with a tax title since 2015. It was expected that the data required would come from different computers or different screens within a database should a printout not be available. Rather than merging data files through software, only the relevant data were captured in Excel and then analyzed, with some calculations being required (Pienta et al., 2011). An example of a calculation is the interest earned. Interest earned (USD) required the starting bid value, high bid value, date of redemption, how many days transpired relating to the quarter in which it was redeemed following the auction, and then checked to make sure that the (high bid * earned interest rate) $\leq$ starting bid.

The amount of time afforded by the City of Florence to access its databases and written records was expected to be limited. Rather than collecting the data in Excel directly from each record, a picture of each record could have been taken, cataloged by tax map number, with multiple images being required by tax map number, and then transcribed outside of the Florence County Complex. Market value data were accessible online without the need for a physical visit to the City of Florence offices. Data

compilation and analysis outside the City of Florence offices took place. Source documents received from the Florence County Treasurer and Florence County Deputy Treasurer responsible for the delinquent tax department provide hard copies of all required material. The creation of a visual record of all data that were to be photographed, verifying the integrity of possible errors, was not needed as no pictures were taken

Using Excel, descriptive statistics that were generated included minimum, maximum, mean, and standard deviation for all variables of numeric value. Histograms of the full data set by variable and then a reduced set of 90% of the variable's population were examined giving additional clarity from lack of outliers, thus smaller interval sizes. The cleaned data were then loaded into SPSS Version 28.0.1.0. (142) and evaluated a second time for integrity as well as trends, anomalies, and outliers. Multiple regression models were generated using the specific independent and dependent variables stated in RQ1 and RQ2. The graphs and resulting statistics were created from SPSS Version 28.0.1.0. (142) models as well as Excel were used to compare the relationships between the independent and dependent variables and to test the hypotheses of this study. The dataset was also evaluated to validate if it was a normal distribution along with other assumptions required for the models selected. Having awareness of the proper use of data analysis increases the validity of the statistical methods used, particularly for this correlational research study (Disman et al., 2017). The exploratory data analysis included 36 graphical outputs as well as descriptive statistics and quantitative, modeled data (Critical Data, MIT, 2016). In addition to the multiple linear regression and multiple

binary logistic regression analysis, hypothesis testing was performed within the stated confidence levels (Critical Data, MIT, 2016). This analysis and evaluation of the data ensured that the research topic and the data were properly aligned (Johnston, 2017).

The integrity of the data could be enhanced by reducing the input errors from either me or the government worker as the data were entered into the database as well as into Excel/SPSS Version 28.0.1.0. (142). Error reduction can be attained by increasing the redundancy of the data, cross-checking, and outlier verification. There was no control over the input of data by government workers, but outliers were flagged by evaluating scatter plots and descriptive statistics. All outliers present were actual values within the population; none were errors. Missing data were also identified by sorting the data and determining which cells were empty. Missing data, typically in the form of no-bids for the high bid variable, were coded appropriately when loaded into SPSS Version 28.0.1.0. (142). It was unlikely that missing data would be evident within the government database due to the error-checking algorithms employed by the organization, resulting in no additional follow-up (Doolan & Froelicher, 2009). No data were unaccounted for during the data collection and review process. Missing data in the form of no-bids was eliminated from the modeling pairwise while allowing for a satisfactory large sampling for the models.

It was assumed that some training on the software and computer systems would need to take place to become familiar with the government databases being used. This was not needed as hard copies of the data were provided by the Florence County Treasurer rather than granting digital access No other requirements were put in place

when the data were being collected given the use of hard copies. There was the possibility that the exclusion of cameras, specified hours of availability, nondisclosure agreements, and potential scrutiny of the county government would be required if access to the Florence County Treasurer's assets were granted (Shelton, 2018). It was unlikely that the records would be able to be downloaded and converted to Excel and SPSS Version 28.0.1.0. (142), which was validated during the interaction with Florence County, South Carolina, associates ("Sources of Data for Research," 2014). Analyzing the data from secondary sources as well as the process leading up to it must be systematic (Johnston, 2017). SPSS Version 28.0.1.0. (142) was used in the analysis of the data, specifically the modeling of the data and to test assumptions. Once electronically uploaded to SPSS Version 28.0.1.0. (142), the data were evaluated for any outliers, as was done after the data were entered into Excel. Further analysis included univariate descriptive statistics, graphical representations of the data, inferential statistics for hypothesis testing, correlation evaluation, and regression output in addition to a discussion on the limitations of the models and generalizability (Antonius, 2013).

Threats to Validity

Threats to validity in this quantitative, nonexperimental, explanatory correlational study were internal validity and external validity. Depending on the type, depth, and width of a study, researchers have faced different aspects of validity which may reduce the value and generalizability of a study. By addressing validity at the start of the study through proper, robust, and proven research methods, the impact of validity issues can be known and minimized through design and proper methodology (Cronbach, 1971).

Specific to this study, overall validity was high due to the large sample size, as a percentage of the population, and detailed government data. Using government data that were collected on an annual basis over decades, required for revenue replenishment, and subject to auditing is likely to yield collection methods and recording that is repeatable and reliable.

External Validity

External validity was how accurately the research findings could be applied to a larger population (Mitchell, 2012). In determining the proper methodology to minimize the threats to external validity, researchers can address selection bias and if the sample being analyzed properly reflects the broader population. Specific to the research undertaken, a sample size of approximately 100% of all available data for one year was targeted and realized. To enhance the generalizability, additional years and other counties could be analyzed as well. Should additional years or counties be researched, attention to variables such as inflation rate, demographic changes, assessed values, inflation, real interest rates, and other macroeconomic factors would need to be examined. Due to the high sampling rate, the opportunity for bias has been minimized. This quantitative study had no surveys, pre-tests, post-tests, or instruments that gathered data that could be impacted by a person's state of mind, reaction, or inherent bias. Should this type of bias have existed, it likely would have occurred at the time of the delinquent tax sale itself and then been captured in the data. The data reviewed were purely quantitative, none of it qualitative or subjective, also minimizing the potential for validity errors. Given that the same auction process was used year over year, results from a single year will likely yield

similar results outside of macroeconomic fluctuations and inputs and the makeup of attendees. To better enhance results, a multi-year longitudinal study would be beneficial (Easton et al., 2020).

Internal Validity

Internal validity focuses on the research itself. The research question and resulting data should have led to the implied outcome of the experiment. Should other attributes have yielded the same result they must be discussed. Other attributes were not found in this tudy, but their possible influence on the model created have been discussed in Chapter 5, the Recommendations for Future Research. The effect must be due to the cause that was hypothesized in this study. The aforementioned statement was addressed by examining the degree of the causal influence of the independent variables on the dependent variables. For this study, the dependent variables are the interest earned on a tax deed if the property was redeemed by its owner and receiving a tax deed if the property was not redeemed by the original owner.

An example of poor internal validity involves numerous invalid measurements. For this study, the measurements made are strongly argued to be valid given the mature process of data collection from primary sources and systematic government auditing. With the key threats to internal validity addressed, the causal relationships, if any, between the variables were justified from a cause and effect perspective, primarily due to lack of expected methodological errors (Cook & Campbell, 1979). While the data being analyzed were not generated for this study, the data were not overly specialized, as the intended audience were the taxpayers of Florence County, South Carolina. The

characteristics of this secondary source data accurately reflect the primary data obtained by county workers 3 to 5 years (Doolan & Froelicher, 2009; McCaston, 2005). Due to the nature of the data, how it was generated, the methodology of how it was attained, its recovery from a database, and the resulting statistical conclusions, this study appears to have a high degree of internal validity.

Ethical Procedures

There are no ethical issues associated with this study given that the data were publicly available, including the names of owners and organizations by tax map number. Permission was requested and granted to view county records from the Florence County Treasurer, as described in the Walden University IRB application process. All bidders participated voluntarily at the tax sale and were advised by the auctioneer as well as the Florence County Deputy Treasurer of their roles, rights, and responsibilities before participating in the auction. While I do invest in delinquent tax sale properties, I am not associated with the Florence County government or the auction company, nor does the tax sale represent a substantial percentage of my annual earned income, minimizing the likelihood of bias ("Sources of Data for Research," 2014).

All data collected were stored on the my computer's hard drive and were not uploaded to the cloud or other database, posted on social media, or shared with any other people or entities. A backup of the data were stored on a Universal Serial Bus (USB) in one Excel file. The computer was password protected and only myself and my employer, via the IT administrator, had access. The USB with backup data was stored in my locked office. Should an outside entity have gained access to my files, all data available could

also be found via a public data search or through FOIA. No personally identifiable information that was confidential, or of sensitive content, was present. Further, there was no expectation of privacy for persons or organizations on record.

Construct Validity

Construct validity was proven by relating how an instrument being used in this study measures the subject matter reliably (Broniatowski & Tucker, 2017; Sürücü & Maslakçı, 2020). The evaluation of the measuring instrument, which affirms that the variables being used have logical relationships, was the primary determinant of high construct validity (Allen & Meyer, 1990). This study does not use any survey questions, interviews, or other instruments in the collection of data, only secondary source material from local government databases. Data were taken from Appendices C, D, and E as well as the Florence County, South Carolina, website to address research questions one and two.

Measurements garnered from the delinquent tax process were a result of data captured in real-time at the 2017 delinquent tax sale and recorded by government employees. Other data were based on government assessor's calculations, tax values, and penalties using predetermined formulas from South Carolina State statutes that are applied unilaterally to all records (South Carolina Code of Laws, Title 12, Taxation, n.d.). The constructs evaluated in this study were the same subject matter collected during the delinquent tax sale process and maintained in my secured office. These steps of securing the data ensured that the information does not become compromised by a third party. The anonymity of the participants (auction participants and original owners) does not need to

be protected as all data were publicly available through the County of Florence government databases. Regardless, the data were summarized and amalgamated, then evaluated with only the exhibits in Appendices C, D, and E showing owner names (Rao et al., 2021). Although this personal information exists in the form of names for reference only, the full report of names was not published in the research findings.

There was an expectation of anonymity due to the public availability of the data. In research studies where anonymity was required, demographic variables of the participants should be minimized and broad measures of analysis could be used. These aspects of research do not apply to this study and were not an expectation. Upon completion of the analysis, the data will not need to be deleted due to its public availability but will be done so to preserve overall privacy. Being respectful of auction participants and their privacy may allow additional research to be conducted via the Florence County, South Carolina, government in the future, given the trend of additional privacy protection laws such as the General Data Protection Regulation (GDPR) found in the European Union (EU) (Rumbold & Pierscionek, 2017). Due to the nature of the secondary sources being used, the constructs were isolated from random error variance after the data were reviewed for outliers (Gray et al., 2017). Each variable used in this study was unidimensional (Ziegler & Hagemann, 2015). The units used for all variables in this study consisted of United States Dollars (USD), percentages, days/dates, or were dimensionless, aligning well with the theoretical framework presented.

IRB Approval

The collection of data for this research study began after approval number 04-05-22-1015495 was received from Walden University's IRB. The data collection procedure was to gather secondary source material housed and maintained by the Florence County, South Carolina, government. While all of the material required was public, the ease with which to access the data varied. Accessibility to the full dataset required for this study was controlled by the Florence County, South Carolina, government's digital repository in which approximately 70% of the material was only available at the county offices and 30% available through web-based means. Upon IRB approval, the Florence County, South Carolina, Treasurer was contacted to discuss what material was needed for this study that was not available through web-based services. A follow-up discussion with the Florence County Treasurer/Delinquent Tax Deputy Treasurer to clarify 45 properties with discrepancies was scheduled and completed during the week of May 30, 2022.

Summary

The purpose of this quantitative, nonexperimental, explanatory correlational research study was to examine the amount of interest earned from a property redemption (RQ1) and investigate the probability of obtaining a deed to real estate (RQ2) at a delinquent tax sale in Florence County, South Carolina. The study focused on the 2017 tax year as this was the most recent year that would not be impacted by the COVID-19 pandemic. The quantitative method used in this study required me to review public records provided by the Florence County, South Carolina, government for the tax years 2016 and 2017 as tax payments were made in arrears. The data span from the October

2017 delinquent tax sale through October 2018 when the redemption data ended, and into the first half of 2019 when the deed was received by the high bidder if the original owner did not pay the required past-due taxes and fees. The data generated by the research study created a model that participants can evaluate to determine the likelihood of earning interest on real property should they be the high bidder or the economic benefit should they acquire a tax deed. An overall economic model illustrating this type of relationship was based upon t,he initial bid of the property, the highest bid on the property, and the number of months the property was held if redeemed. It also included the property's market value at the time of the sale, the market value if sold by the high bidder, and was the result of data analysis from the regression models.

All owners of real property within South Carolina were and are subject to the delinquent tax sale proceedings should their tax levy not be paid annually. All members of the public were and are eligible to take part in the auction process, held once per year for most counties within South Carolina. Although the guidelines of the auctions are provided by the State of South Carolina, it has been up to senior-level county administrators, such as the county Treasurer to oversee the auction and collect taxes that are past-due. The process of preparing the delinquent tax roll, how it was disseminated, auction announcement content, and the structure of the auction process for each county can vary widely. The data collected from the Florence County, South Carolina, delinquent tax sale were not easily accessible due to the manual nature of the process. The research performed in this chapter created a database that can be used by possible investors to better understand the financial benefit of the delinquent tax process. This

chapter also explained the research efforts required to obtain the data so the general public can make better, informed decisions on their degree of participation. An explanation of the results based on an analysis of the data of this study has been presented in Chapter 4.

Chapter 4: Results

The purpose of this quantitative, nonexperimental, explanatory correlational research study was to investigate the relationships between or among the interest earned for redeemed tax sale properties in Florence County, South Carolina, and the starting bid, highest bid, and time elapsed until the property was redeemed (RQ1). The purpose of this study was also to investigate the relationships between or among receiving a tax deed for nonredeemed tax sale properties in Florence County, South Carolina, and taxes being due before 2016, starting bid, highest/final bid, if 12% of the highest/final bid was less than the starting bid, assessed land value, if a structure was on the property, and the economic benefit to the high bidder, representing a deviation from the original RQ2. The goal of this research was to develop a model based on the research questions that would enable a bidder at a tax auction to attain their personal or business goals using data analytics presented in this study as well as resources available to them in the most efficient manner.

The Data Collection section of this chapter describes the process used to obtain all independent variables for the research questions including data required to calculate the independent variables. The Study Results section is separated by the two research questions. Subsections include descriptive statistics, statistical assumptions, and statistical analysis specific to each research question, resulting in the null hypothesis of each variable being accepted or rejected. The study results included a subsection on additional findings for each research question based upon relationships observed between data.

Deviation from Research Plan

There were two deviations from the research plan. I had initially proposed multiple linear regression using an ANOVA to test for two research questions. However, for Research Question 2 (RQ2), logistic regression was deemed more appropriate due to the dichotomous dependent variable of receiving a tax deed (or not) instead of multiple linear regression. The second deviation included the third predictor variable, market value of sold property, as it only applied to the bidders who have earned a deed. Therefore, for the dichotomous dependent value of receiving a deed or not receiving a deed, it was not possible for a high bidder who did not earn a deed to sell property they do not own. The replacement independent variables were consistent with the body of work with all predictor variable values collected at the same time as the original variables from the same secondary source documents and IRB-approved methodology. No additional research was needed. RQ2's revised variables included:

- Independent Variable 1: Taxes due prior to 2016
- Independent Variable 2: Starting bid
- Independent Variable 3: Highest/Final bid
- Independent Variable 4: 12% of the highest was less than the starting bid
- Independent Variable 5: Assessed land value
- Independent Variable 6: Structure on property
- Independent Variable 7: Economic benefit (assessed value-high bid value)
- Statistical analysis to be used: Binary logistic regression

Thus, the wording for RQ2 and the corresponding hypotheses was revised as follows:

RQ2: Do relationships exist between or among earning a tax title/deed for nonredeemed tax sale properties in Florence County, South Carolina, and taxes being due prior to 2016, starting bid, highest/final bid, if 12% of the highest/final bid is less than the starting bid, assessed land value, if a structure is on the property, and the economic benefit to the high bidder?

H_0: There is no relationship between the independent variables of taxes being due prior to 2016 (IV_1), starting bid (IV_2), highest/final bid (IV_3), if 12% of the highest bid is less than the starting bid (IV_4), assessed land value (IV_5), if a structure is on the property (IV_6), and the economic benefit to the high bidder (IV_7) and the dependent variable of receiving a tax deed (DV).

H_a: At least one of the independent variables of taxes being due prior to 2016 (IV_1), starting bid (IV_2), highest/final bid (IV_3), if 12% of the highest bid is less than the starting bid (IV_4), assessed land value (IV_5), if a structure is on the property (IV_6), and the economic benefit to the high bidder (IV_7) are useful in explaining and/or predicting relationships with receiving a tax deed (DV).

Data Collection

There were two options to collect the data that were housed in the Florence County offices on their computers: (a) physically accessing the computers and (b) reviewing printouts of the required information. The Florence County Treasurer provided physical copies of the public records required for the study based on the email I

previously sent. Although auction data from 2017 and all other tax sales are available to the public, access to the data was limited and must be requested through the Florence County Treasurer's Office. Data that were not available through web-based means were provided by hard copy by the Florence County treasurer. Three secondary source records were provided. The resources used for the 2017 Florence County, South Carolina, delinquent tax sale include a bidder receipt journal, properties that were redeemed, and properties that did not have winning bids placed (Florence County Delinquent Tax Office, 2022a; Florence County Delinquent Tax Office; 2022b; Florence County Delinquent Tax Office, 2022c). Table 3 is a summary of the documents required to complete the data collection for this study.

Table 3

Data Collection Source Summary

Research question	Variable type	Variable description	Data collection method	Location of data, Florence County	Florence County, South Carolina secondary source document title(s)	Accessibility to public
1	Dependent	Earned interest by high bidder in USD	Calculated	Treasurer's office	Redeemed properties from 10/2/17 through 10/3/18	Limited
1	Independent	Starting bid	Calculated	Treasurer's office	Bidder receipt journal, properties without winning bids placed	Limited
1	Independent	High bid	Direct	Treasurer's office	Bidder receipt journal	Limited
1	Independent	Elapsed days between tax sale and property redemption	Calculated	Treasurer's office	Redeemed properties from 10/2/17 through 10/3/18	Limited
2	Dependent	Deed received by high bidder	Direct	Treasurer's office	Bidder receipt journal	Limited
2	Independent	Taxes due prior to 2016	Direct	Treasurer's office	Bidder receipt journal	Limited
2	Independent	Starting bid	Direct	Treasurer's office	Bidder receipt journal, properties without winning bids placed	Limited
2	Independent	High bid	Direct	Treasurer's office	Bidder receipt journal	Limited
2	Independent	12% of the highest bid is less than the starting Bid	Calculated	Treasurer's office	Bidder receipt journal, properties without winning bids placed	Limited
2	Independent	Assessed land value	Direct	Online services	Tax assessor property card	Full
2	Independent	Structure on property	Direct	Online services	Tax assessor property card	Full
2	Independent	Economic benefit (assessed-high bid value)	Calculated	Treasurer's office, online services	Bidder receipt journal, Tax assessor property card	Limited
2	Independent	Assessed (property) market Value	Direct	Online services	Tax assessor property card	Full
2	Independent	Actual property market value	Direct	Online services	Clerk of Court, indexed records	Full

A total of 843 properties were scheduled for the Florence County delinquent tax sale from the initial list of 1,583 properties published on the Florence County, South Carolina, Delinquent Tax department website and local newspaper 3 weeks before the tax sale. The 1,583 properties and descriptions of the property provided by the Florence County Delinquent Tax office were used as a template to collect the required data. The data were converted from a pdf file to Excel spreadsheet and organized by property owner as of September 2017. The information published and provided to the public was based upon the tax map number, also referred to as the Map/Block/Parcel number, as it provided a unique identifier for each property. All 1,583 properties that were published 3 weeks before the delinquent tax sale were entered into my spreadsheet. A subset, 843 properties still not redeemed before the date of the tax sale and scheduled to be sold to the highest bidder, were noted in the spreadsheet and the basis for the two proposed research questions. Specific data entered into the spreadsheet for each tax map number included:

- tax map number
- owner of property at time of auction
- if the high bidder earned interest
- if the high bidder received a tax deed
- the date of the tax sale, as it was held across 2 days
- taxes due prior to 2016, in dollars
- taxes due in 2016, in dollars
- taxes due in 2017, in dollars

- if a land mortgage search fee was added as a penalty
- high bid value, in dollars
- property redemption date
- assessed land value, in dollars
- assessed building value, in dollars
- date high bidder acquired the tax deed to property
- date of when property was sold by the high bidder after acquiring a tax deed

The information gathered above was used to make additional calculations required to understand the completeness of the data and to generate values to satisfy the model using the specified dependent and independent variables. In addition to data that were directly input into the spreadsheet, the following information was generated based on calculations:

- all past and current taxes due, in dollars
- total amount owed from the summation of all past and current taxes due plus fees, in dollars
- starting bid from the total amount owed rounded to the next highest dollar amount
- percent increase from starting bid to high bid
- starting bid divided by high bid
- number of elapsed days from date of auction to redemption of property
- partial quarter of redemption after auction date
- actual quarter of redemption after auction date

- percentage of possible interest earned by high bidder based on quarter of redemption
- maximum possible interest earned by high bidder based on highest bid price times the interest percentage from redemption quarter, in dollars
- if the maximum possible interest earned was higher than the starting bid for a redeemed property
- actual interest earned by high bidder for redeemed property, in dollars
- actual ROI by high bidder for redeemed property, as a percentage of high bid
- annualized ROI by high bidder for redeemed property, as a percentage of high bid and number of days elapsed until property was redeemed
- if there was a structure on the property or not
- total assessment of property including land and buildings, in dollars
- possible economic benefit to the high bidder that earned a tax deed calculated by subtracting the assessed value of the property from the high bid, in dollars
- possible economic benefit to the high bidder that earned a tax deed calculated by subtracting the assessed value of the property from the high bid, as a percentage
- nonredeemed property sold value after a tax deed was obtained, divided by the assessed value, as a percentage
- nonredeemed property sold value after a tax deed was obtained, less the high bid value, in dollars

- nonredeemed ROI to the high bidder calculated by value of the property when sold by the high bidder divided by the high bid price, as a percentage.

Before loading the required data into SPSS Version 28.0.1.0. (142), my master spreadsheet contained 1,686 cells used from the 2017 delinquent properties published by the Florence County, South Carolina, Treasurer's office at the time of the auction. A total of 10,959 individual data cells were manually entered into the spreadsheet and 17,703 cells were created based on calculations from the data previously entered. The master spreadsheet accounted for 29,948 cells of research-related data in its final form in addition to 740 properties that were redeemed before the date of the auction. Not all of the cells in the spreadsheet contained data, such as those that did not receive a bid.

Properties that did not receive a bid during the auction were excluded from the research listwise for RQ1, as an investor could not have a high bid should no initial bid from an attendee exist. Out of the 678 properties redeemed by the original owner after the tax sale, 13.6% (92/678) did not receive a bid. If a no-bid was received, the dataset for RQ1 was incomplete as the high bid independent variable did not exist; thus properties without a bid were eliminated from the model. This elimination reduced the number of properties to 586 used in the model for RQ1. Interest was earned and provided to the high bidder for all 586 properties, or 69.5% (586/843) of the properties that went to auction in the 2017 Florence County, South Carolina, tax sale.

No-bids had a similar effect on the second research question, where 44.2% (73/165) of the deeds not redeemed by the owner did not have a high bid, making it impossible for a tax deed to be delivered to a high bidder. The administrators of the

auction will sometimes cancel the sale of a particular property if procedural errors are found. For the 2017 Florence County, South Carolina, tax sale, there were 18 properties that had their sale canceled, reducing the number of properties that were not redeemed but received a bid to 75. From this group of 75 properties, six additional deeds were refused by the high bidder, yielding 69 total properties that had their deeds transferred to new owners, or 8.2% (69/843) of the total properties that went to auction in 2017. No changes or discrepancies regarding the process of collecting the data, as submitted to IRB, were made. All IRB policies were abided by when conducting the research for this study. Data collection and entry took place over 7 weeks from April 7, 2022 through May 26, 2022.

Study Results

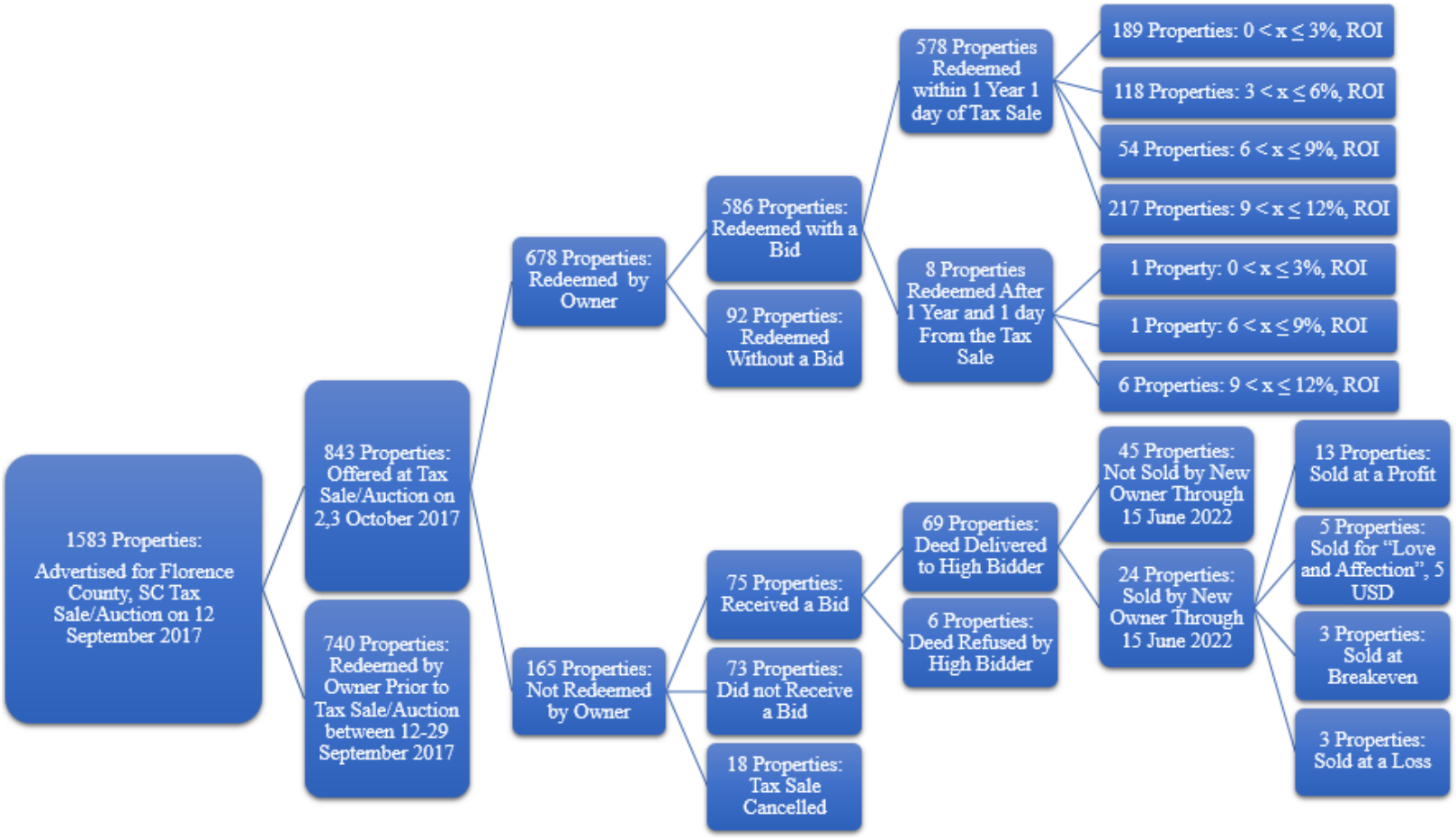
This section is divided into three groups of analyses: a general overview of important characteristics of the entire population and one for each of the two research questions. Quantitative data in the form of descriptive statistics, statistical assumptions, statistical testing, and analysis, followed by additional findings were used to characterize the population of this study. The sample size used represents the full population of the 2017 Florence County, South Carolina, delinquent tax sales as every physical property to be auctioned in October 2017 was entered into the models for analysis. Multiple linear regression was used to test the hypotheses of the first research question. Multiple binary logistic regression was used to test the hypotheses of the second research question.

Population Descriptive Statistics

The population for the 2017 Florence County, South Carolina delinquent tax sale was 843 individual properties, each delineated by a unique 10-digit tax map identifier. The sample used was equal to the population; 843 records representing a 100% sampling rate which was the best characterization possible for a population (Kaliyadan & Kulkarni, 2019). The initial outcome of the auction results in properties receiving a bid or not receiving a bid. High bidders on properties that had past-due taxes and associated fees paid in full received their bid money back plus interest. The high bidder's ROI ranged from 1.4% to 12% depending on the timing of the redemption, the starting bid price, and the maximum bid. The results of the properties redeemed are shown in Figure 2. Properties that were not redeemed but did have a high bid were subject to having their deed transferred to the high bidder. These results are also shown in Figure 2. Figure 2 accounts for all 1,583 properties that were advertised to be sold at auction 3 weeks before the sale, including the 843 properties that were the focus of this study.

Figure 2

2017 Delinquent Tax Results, Florence County, South Carolina



Figures for seven model variables from the population of 843 records are shown below. Independent variables based on a scale category included the starting bid, high bid, the assessed value of the land, and the possible economic benefit from the acquisition of a deed. Independent variables based on a nominal category include if taxes were owed before 2016, if 12% of the final bid would be less than the starting bid, and if a structure was on the property. In the seven figures that follow, a high-level view of each variable used by both research questions is shown based on the full population, followed by comprehensive population descriptive statistics in Tables 4 and 5.

Figure 3 shows the starting bid value for all 843 properties presented at the 2017 delinquent tax sale. Results show that 71.5% (603/843) of the values fall between 154 and 1,154 USD with very high bids such as 28,812 USD also evident (see Table 4). A total of 85.9% (724/843) of the starting bids were between 154 and 2,154 USD. Although every property had a starting bid calculated by the Florence County, South Carolina, Treasurer's office, not every property received a bid, eliminating the possibility for a high bid, which disqualified these data from calculations as part of the two research questions.

Figure 4 shows the high bids received for each property with 19.8% (167/843) of the properties not receiving a bid. Over half (n = 443; 52.6%) of the 843 properties received a high bid that ranged in value from 178 to 10,178 USD with the highest bid value equal to 240,000 USD.

Figure 5 shows the market value for land only of 100% of the 843 properties that were to be sold at the tax sale. No buildings or structures are included in this calculation. The total property assessment was not used; instead, it was separated into two

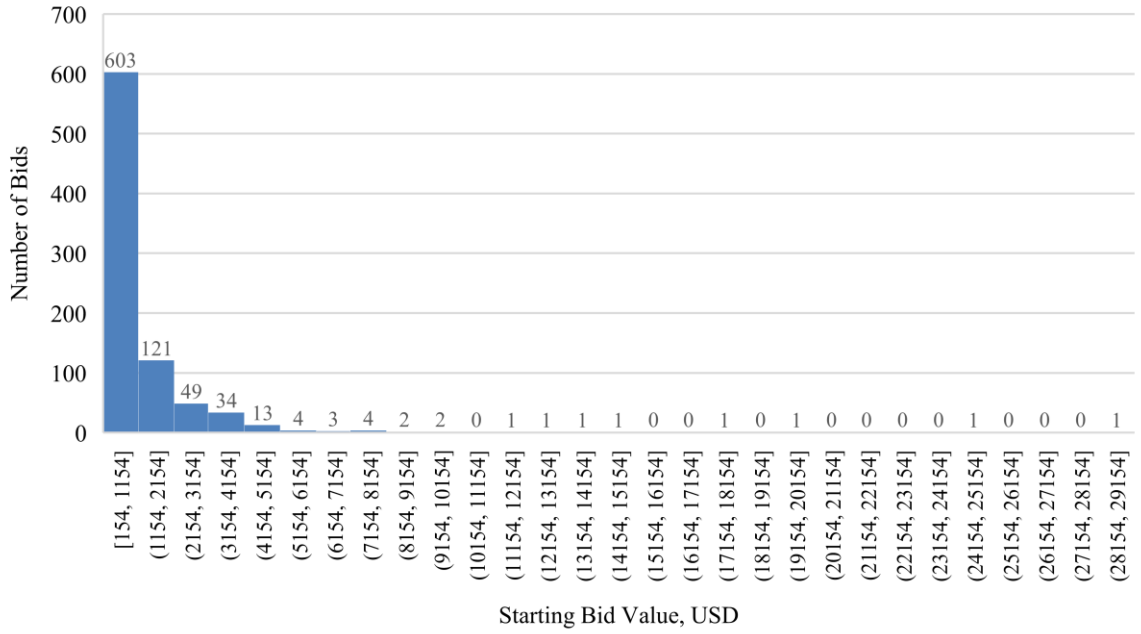
independent variables that included land value and if there was a structure on the property or not. This land valuation was determined by the Florence County, South Carolina, Tax Assessor. A total of 64.3% (542/843) of the properties had a valuation of less than 10,100 USD while 86.4% (728/843) were valued at less than 20,100 USD.

Figure 6 shows the amount of possible economic benefit that could be earned based on the assessed value of the property. This value includes the aforementioned land value and any structures such as a building. These data include 167 records that did not receive a bid. Seven records have a value of zero or less, indicating that the final bid price was equal to or higher than the assessed market value of the property. After eliminating the seven negative values, 47.1% (397/843) of the properties had a theoretical economic benefit to a new owner averaging 30,556 USD should the property not be redeemed.

Table 4 shows very high standard deviations across all four selected variables, particularly the high bid where the standard deviation was 2.3 times the mean value. The low median value compared to the mean for each variable indicates that the dataset was clustered around lower values, as visually seen in Figures 3–6.

Figure 3

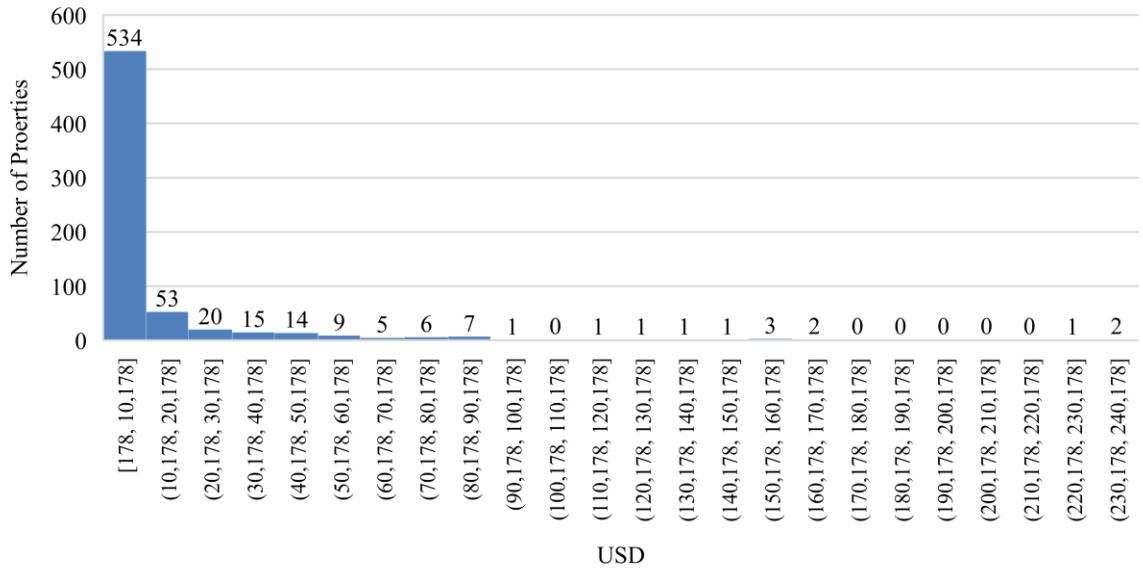
Population Starting Bid Value



Note. *N* = 843.

Figure 4

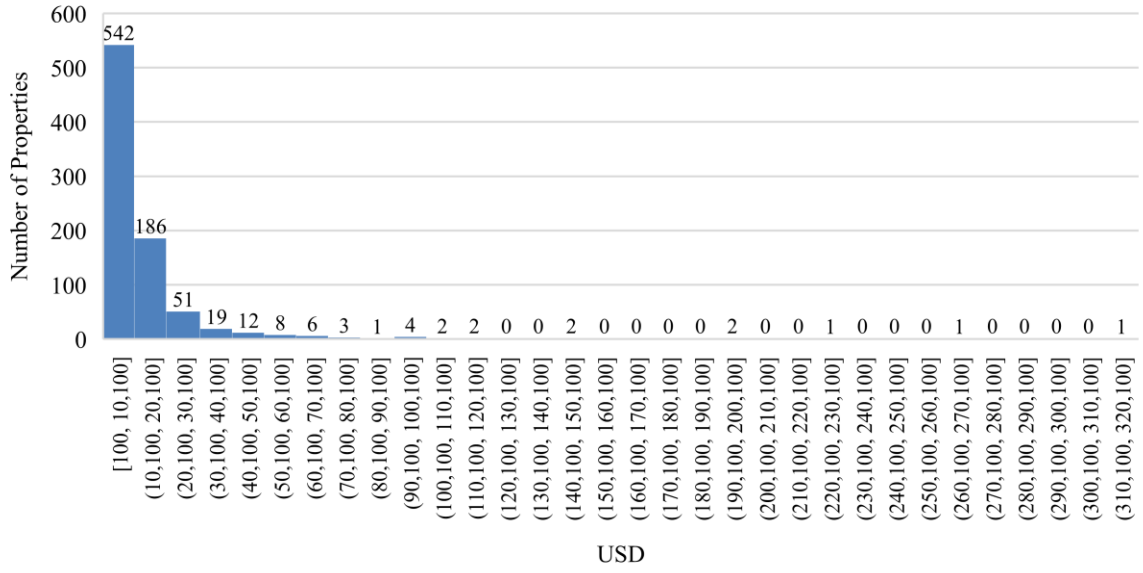
Population High Bid Value



Note. *N* = 843,167 of which are no-bids.

Figure 5

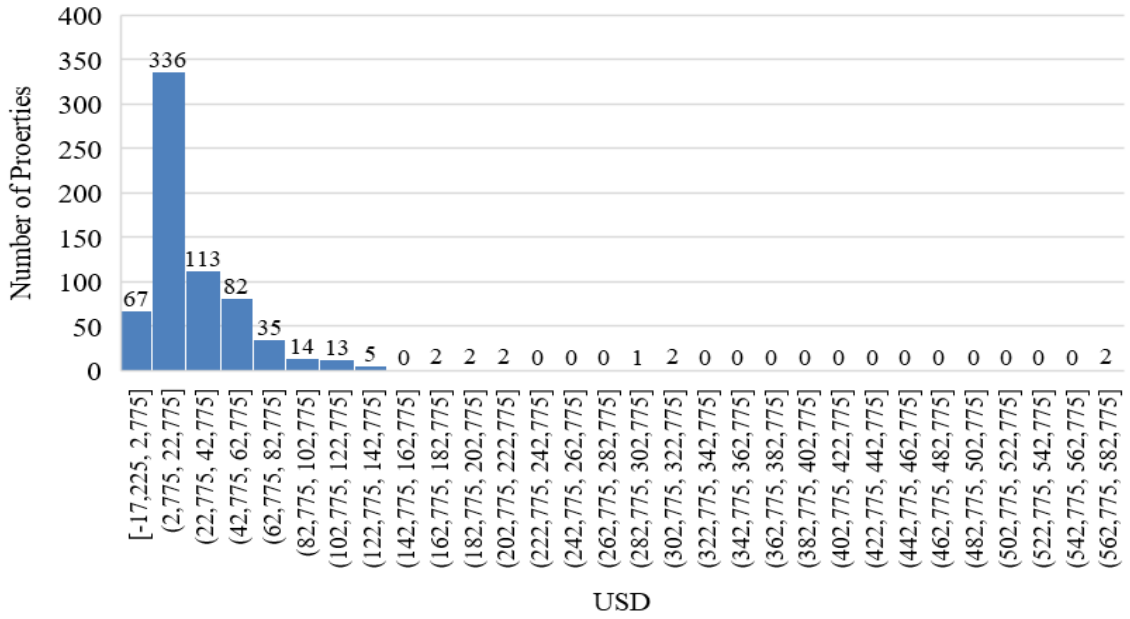
Population Assessed Land Market Value



Note. *N* = 843.

Figure 6

Population Possible Economic Benefit from Deed Acquisition



Note. N = 843, 167 of which are no-bids.

Table 4

Population Descriptive Statistics for Select Continuous Model Variables

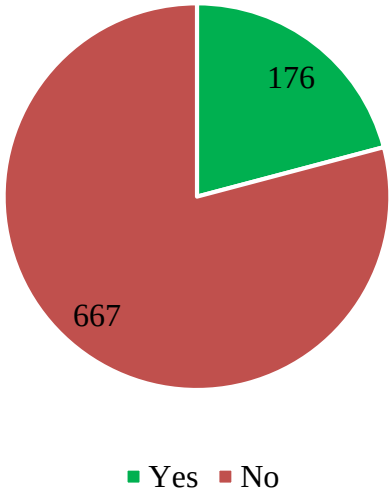
Variable	*N*	Minimum	Maximum	*M*	*Mdn*	*SD*
Starting bid	843	$154	$28,812	$1280	$678	$2,154
High bid	676	178	240,000	11,658	2,600	27,347
Land value	843	100	312,095	13,599	7,900	23,879
Possible economic benefit	676	-17,225	574,809	30,209	16,149	49,664

Figures 7–9 and Table 5 pertain to RQ2, using three nominal variables, $N = 843$. Figure 7 shows taxes delinquent in the current year only compared to those that have taxes due before 2016 in addition to current taxes. Current year taxes exceed those properties that are delinquent by more than one year at a rate of approximately 3.8:1 ($N = 843$; 667/176). Figure 8 shows that 67 ($N = 843$, 455 - 388) more properties have structures present compared to land only, which was 17.3% (67/388) greater than properties without a structure. Figure 9 shows properties that were able to receive the full interest rate, as when the high bid was multiplied by 12% the result was less than the starting bid at the tax sale. This variable reflects the maximum interest payout of up to 12% of the high bid after 9 months from the auction date up to the starting bid amount. The interest paid out by the Florence County, South Carolina, government cannot exceed the starting bid. Tax map number 00048-03-003 was an example of this. The starting bid for the property was 208 USD. The high bid on the property, made by me, was 3,600 USD. This property was redeemed after 192 days or into the 3rd quarter. The interest percentage paid out in the 3rd quarter was 9%. The maximum interest that could have been earned if not limited by the starting bid value was an interest payout of 324 USD (0.09*3,600). Since the starting bid was 208 USD, the high bidder received 208 USD in interest, or a 5.8% (208/3,600). A check from Florence County, South Carolina in the amount of 3,804 (208+3,600) was sent to the high bidder after the property was redeemed by the original owner. The scenario illustrates how a 3%, 6%, 9%, or 12% return is not guaranteed if a high bidder bids more than 8.33 ((Starting Bid/.12)/Starting Bid) times the starting bid of the property. This scenario could have occurred in 14.9% (126/843) of the

properties that went to auction and 18.6% (126/676) of the properties that received a bid, should they not have been redeemed.

Figure 7

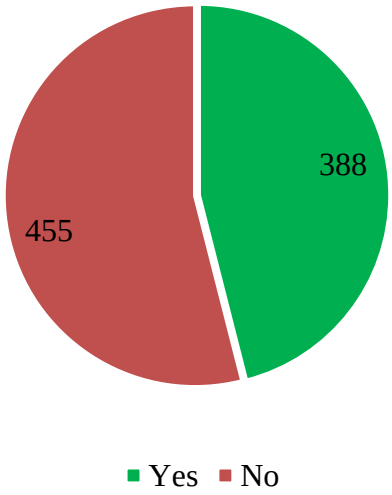
Population Taxes due Prior to 2016



Note. *N* = 843.

Figure 8

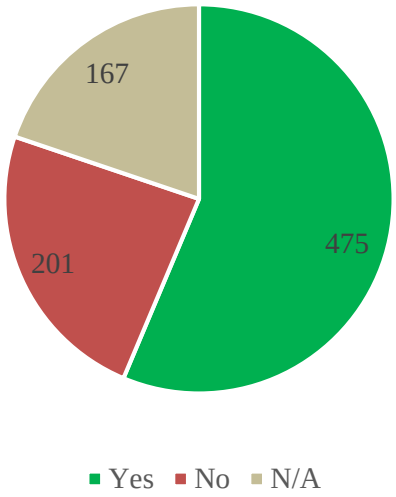
Population Structure on Property



Note. $N = 843$.

Figure 9

Population 12% of the Final Bid was Less than Starting Bid



Note. N = 843.

Table 5

Population Descriptive Statistics for Select Nominal Model Variables

Variable	Yes	No	No Bid	Total
Taxes due Before 2016	20.9%	79.1%	N/A%	100.0%
Structure on Property	46.0	54.0	N/A	100
12% of the Final Bid was Less than Starting Bid	56.3	23.8	19.8	99.9

Note. N = 843.

Research Question 1

Do relationships exist between or among interest earned for redeemed tax sale properties in Florence County, South Carolina, and the starting bid, highest bid, and time elapsed until the property was redeemed?

Descriptive Statistics

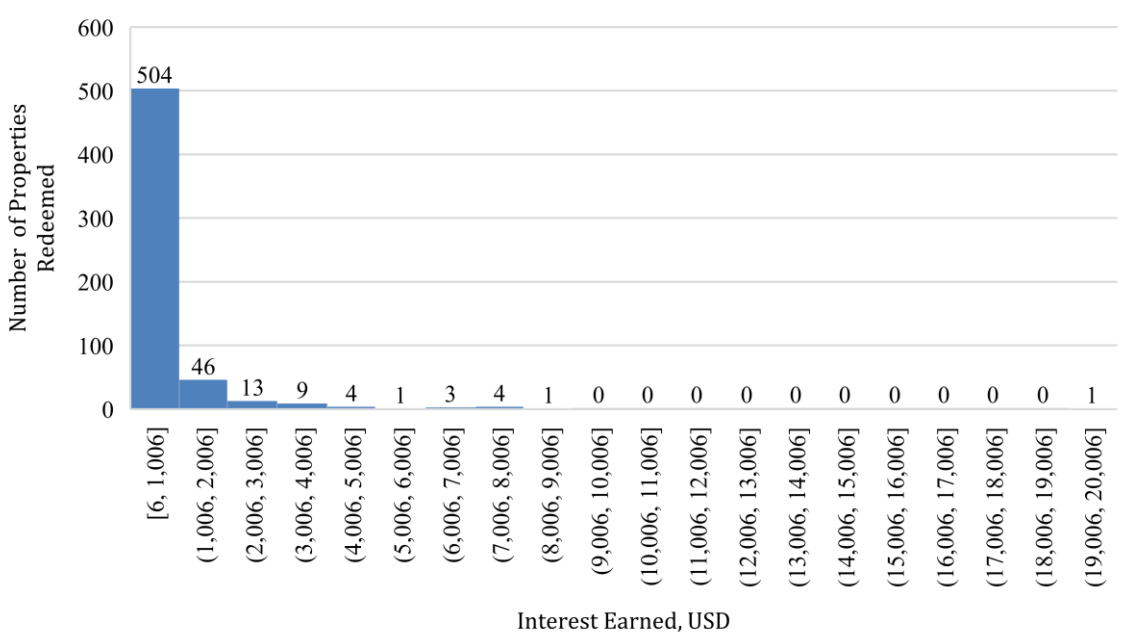
Visualizing the model variables in graphic form aids in understanding and transparency (Postma & Goedhart, 2019). The seven figures that follow represent the model variables in RQ1, where relationships are explored between or among interest earned for redeemed tax sale properties in Florence County, South Carolina, and the starting bid, highest bid, and time elapsed until the property was redeemed. Only one of the four variables had a standard deviation less than the sample mean, suggesting a large variation within three of the other model variables (Livingston, 2004). It was difficult to visualize these data via graphic means when sample values are clustered together but also have a small number of values exhibiting a large difference from the mean. In the three model variables that exhibit this behavior, a second figure was created that eliminates the highest 10% of the values, which are the cause of a significant variation. These plots allow for easier visual interpretation of the majority of the samples specific to each variable.

Figures 10 (n = 586) and 11 (n = 528) are frequency distribution histograms of the dependent variable where the interest earned by the high bidder on redeemed properties is shown. Figure 10 shows the amount of interest earned by each of the 586 properties. 678 properties were redeemed by the original owners out of 843 properties that were part of

the tax sale. The number of properties that did not receive bids were 92 out of 678 did not receive bids; thus no interest was paid out by the County since there was no high bidder. Figure 10 shows that 86.0% (504/586) of the interest earned was between 6 and 1,006 USD. Adding an additional 1,000 USD to this interval, yielding values between 6 and 2,006 USD, shows that 93.9% (550/586) of interest data falls within these two intervals of the plot. Figure 11 shows the same data but with the highest 10% of the observations eliminated to provide more granularity. The revised figure yields a much better visual assessment of the data, clearly showing a flattening of the curve, or “long tail”, after 600 USD of interest has been reached. Figure 11 also shows that a relatively small range of the first four intervals, 6 – 206 USD, make up almost half of all interest earned by high bidders (49.3%; 289/586).

Figure 10

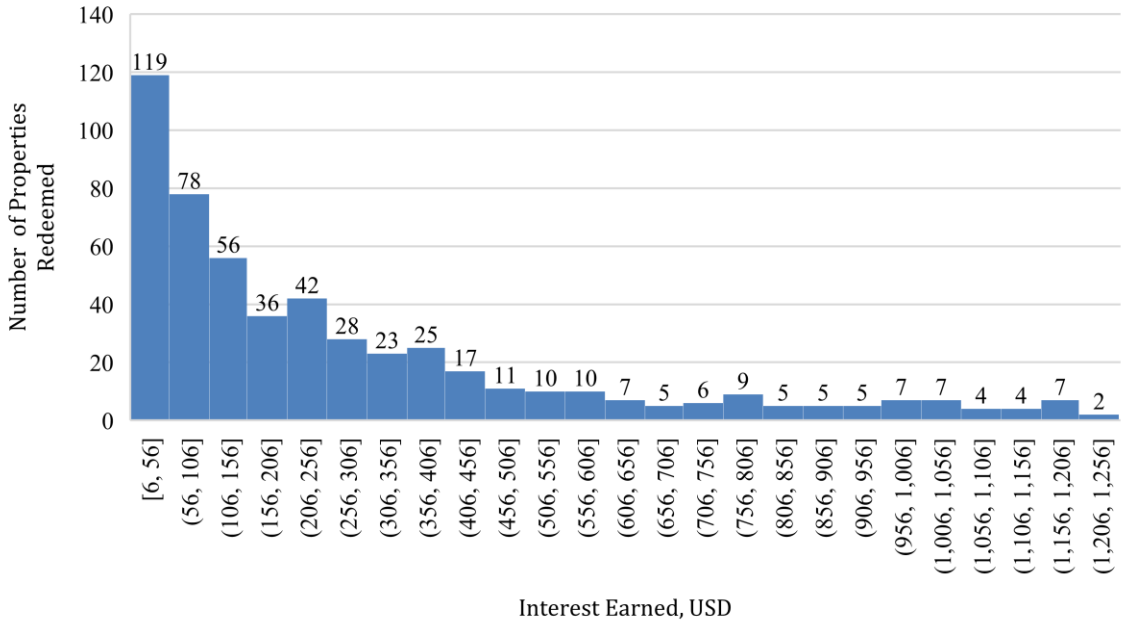
Interest Earned on a Tax Deed, USD



Note. n = 586.

Figure 11

Lowest 90% of Interest Earned on a Tax Deed, USD



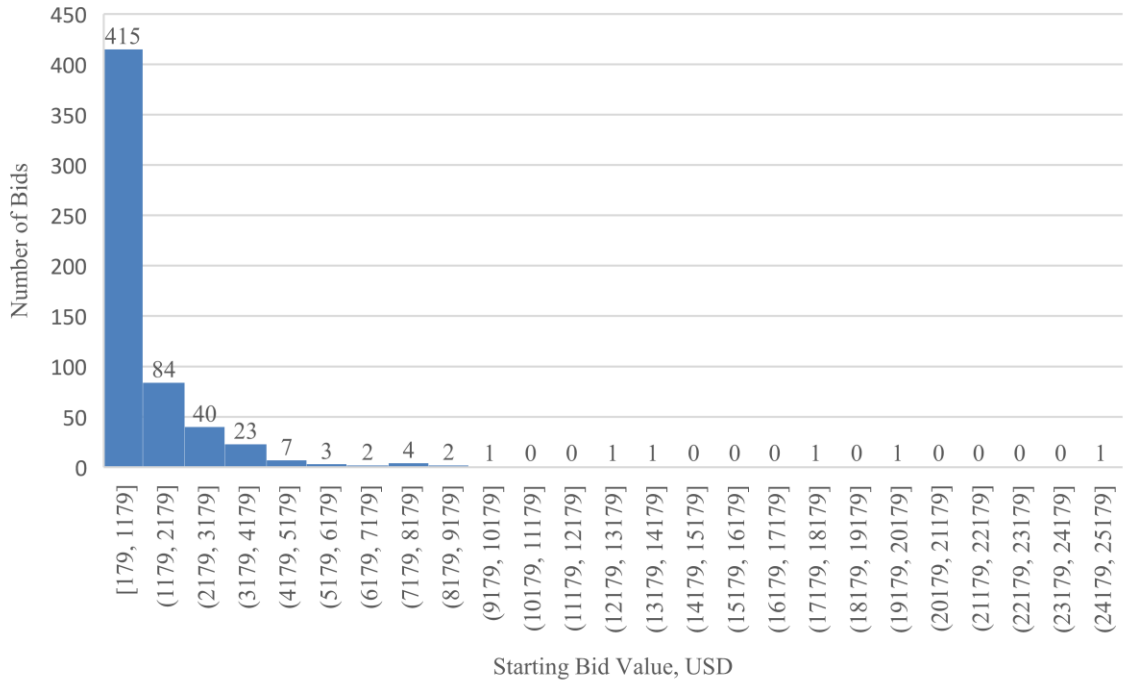
Note. $n = 528$.

Figures 12 ($n = 586$) and 13 ($n = 528$) are frequency distribution histograms of the independent variable that plot the starting bid value for redeemed properties. These data are a subset of Figure 3 ($N = 843$) as 165 properties were not redeemed by their owner and 92 properties did not receive bids and thus were eliminated when linear multiple regression was performed on these variables. Figure 12 shows that 70.8% (415/586) of the starting bids are between 179 and 1,179 USD, a 1,000 USD range. Adding an additional 1,000 USD to this interval, yielding values between 179 and 2,179 USD, shows that 85.1% (499/586) of the data falls within two intervals of the plot. Figure 13 shows the same data but with the highest 10% of the observations eliminated to provide more granularity. This yields a much better visual assessment of the data, clearly showing

that the first three 100 USD intervals represent the most common ranges of a starting bid equating to 33.1% (194/586) of all starting bids for the auction. This range of values has an initial bid price between 179 and 479 USD, as set by the Florence County, South Carolina, Treasurer to recoup unpaid taxes and fees.

Figure 12

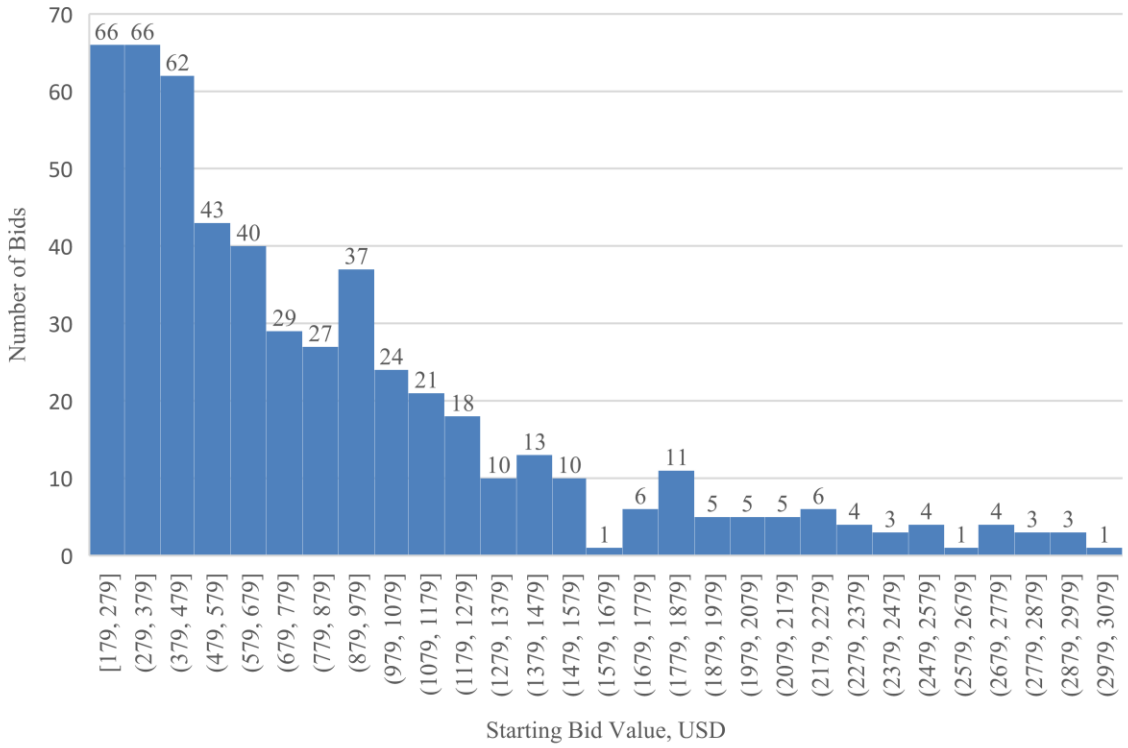
Starting Bid Value, Redeemed Properties, USD



Note. n = 586.

Figure 13

Lowest 90% of Starting Bid Value, Redeemed Properties, USD



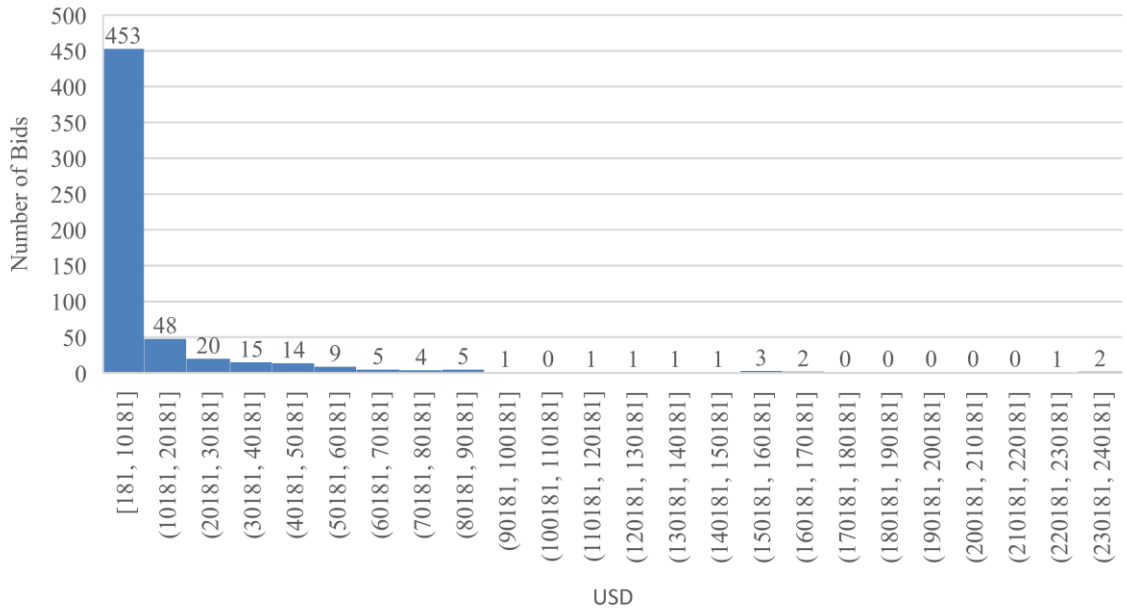
Note. n =528.

Figures 14 (n = 586) and 15 (n = 528) are frequency distribution histograms of the independent variable that plot the high bid value for redeemed properties. These data are a subset of Figure 4 (N = 843) as 165 properties were not redeemed by their owner and 92 properties did not receive bids, thus were eliminated, listwise, when linear multiple regression was performed on these variables. Figure 14 shows that 77.3% (453/586) of the high bids are between 181 and 10,181 USD, a 10,000 USD range. Adding an additional 10,000 USD to this interval, yielding values between 181 and 20,181 USD, shows that 85.5% (501/586) of the data fall within two intervals. The remaining 14.5% of

the high bids are spread between the intervals of 20,181 and 240,181 USD, a 220,000 USD range. Figure 15 shows the same data but with the highest 10% of the observations eliminated to provide more granularity. This yields a much better visual assessment of the data, clearly showing the first 1,000 USD interval (181 - 1,181 USD) represents the most common range of a high bid, 29.7% (174/586). A flattening of the curve was also evident beyond 12,181 USD.

Figure 14

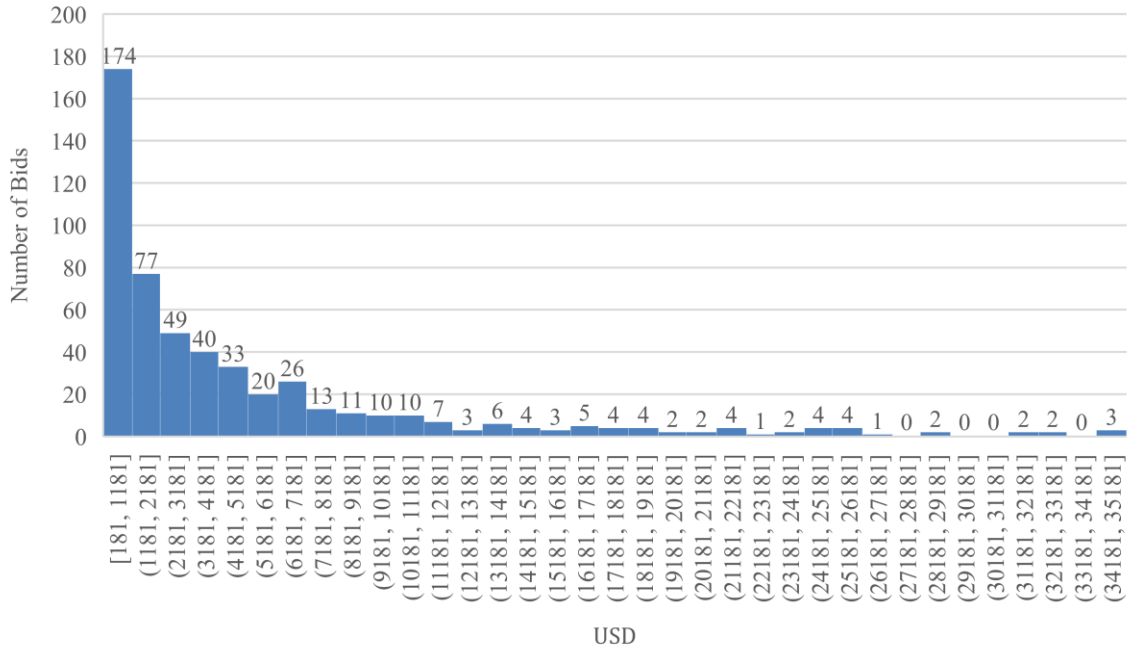
High Bid Value, Redeemed Properties, USD



Note. n =586.

Figure 15

Lowest 90% of High Bid Value, Redeemed Properties, USD



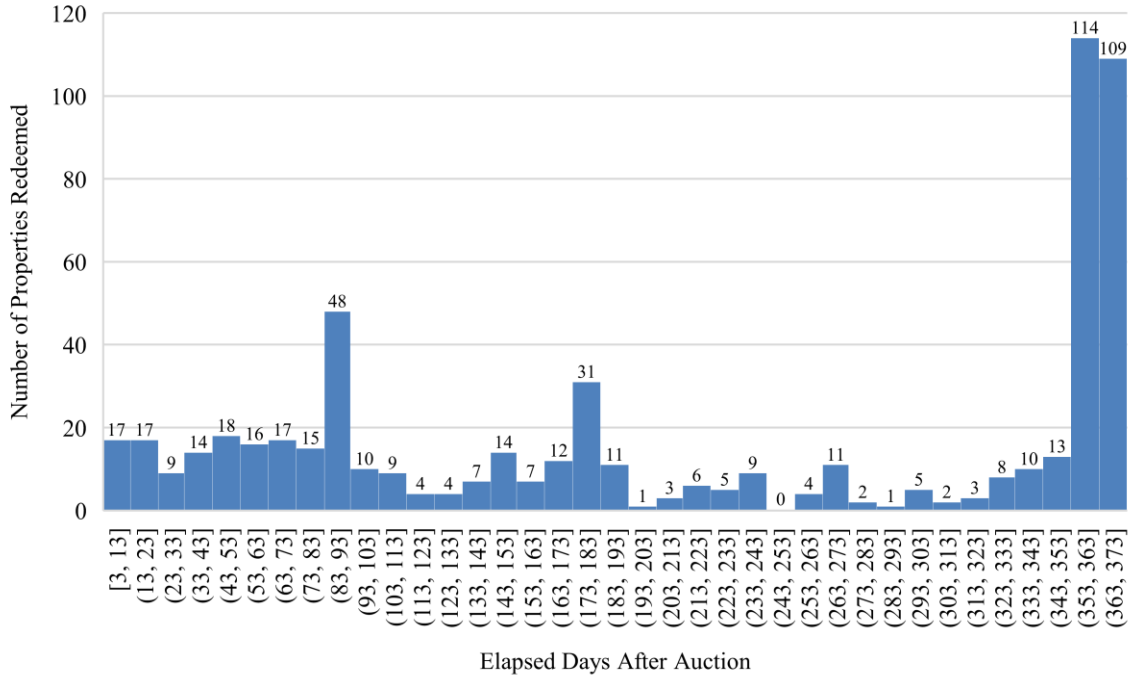
Note. n =586.

Figure 16 (*n* = 586) was a frequency distribution histogram of the independent variable that plots the number of days from when the delinquent tax auction took place until the property was redeemed by the original owner. The importance of this variable relates to the percentage of interest earned by the high bidder: 3%, 6%, 9%, or 12% depending on when the redemption takes place, up to the value of the starting bid. Figure 16 shows that 38.1% (223/586) of the redemptions occur approximately one year after the auction, just before the expiration of the redemption period. Should these properties not be redeemed by their owner, the deed to the property would be transferred to the high bidder. This figure also shows that it was common for owners to wait until the end of a 3-month period after the auction to pay their past-due taxes and fees, just before the fees

incurred went up by an additional 3% of the high bid value. Figure 16 shows an uptick in redemptions at the 90, 180, 270, and 360+ day mark within the 10-day intervals of the plot.

Figure 16

Days Elapsed Between Auction and Redemption



Note. n =586.

A quantitative summary of the previous seven figures was shown in Table 6, Descriptive Statistics for Model Variables, RQ1. Table 6 confirms the large variance within each model variable with the exception of the number of days between the end of the auction and the redemption of the property by the original owner. While the mean interest earned by a high bidder was 589 USD, the median value was only 210 USD, indicating that half of all bidders that earned interest were at or below this 210 USD.

Table 5 can be somewhat misleading. The high bid, for example, shows a mean value of 12,511 USD while the median was considerably less at 3,000 USD. Figure 15 shows that 29.7% of the high bids fell into a range of 181 – 1,181 USD. This range was 90.6% (11,330/12,511) to 98.6% (12,330/12,511) less than the mean of 12,511 USD. A similar lack of granularity exists with the number of days past the auction date until a property was redeemed. The descriptive statistics data yield no information about the previously discussed redemptions that occur with a high rate at the end of each quarter (see Figure 16). The number of days it takes a property to be redeemed did show the least variation about the mean compared to any of the other model variables.

Table 6

Descriptive Statistics for Model Variables, Research Question 1

Variable	*n*	Minimum	Maximum	*M*	*Mdn*	*SD*
Interest earned	586	$6	$19,200	$589	$210	$1,324
Starting bid	586	179	24,787	1,313	720	2,060
High bid	586	181	240,000	12,511	3,000	28,551
Elapsed days for redemption	586	3 days	366 days	223 days	231 days	133 days

Multiple Linear Regression Statistical Assumptions

The sample size in this study was equal to the population and represented an important aspect of the research design. Since the entire population was known and measured, the basis for generalization from the sample was eliminated (Lakens, 2022). The relevance of sampling and classical statistical assumptions are diminished due to the lack of inference required. A confidence interval does not need to be calculated because the effect size of the population was known (Lakens, 2022). No randomization of the data

was performed since the entire population was used, minimizing the importance of estimates of error as resulting probabilities will not be projected from the sample to a population (Montgomery et al., 2021). Evaluation of statistical assumptions is relevant in this study to test the robustness of the model. Identifying and understanding any violations of statistical assumptions for the 2017 Florence County, South Carolina, tax sale model variables provides insight into how applicable the model may be for other county tax sales in South Carolina and in future years. When linear regression has been used in research, there has been a lack of clarity for statistical assumptions found in 92% of resulting publications (Ernst & Albers, 2017). Prior to addressing the assumptions made in this study, an investigation of outliers within the data was made. The statistical assumptions explored in association with the multiple linear regression model for this study included multivariate normality, linear relationships, lack of multicollinearity, independence of errors, and homoscedasticity (Ernst & Albers, 2017; Field, 2018).

Figure 17 was a histogram of the standardized residuals which shows the deviation from a normal distribution. The values shown are the residuals from the independent variables' prediction of the dependent variable's value, converted to scores of a mean of zero and a standard deviation of one, a Z-Score. While not a normal distribution, there was a higher frequency of smaller residuals as shown by the peak extending above the expected normal curve with several values being far from the mean, indicating a large variance within the model. A perfectly normal distribution correlates to 68.2% of the data falling within one standard deviation of the mean. The data yields 91.1% (534/586) of the residuals falling within one standard deviation about the mean,

validating how closely grouped the residuals are about the mean. Two standard deviations from the mean accounts for 95.7% (561/586) slightly exceeding the 95.4% expectation for a normal distribution. The model begins to show a failure to accurately predict expected values of interest as it approaches three standard deviations from the mean as 98.5% (577/586) of the data are within this group but 99.7% are expected. This indicates that instead of 0.3% of the data being beyond three standard deviations from the mean, 1.5% of the actual data exceed this value.

Figure 17

Standardized Residuals, ZRE_1

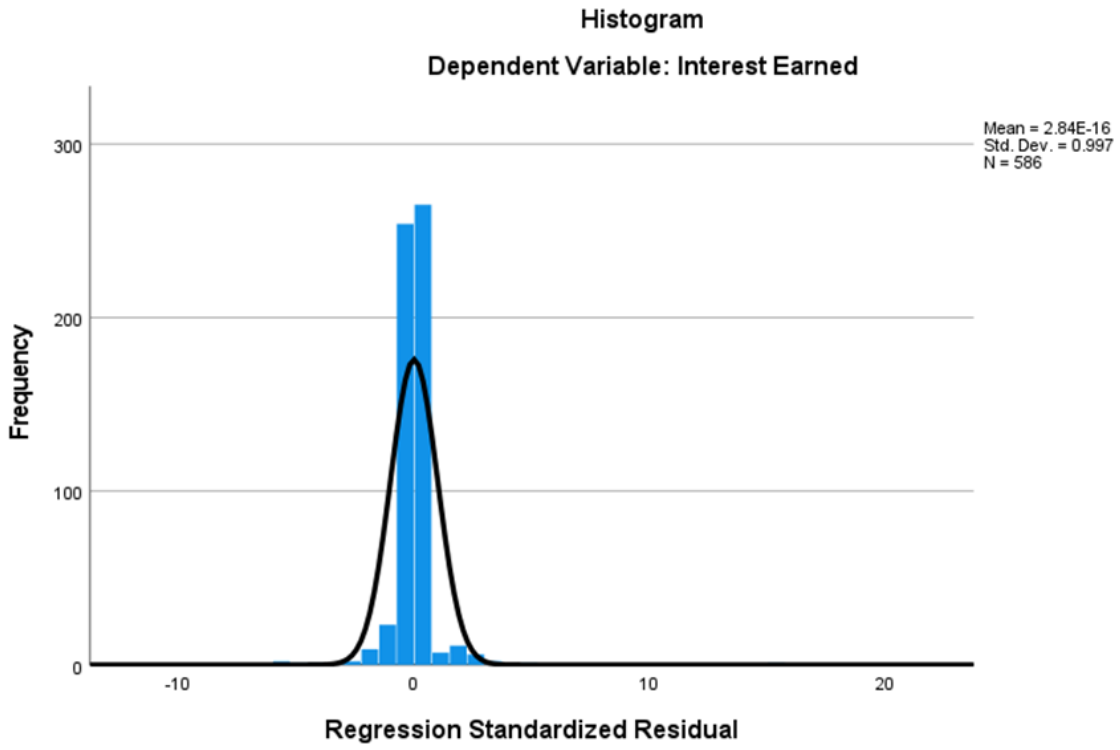
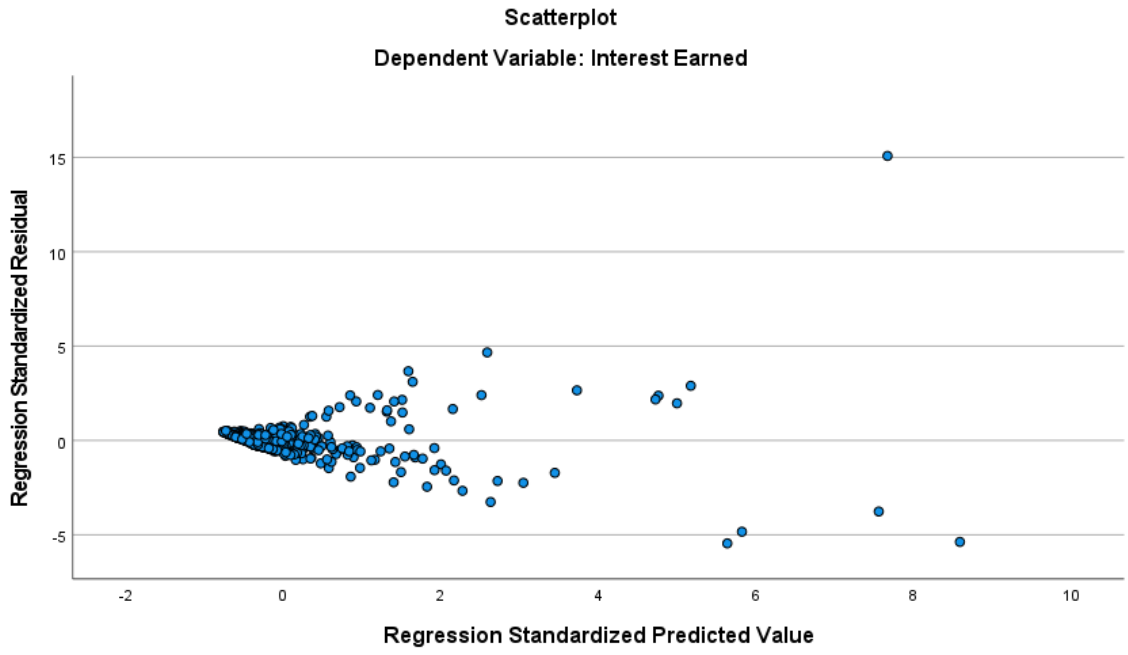


Figure 18 was a scatterplot of the regression standardized predicted values compared to the regression standardized residual values for the model variables of research question two. This figure clearly shows a very high concentration of the 1,172 data points across 586 records grouped within approximately one standard deviation about the mean of zero. Several data points are very far from the mean including one standardized residual equal to approximately 15 standard deviations away from the mean. This data point and others greater than three standard deviations from the mean are not outliers but represent the model's lack of robustness with the four model variables when attempting to fit the actual results from the delinquent tax sale. In testing for outliers, they are present but are confirmed events within the full population.

Figure 18

Standardized Predicted vs. Residual Values



There are very large differences in the standardized residual as well as predictor values, which may not clear the assumption of independence and constant variance, discussed in the Statistical Testing and Analysis section. Investigation of the standardized residual and predictor values shows 91.6% (1074/1172) are within one standard deviation of the mean where only 68.2% of the data would be located if this were a perfectly normal distribution. Two standard deviations from the mean accounts for 96.1% (1126/1172) slightly exceeding the 95.4% expectation for a normal distribution. The model begins to show a failure to accurately predict expected values of interest as it approaches three standard deviations from the mean as 98.2% (1151/1172) of the data are within this group but 99.7% are expected. This indicates that instead of 0.3% of the data being beyond three standard deviations from the mean, 1.8% of the actual data exceed this value. Exploring the data that are greater than three standard deviations from the mean yields information regarding where the model failed to predict the dependent variable of interest earned. All data points that have a standardized predicted value (ZPR_1) or a standardized residual value (ZRE_1) greater than three standard deviations from the mean are shown in Table 7.

Table 7

Predicted or Residual Values Exceeding 3σ from the Mean

Record number	Interest earned	Starting bid	High bid	Elapsed days for redemption	Unstandardized predicted value, PRE_1	Standardized predicted value, ZPR_1	ZPR_1 greater than 3σ from the mean	Unstandardized residual, RES_1	Standardized residual, ZRE_1	ZRE_1 greater than 3σ from the mean
63	3,586	3,586	240,000	97	7,108	5.63	Yes	-3,522	-5.451700	Yes
102	7,050	17,988	235,000	31	10,521	8.59	Yes	-3,471	-5.373740	Yes
569	4,200	24,787	35,000	365	7,323	5.82	Yes	-3,123	-4.833750	Yes
586	6,900	13,501	230,000	87	9,331	7.56	Yes	-2,431	-3.762610	Yes
446	1,530	13,098	17,000	185	3,635	2.63	No	-2,105	-3.258020	Yes
296	2,667	2,667	141,000	27	4,115	3.05	Yes	-1,448	-2.241820	No
157	3,470	3,470	140,000	233	4,577	3.45	Yes	-1,107	-1.713560	No
328	7,644	7,644	170,000	183	6,370	5.00	Yes	1,274	1.972860	No
66	7,461	7,461	160,000	183	6,054	4.72	Yes	1,407	2.177610	No
65	7,632	7,632	160,000	183	6,097	4.76	Yes	1,535	2.375410	No
427	6,619	6,619	125,000	184	4,901	3.73	Yes	1,718	2.658960	No
101	8,446	8,446	170,000	183	6,572	5.17	Yes	1,874	2.900600	No
90	4,500	4,763	50,000	239	2,491	1.64	No	2,009	3.110030	Yes
508	4,800	4,974	40,000	349	2,428	1.59	No	2,372	3.672140	Yes
567	6,600	7,868	55,000	365	3,585	2.59	No	3,015	4.667360	Yes
441	19,200	19,938	160,000	364	9,458	7.67	Yes	9,742	15.079650	Yes

Table 7 shows 12 ZPR_1 values and 9 ZRE_1 values that exceed plus or minus three standard deviations from the mean yielding 1.8% (21/1172) of the population. In five instances the same record had both the ZPR_1 and ZRE_1 score exceeding three standard deviations from the mean, yielding 16 unique records having at least one standardized predictor or residual value exceeding three standard deviations, or 2.7% (16/586) of the records in the population. Of the four variables in the model, only the independent variable of elapsed days for redemption showed no noticeable clustering of violations within the data.

Interest Earned, the dependent variable for RQ1, shows the model fails when the value becomes high. Sorting all of the 586 records from the largest amount of interest earned to the smallest shows that the highest 9 out of 9 records are greater than three

standard deviations from the mean and 12 out of the top 13 records also exceed three standard deviations from the mean. The highest 46 records for interest earned encompass all 16 records that exceed three standard deviations from the mean. The lowest 92% (540/586) of interest earned had no outliers based on the model's calculations. The first outlier occurs when interest was at 1,530 USD while after 3,470 USD, 14 out of the remaining 19 largest interest earned values are greater than three standard deviations from the mean.

Starting Bid, an independent variable, shows the model also fails when this value becomes high. Sorting all of the records from the largest amount of starting bid value to the smallest shows that the highest 4 out of 4 bids were greater than three standard deviations from the mean for both the predictor and residual values. Further, the first five records sorted by highest starting bid all had at least one predictor or residual that exceeded three standard deviations from the mean, as did the first 11 out of 14 records, beginning with a starting bid of 6,619 USD.

High Bid, an independent variable, also shows the model fails when this value was high. Sorting all of the records from the largest amount of high bid value to the smallest indicates that the highest 11 out of 11 bids were greater than three standard deviations from the mean for at least one predictor or residual values. All high bids of 125,000 USD and over violated the model with four of the records having violations for predictor and residual values.

A reason this model fails at the higher values was that interest earned cannot exceed the starting bid per state law. Regardless if a bidder was to earn 3%, 6%, 9%, or

12% of their bid on redeemed property, South Carolina state law limits the amount of the interest earned on a property to be no greater than the starting bid, which the model does not account for. In 50% (8/16) of the records with at least one predictor or a residual value greater than three standard deviations from the mean, the interest earned by the high bidder was equal to the starting bid. In summary, if the high bid was 125,000 USD or above, the starting bid was 13,098 USD or above, and if the interest earned was at or above 6,600 USD, the model had a 100% likelihood of forecasting the predictor and/or the residual value to be greater than three standard deviations from the mean.

Statistical Testing and Analysis

Small sample sizes minimize the generalizability should outliers be present in the data, causing the possibility of assumptions associated with multiple linear regression tests to be violated (Hickey et al., 2019; Knief & Forstmeier, 2021). Outliers have been confirmed within this study as well as the possibility of the data not being normally distributed. Knief and Forstmeier (2021) found that even when outliers are present, models created by parametric tests such as multiple linear regression were still found to be predominantly objective and accurate. Parameter estimates created by the model have resulted in predicted and residual Z-scores that vary up to 15 standard deviations from the in one record and 2.6% of the Z-scores between 3 and 9 standard deviations from the mean. Given that the sample size was much larger than 10, if a violation of normality did exist, it was unlikely to cause an appreciable change in results (Schmidt & Finan, 2018). To further explore the assumptions associated with multiple regression modeling, the following statistical tests and analyses were performed: multivariate normality, linear

relationships, lack of multicollinearity, independence of errors, and homoscedasticity (Ernst & Albers, 2017; Field, 2018).

Multivariate Normality. The purpose of this assumption and resulting tests are to ensure that all of the model variables' residuals are normally distributed around zero (Ernst & Albers, 2017; Montgomery et al., 2021). All errors from the regression model should be normally distributed. Figure 18 visualizes the distribution from a qualitative perspective, yielding the potential for nonnormality. Table 8 shows descriptive statistics for normality and Table 9 provides Kolmogorov-Smirnov and Shapiro-Wilk outputs. Four quantitative values from three tests that measure normality are unsupported for the multiple linear regression model in this study. Kurtosis was measured at 94.2 indicating a very high value due to the aforementioned outliers. Skewness was measured at 5.4 indicating a much smaller impact compared to kurtosis. Mishra et al., (2019) give guidance for large sample sizes of > 300, that the skewness with a value of ±2.0 for $p <$ .05 was acceptable and kurtosis ±4.0 for $p < .05$. Both kurtosis and skewness exceed the maximum allowable values for normality. The Kolmogorov-Smirnov and Shapiro-Wilk both show an output of < .001 which was less than $p < .05$. This was a statistically significant test result for both measures, resulting in the null hypothesis being rejected. The model was not normally distributed based on the aforementioned values (Montgomery et al., 2021). Since normality has been violated, a Box-Cox transformation could be used to create a normal shape by a transformation of the dependent variable (Hickey et al., 2019). This transformation was not done as this study's sample size was

the whole population. The multivariate normality assumption does not appear to have been fully met.

Table 8

Standardized Residual Descriptive Statistics for Normality

Statistic	Value
Mean	.0000
5% Trimmed Mean	-.0207
Median	-.0003
Variance	.995
Std. Deviation	.99743
Minimum	-5.45
Maximum	15.08
Range	20.53
Interquartile Range	.52
Skewness	5.439
Kurtosis	94.176

Note. n = 586.

Table 9

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
Attribute	Statistic	*df*	Sig.	Statistic	*df*	Sig.
Standardized Residual	.243	586	<.001	.559	586	<.001

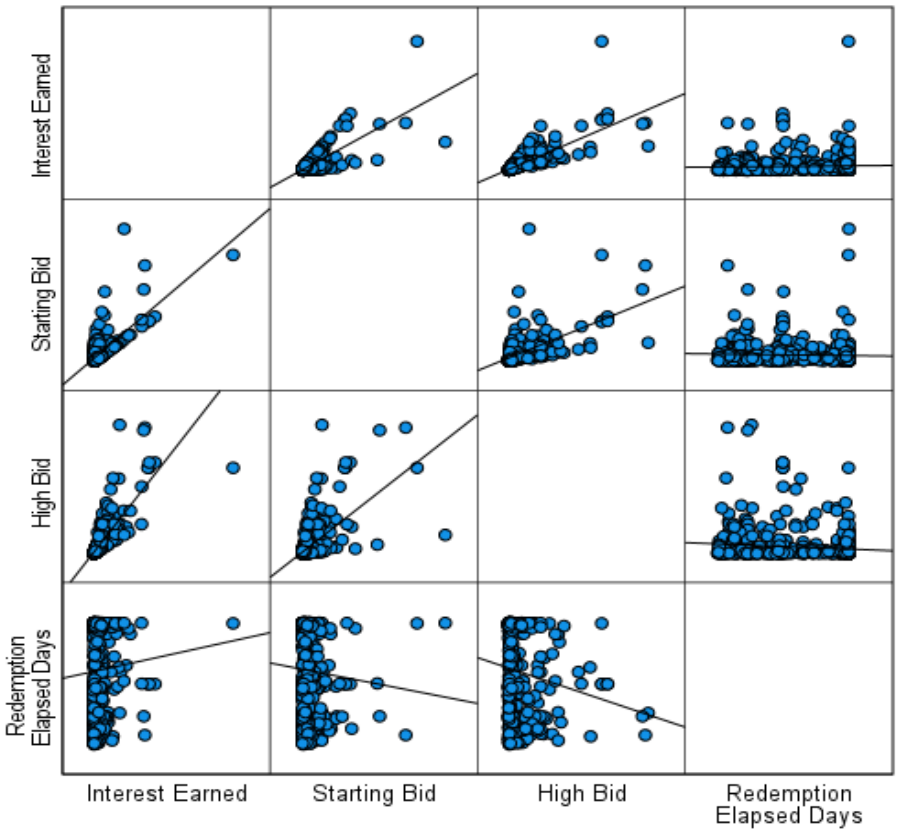
Note. n = 586.
[a]Lilliefors significance correction.

Linear Relationships. The purpose of this assumption and the resulting test was to ensure that a linear relationship exists between each of the three independent variables and the dependent variable (Montgomery et al., 2021). A scatterplot for each of the

independent variables and the dependent variable was shown in Figure 19, in the form of a matrix. A linear curve was added to each matrix block. Visual inspection of the data demonstrate a linear relationship between variables in their current functional form, the most prominent being Starting Bid/Interest Earned, High Bid/Interest Earned, and High Bid/Starting Bid. The model's resulting standard errors and coefficients appear to be reliable (Schielzeth et al., 2020). The linearity assumption appears to have been fully met.

Figure 19

Linear Relationship Matrix



Note. n = 586.

No Multicollinearity. The purpose of this assumption and the resulting test are to ensure that none of the independent variables are highly correlated with other

independent variables (Montgomery et al., 2021). When two or more independent variables have a linear relationship or collinearity, the model is deemed to have multicollinearity (Ernst & Albers, 2017). Table 10 shows the coefficient correlations between the independent variables with values of -.124, -.045, and .600. The strongest correlation exists between the starting bid and high bid variables, having a Pearson Correlation Coefficient of .600. Collinearity was unlikely to exist as the maximum value of .600 was less than .800 (Shrestha, 2020). A collinearity value of 0.800 or above represents a significant relationship (Senaviratna & Cooray, 2019). Table 11 shows the tolerance and variation inflation factor (VIF). All of the independent variables have a VIF of < 4, indicating that multicollinearity was not present; thus no variables need to be dropped from this model (Daoud, 2017; Hickey et al., 2019; Senaviratna & Cooray, 2019). The possibility of having the independent variables not conforming to a model and having nonlinear dependencies was minimal (Ernst & Albers, 2017). The lack of multicollinearity assumption appears to have been fully met.

Table 10

Coefficient Correlations

Variable	Test attribute	Starting bid	High bid	Redemption elapsed days
Starting bid	Pearson Correlation	1	.600[a]	-.045
	Sig. (2-tailed)		<.001	.243
	N	843	676	678
High bid	Pearson Correlation	.600[a]	1	-.124[a]
	Sig. (2-tailed)	<.001		.003
	N	676	676	586
Redemption elapsed days	Pearson Correlation	-.045	-.124[a]	1
	Sig. (2-tailed)	.243	.003	
	N	678	586	678

[a]Correlation was significant at the 0.01 level (2-tailed).

Table 11

Collinearity Coefficients

		Collinearity Statistics	
Model	Variable	Tolerance	VIF
1	Starting Bid	.626	1.598
	High Bid	.618	1.619
	Redemption Elapsed Days	.984	1.017

Note. Dependent variable: interest earned, VIF = Variable inflation factor.

Independence of Errors. The purpose of this assumption and the resulting test was to ensure that each observation, the residual value, and the variable, were independent and there was no concern for autocorrelation (Montgomery et al., 2021). The Durbin-Watson test examines errors in the model for serial correlations (Field, 2018). This resulting statistic should be between 0 and 4, preferably between 1 and 3, and have a somewhat normal distribution with a mean target value of 2 (Field, 2018; Uyanto, 2020).

The value of the Durbin-Watson output was 1.954 (see Table 12). The sample size was considered large for this test, and the results remain valid (P. Turner, 2020). The difference in the observed Durbin-Watson statistic and the target was 0.046, which was acceptable. The independence of errors assumption appears to have been fully met.

Table 12

Durbin-Watson Model Summary

Model	*R*	R^2	Adjusted R^2	Std. error of the estimate	Durbin-Watson
1	.803 [a]	.645	.644	790.07290	
2	.863 [b]	.744	.743	671.12407	
3	.874 [c]	.763	.762	646.00359	1.954

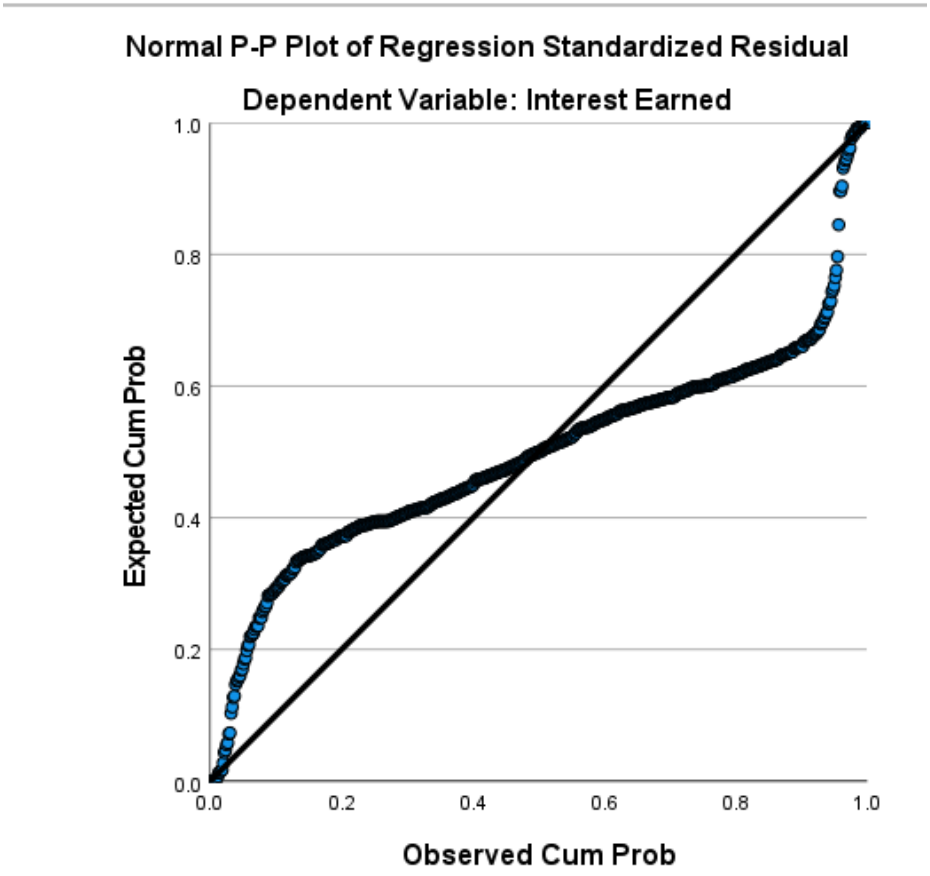
Note. Dependent variable: interest earned.
[a]Predictors: (Constant), high bid.
[b]Predictors: (Constant), high bid, starting bid.
[c]Predictors: (Constant), high bid, starting bid, redemption elapsed days.

Homoscedasticity. The purpose of this test was to ensure that there was a consistent variance of residuals for any amalgamation of independent variables throughout the linear model (Montgomery et al., 2021). For a multiple linear regression model, all of the independent variables should have resulting errors from the model distributed equally (Hickey et al., 2019). Figure 18, which plotted standardized predicted vs. residual values should appear to have a box-type shape, without a discernable pattern and commonality in the location of the points (Đalić & Terzić, 2021; Ernst & Albers, 2017). The horizontal cone shape of the data indicate that the data do not exhibit homoscedasticity, but exhibits heteroscedasticity (Hickey et al., 2019). Figure 20 shows the Probability-Probability (P-P) plot of the empirical vs. theoretical values, which also shows heteroscedastic behavior. The scatterplot in Figure 18 clearly shows that the errors

are not homogenous. As noted in the discussion, the model fails to account for large starting bids, high bids, and interest earned, explaining the shape of the P-P plot. The homoscedasticity assumption does not appear to have been fully met.

Figure 20

Normal P-P Plot



Hypothesis Testing

To approach RQ1, “Do relationships exist between or among interest earned for redeemed tax sale properties in Florence County, South Carolina, and the starting bid, highest bid, and time elapsed until the property was redeemed?”, a multiple linear

regression analysis was conducted to evaluate the prediction of interest earned from the starting bid, highest bid, and days elapsed until the property was redeemed. Table 13, an analysis of variance (ANOVA), shows the observed and predicted distributions for n = 586 records from N = 843 with 257 cases being excluded listwise. The missing cases were due to missing data from properties redeemed by their owner and a lack of bids on properties. The F-statistic was large within this model, indicating variation between sample means relative to the variation within the samples (Montgomery et al., 2021).

Table 13

ANOVA

Model		Sum of squares	*df*	Mean square	*F*	Sig.
3	Regression	783043767	3	261014589	625	<.001[a]
	Residual	242880609	582	417320		
	Total	1025924376	585			

Note. Dependent variable: interest earned, n = 586.
c. Predictors: (Constant), High Bid, Starting Bid, Redemption Elapsed Days.

The results of the multiple linear regression analysis revealed a statistically significant association between interest earned from the starting bid, highest bid, and days elapsed until the property was redeemed. Table 14 shows the model summary for multiple linear regression of the variables. This model explains 76.3% of the variance in the interest earned dependent variable with 23.7% not being explained by the model variables. The Sig. F. Change result yields a value of < .001, which can also be considered the p-value for the model itself. Since the Sig. F Change was << p = .05, the model was statistically significant (Htway, 2016).

Table 14

Model Summary

						Change statistics			
Model	*R*	R^2	Adjusted R^2	Std. Error of the estimate	R^2 change	*F* change	*df*1	*df*2	Sig. *F* change
1	.874[a]	.763	.762	646.00359	.763	625.453	3	582	<.001

Note. Dependent variable: interest earned, *n* = 586, Predictors: (Constant), high bid, starting bid, redemption elapsed days.

Table 15 shows the coefficients of the model. Starting Bid, High Bid, and Redemption Elapsed Days are significant as $p < .001$ for each independent variable. None of the confidence intervals for unstandardized β include the value of zero. The predictor variables do not have a slope of zero anywhere in the population since $\beta \neq 0$.

Controlling for High Bid and Redemption Elapsed Days, the regression coefficient β = .253, 95% Confidence Interval (.221, .285) $p < .05$ associated with the Starting Bid suggests that each additional dollar increase in the Starting Bid will yield an increase in the Interest Earned by the high bidder of approximately 25.3 cents. The confidence interval associated with the regression analysis does not contain 0, which means the null hypothesis should be rejected, as there was no association between values in the Starting Bid and Interest Earned (Htway, 2016). Similar results were found for the second independent variable, High Bid.

Controlling for Redemption Elapsed Days and Starting Bid, the regression coefficient β = .027, 95% Confidence Interval (.025, .029) $p < .05$ associated with the High Bid suggests that each additional dollar increase in the High Bid will yield an increase in the Interest Earned by the high bidder by approximately 2.7 cents. The

confidence interval associated with the regression analysis does not contain 0, which means the null hypothesis should be rejected, as there was no association between values in the High Bid and Interest Earned (Htway, 2016). Similar results were found for the third independent variable, Redemption Elapsed Days.

Controlling for Starting Bid and High Bid, the regression coefficient $\beta = 1.387$, 95% Confidence Interval (.991, 1.783) $p < .05$ associated with the Redemption Elapsed Days suggests that with each additional day it takes for a property to be redeemed, the Interest Earned by the high bidder will increase by approximately 1.39 USD. The confidence interval associated with the regression analysis does not contain 0, which means the null hypothesis should be rejected, as there was no association between values in the Redemption Elapsed Days and Interest Earned (Htway, 2016).

Table 15

Coefficients

		Unstandardized Coefficients		Standardized Coefficients			95.0% Confidence Interval for B	
Model		B	*SE*	Beta	*t*	Sig.	Lower Bound	Upper Bound
1	(Constant)	-389.352	56.014		-6.951	<.001	-499.366	-279.339
	Starting Bid	.253	.016	.393	15.415	<.001	.221	.285
	High Bid	.027	.001	.580	22.602	<.001	.025	.029
	Redemption Elapsed Days	1.387	.202	.140	6.872	<.001	.991	1.783

Note. Dependent variable: interest earned, $n = 586$.

Post-Hoc Summary

A post-hoc analysis summary was performed for each of the individual hypotheses using the results from Table 15.

H_o1 There was not a statistically significant relationship between the interest earned for redeemed tax sale properties in Florence County, South Carolina, and the initial bid of the property at a delinquent tax sale.

H_a1 There was a statistically significant relationship between the interest earned for redeemed tax sale properties in Florence County, South Carolina, and the initial bid of the property at a delinquent tax sale.

First coefficient model: $t(586) = 15.415$, $p < .001$

Model outcome: Reject the null hypothesis, H_o1.

Result: A statistically significant relationship exists between the Starting Bid and Interest Earned.

H_o2 There was not a statistically significant relationship between the interest earned for redeemed tax sale properties in Florence County, South Carolina, and the highest bid of the property at a delinquent tax sale.

H_a2 There was a statistically significant relationship between the interest earned for redeemed tax sale properties in Florence County, South Carolina, and the highest bid of the property at a delinquent tax sale.

First coefficient model: $t(586) = 22.602$, $p < .001$

Model outcome: Reject the null hypothesis, H_o2.

Result: A statistically significant relationship exists between the High Bid and Interest Earned.

H_o3 There was not a statistically significant relationship between the interest earned for redeemed tax sale properties in Florence County, South Carolina, and the number of days after the tax sale owner redeems property.

H_a3 There was a statistically significant relationship between the interest earned for redeemed tax sale properties in Florence County, South Carolina, and the number of days after the tax sale owner redeems property.

First coefficient model: $t(586) = 6.872$, $p < .001$

Model outcome: Reject the null hypothesis, H_o3.

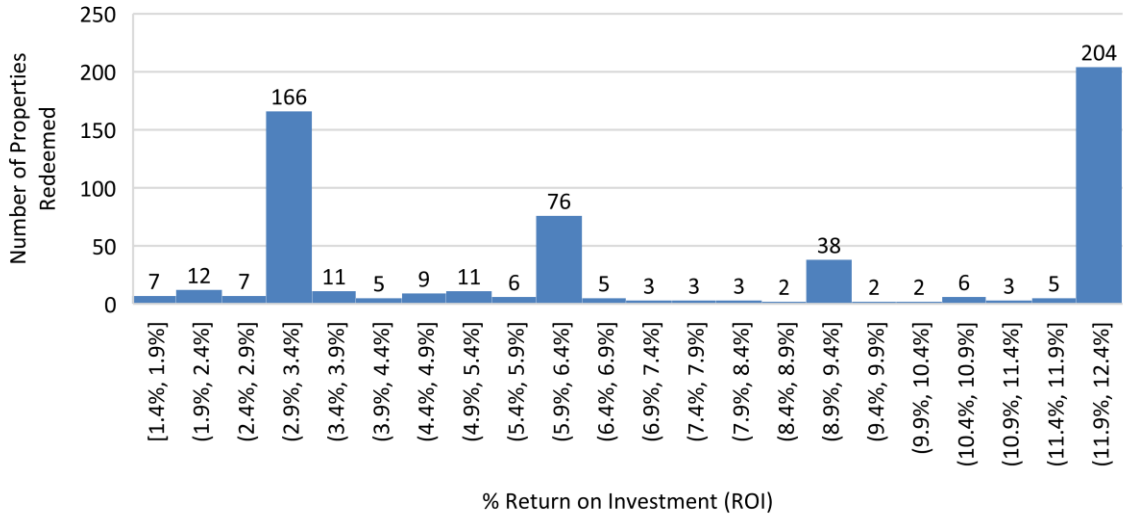
Result: A statistically significant relationship exists between the number of days after the tax sale the owner redeems their property and Interest Earned.

Additional Findings

Figure 21 was a histogram of interest earned as a percentage of high bid. This complements the Figure 2 "Results of Delinquent Tax Sale Properties in Florence County, South Carolina, 2017" flow chart, Figure 10 "Interest Earned on a Tax Deed", and Figure 11, "Lowest 90% of Interest Earned on a Tax Deed, USD", as the ROI was shown as a percentage and not a dollar value. The information can be valuable to a bidder when setting goals of interest earned at a tax sale. The data clearly show the ROI relationship to redemption percentages of 3%, 6%, 9%, or 12%, which are the payouts after each quarter following the tax sale. On average, the high bidder would expect to earn 7.4% of their bid if they are the highest bidder at the tax sale and the property is redeemed. For this analysis, the median value was 6.0% and the standard deviation was 3.9%.

Figure 21

Return on Investment (ROI) for Redeemed Property



Note. n =586.

Research Question 2

Do relationships exist between or among receiving a tax deed for nonredeemed tax sale properties in Florence County, South Carolina, and taxes being due prior to 2016, starting bid, highest/final bid, if 12% of the highest/final bid was less than the starting bid, assessed land value, if a structure was on the property, and the economic benefit to the high bidder?

Descriptive Statistics

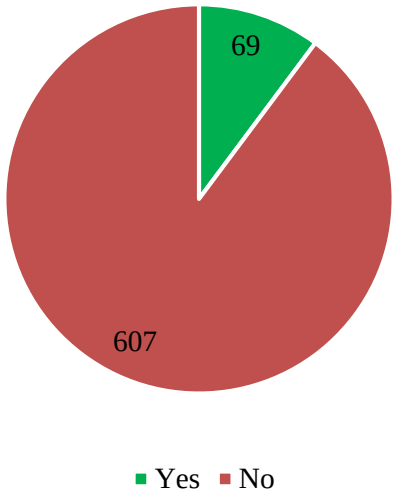
The importance of visualizing data in a research study was detailed in the RQ1 section earlier in this chapter as a precursor to the linear multiple regression analysis that was used for RQ1. RQ2 requires the same initial assessment of data, although the statistical analysis used for this research question was a multiple binary logistic

regression. Figures for the dichotomous variables are presented in Figures 22-25 and Table 16. Model variables include the dependent variable of Obtaining a Tax Deed by a High Bidder (DV2) and independent variables Taxes due Prior to 2016 (IV_1), 12% of the High Bid was Less Than the Starting Bid (IV_4), and Structure on Property (IV_6).

Figure 22, “Obtaining a Tax Deed by a High Bidder”, shows that if a bid was made on a property, the likelihood of the high bidder to receive a deed to the property was 10.2% (69/676). This can be important to a bidder, as they should expect to earn a tax deed on approximately 1 property out of 10 that they are high bid on, assuming the high bid was randomly distributed across all available properties. Alternatively, the high bidder should expect that 89.2% of their high bids will not result in receiving a tax deed due to the property being redeemed by the original owner, the tax sale being canceled, or the high bidder refusing to collect the deed.

Figure 22

Obtaining a Tax Deed by a High Bidder

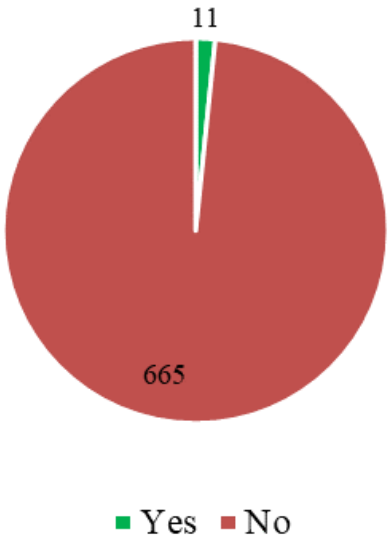


Note. n =676.

Figure 23, “Taxes due prior to 2016”, shows that only 1.6% (11/676) of the properties in the sample had current taxes as well as past taxes due on the property at the time of the auction. The taxes that were past-due prior to 2016 made up 20.9% (176/843) of the entire population. Just 6.3% (11/176) of the properties that had taxes past-due remained in the sample of 676 records being analyzed in this research question. These data indicated that over 93.7% (165/176) of the properties that had taxes owed from previous years did not have a bid, eliminating them from this sample of 676 properties.

Figure 23

Taxes due prior to 2016



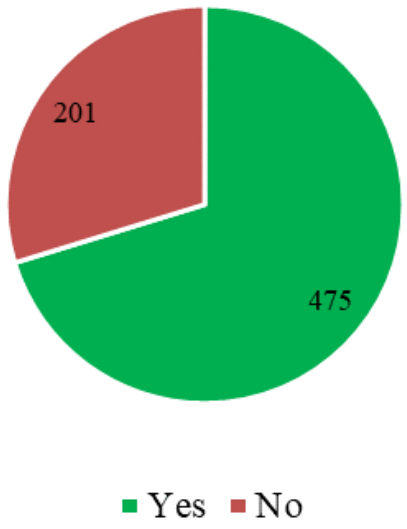
Note. n =676.

Figure 24, "12% of the High Bid was Less Than the Starting Bid" showed that 70.3% (475/676) of the samples had final bids that could maximize the amount of interest earned on a property should the owner not redeem to the final quarter, enabling the high bidder to earn the full 12% ROI on their bid amount. Conversely, 29.7% (201/676) of the bids in this sample received final bids that were higher than the maximum amount of interest potentially earned. First-time bidders, in particular, fall into the group that will earn less than a 12% annualized interest rate as the interest payout by the Florence County Treasurer's Office was limited to the starting bid value (Holsapple, personal communication, June 3, 2022). The assessed value and classification of the property impact the starting bid as annual taxes are based on the total property value and type of use. Farmland receives an agricultural exemption which lowers the taxable value of the

property. Tax map number 00066-36-005, part of this sample, has an assessed land value of 45,780 USD. Since it was farmland with an agriculture exemption, it was taxed at its land use value of 11,310.60 USD, corresponding to a 75.3% (34,469.40/45,780) reduction over owner-occupied residential housing. Due to the lower tax valuation compared to market value, the starting bid for this property would be about 24.7% (11,310.60/45,780) of normally assessed properties with a similar market value, increasing the likelihood that the final bid would not maximize the interest percentage received.

Figure 24

12% of the High Bid was Less Than the Starting Bid



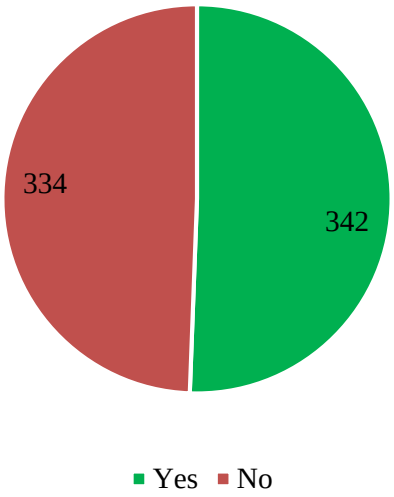
Note. n =676.

Figure 25, “Structure on Property”, shows 49.4% (342/676) of the records in this sample having some type of building on the property compared to 46.0% (388/843) of the

full population. The difference between the population and sample was small, with properties that do not have a structure present having 3.4% (49.4 - 46.0) fewer no-bids. Acquiring land without structures poses less risk to the investor at an auction, as the condition of a structure could significantly decline over the course of the redemption period, negatively impacting the overall value of the property (Mallach, 2018).

Figure 25

Structure on Property



Note. n =676.

Table 16, “Descriptive Statistics for Nominal Model Variables, Research Question 2” was a summary of the pie charts above. Although the table summarizes the dichotomous variables in Yes/No form, it gives insight into changes in the sample compared to the population, such as the large difference found in Figures 7 and 23 regarding the properties that went to auction which had taxes due prior to 2016. Understanding the likelihood of receiving a deed based on the characteristics of the

property was an important part of building a strategy prior to and when present at a delinquent tax sale.

Table 16

Descriptive Statistics for Nominal Model Variables, RQ2

Variable	Yes	No
Deed received	69 (10.2%)	607 (89.8%)
Taxes due Before 2016	11 (1.6)	665 (98.4)
12% of the final bid was less than starting bid	475 (70.3)	201 (29.7)
Structure on property	342 (49.4)	3340.6)

Note. $n = 676$.

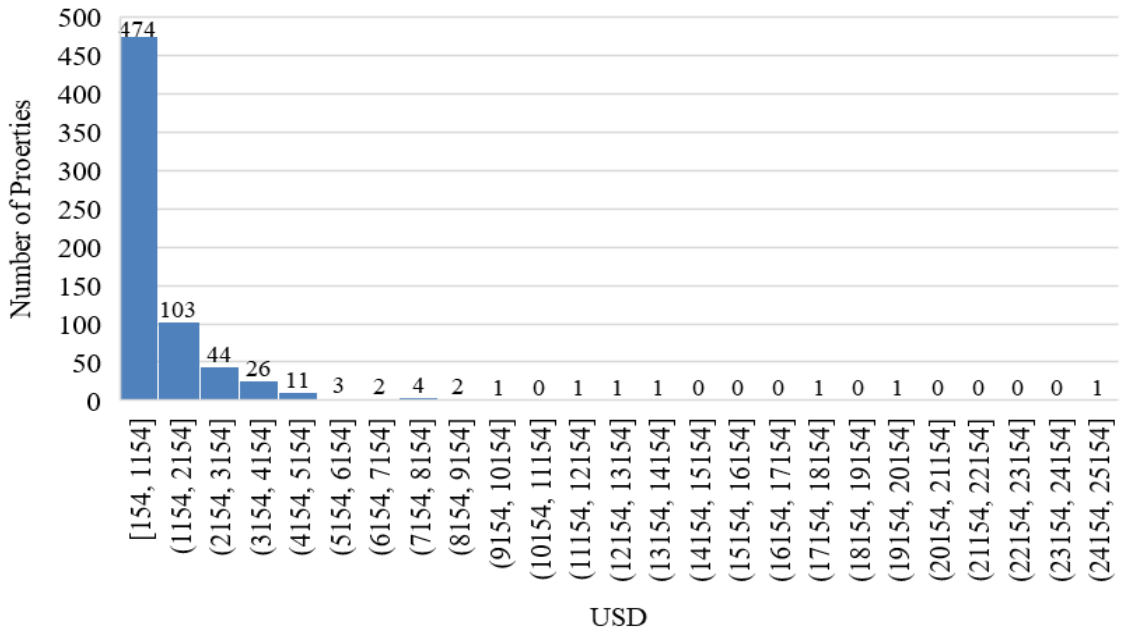
Figures for continuous variables are presented in Figures 26-33 and Table 17. Model variables include independent variables Starting Bid (IV_2), High Bid (IV_3), Assessed Land Value (IV_5), and Economic Benefit (IV_7). The descriptive statistics for each of RQ2's variables have a sample size of 676 (843-167) values. There are 167 missing values due to the lack of bids being placed during the auction, causing the High Bid, 12% of the High Bid was Less Than the Starting Bid, and Economic Benefit to have missing data. The full population of 843 values was previously explored in the Population Descriptive Statistics section.

Figures 26 ($n = 676$) and 27 ($n = 608$) are frequency distribution histograms of RQ2's independent variable that shows the starting bids for this sample. These data are a subset of Figure 3, Starting Bid ($N = 843$). Figure 26 shows the starting bids, equating to 80.1% (676/843) of all starting bids of the population. Figure 26 shows that 70.1% (474/676) of the starting bids were between 154 and 1,154 USD. Adding an additional 1,000 USD to this interval, yielding values between 1,154 and 2,154 USD, increases the

percentage of starting bids falling within these two intervals by 103 to 85.4% (577/676). Figure 27 shows the same data but with the highest 10% of the observations eliminated to provide more granularity. This yields a much better visual assessment of the data, clearly showing a flattening of the curve after 1,554 USD. These results are important to the attendees of an auction as it indicates approximately 85% of the starting bids where a deed could be obtained have a value of just over 1,500 USD each. One-third (32.8%, 222/676) of all starting bids of this sample had a value of 454 USD or less.

Figure 26

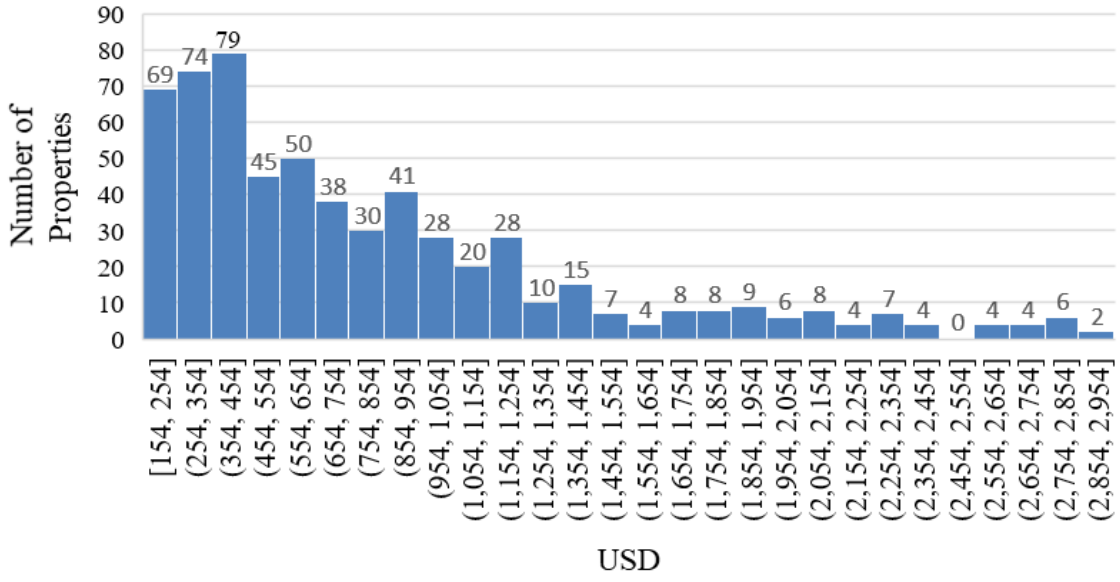
Starting Bid



Note. n =676.

Figure 27

Starting Bid, 90% of Samples

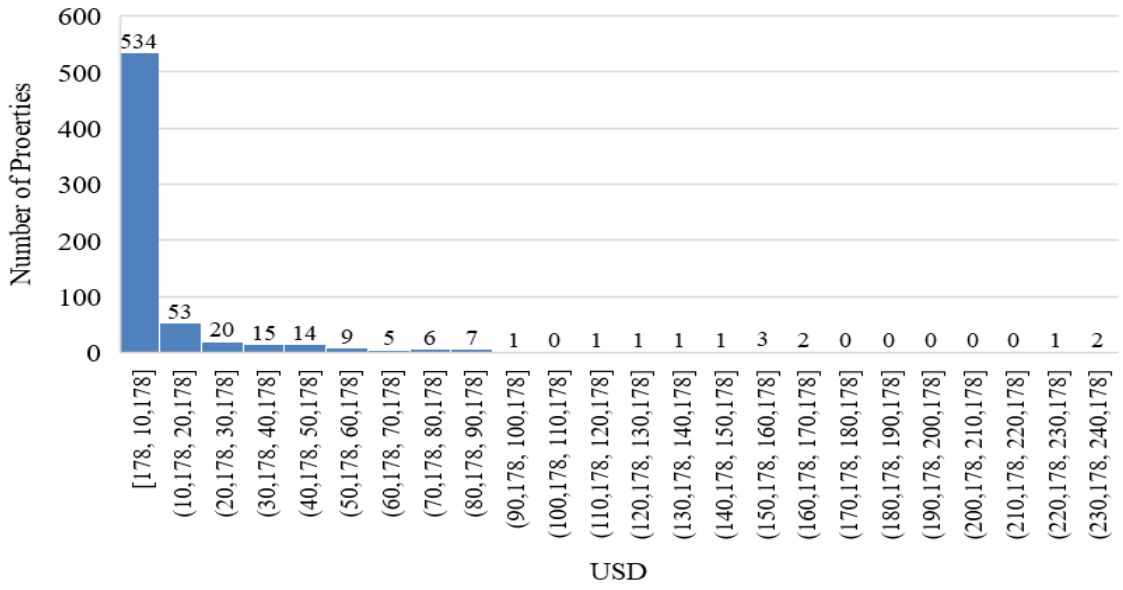


Note. n =608.

Figures 28 (*n* = 676) and 29 (*n* = 608) are frequency distribution histograms of RQ2‘s independent variable that shows the high bids for this sample. Figure 28 (*n* = 676) was identical to the full population, Figure 6, “Population High Bid” as the sample for this research question excludes missing data, such as no-bids. The “Population High Bid” figure can be examined more closely by eliminating the top 10% of the values, as shown in Figure 29, which creates a more detailed representation. Interval 178 – 1,178 USD has the largest number of high bids with 32.0% (216/676). These results are important for auction attendees. Should a bidder wish to participate in a tax sale, approximately one-third of the time the high bid will be equal to or less than 1,178 USD, yielding the opportunity to earn a tax deed or to earn interest on their bid at a reasonable price point.

Figure 28

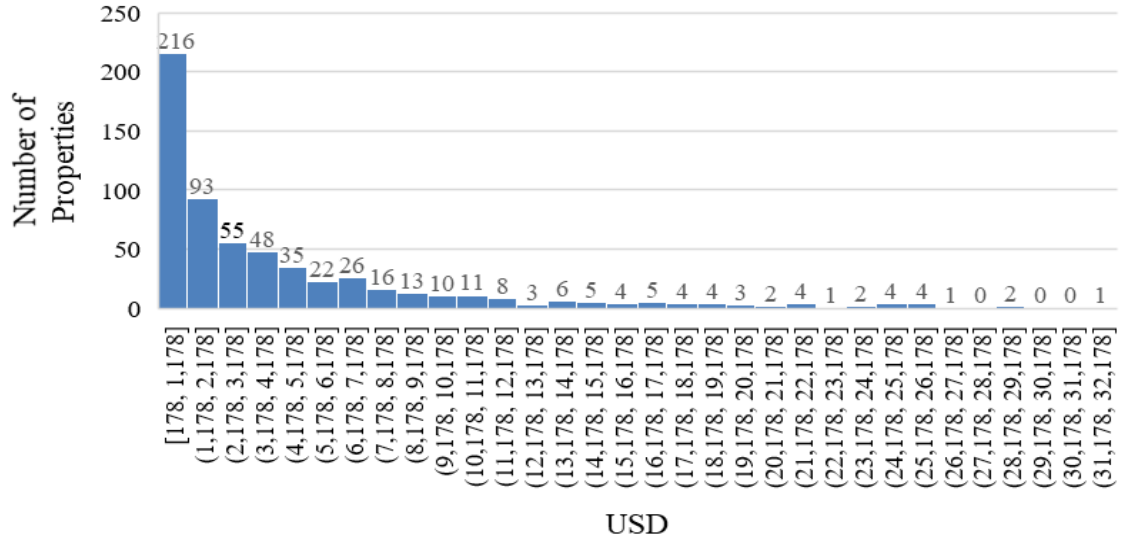
High Bid



Note. n =676.

Figure 29

High Bid, 90% of Samples

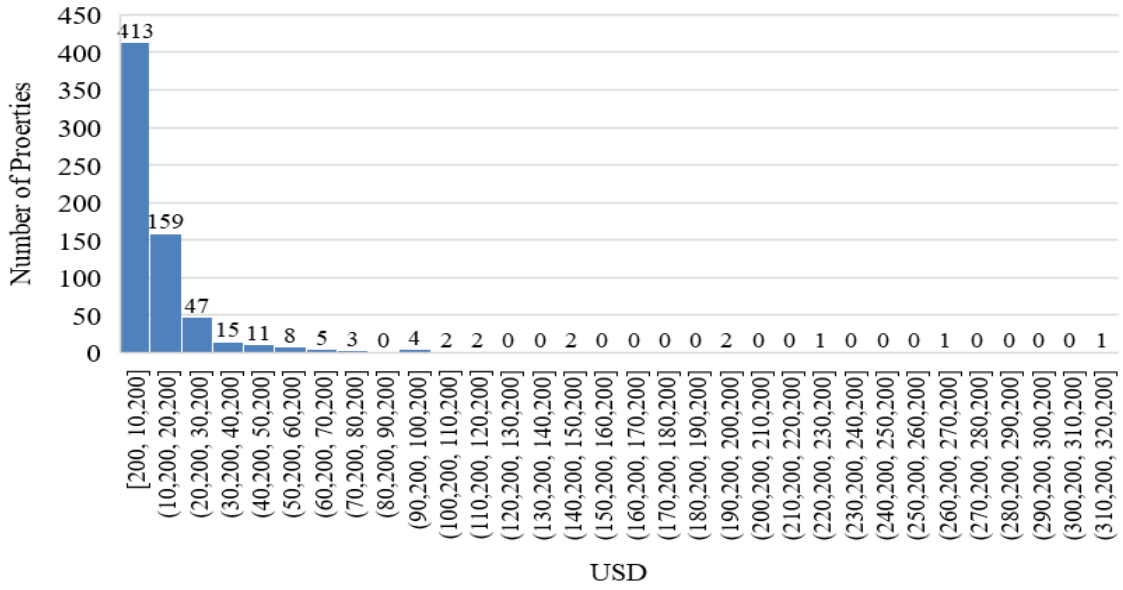


Note. n =608.

Figures 30 (n = 676) and 31 (n = 608) are frequency distribution histograms of RQ2‘s independent variable that shows the assessed land value for this sample. These data are a subset of Figure 5, “Population Assessed Land Market Value”. Figure 30 shows the assessed land-only value for each property, equating to 80.2% (676/843) of all starting bids within the population. Figure 30 shows that 61.1% (413/676) of the valuations were between 200 and 10,200 USD. Adding an additional 10,000 USD, (10,200 – 20,200) USD increases the percentage of land assessments to 84.6 % (572/676). One additional interval of 10,000 USD increases the number of land assessments to 91.6% (619/676) that fall between 200 and 0,200 USD. Figure 31 shows the same data but with the highest 10% of the observations eliminated to provide more granularity. This yields a much better visual assessment of the data, such as the highest concentration of land assessments, 18.5% (125/676) being between 3,200 and 5,200 USD. Land-only valuation gives important information about the property to be sold at a tax sale, which could help guide a bidder’s development of their ROI strategy.

Figure 30

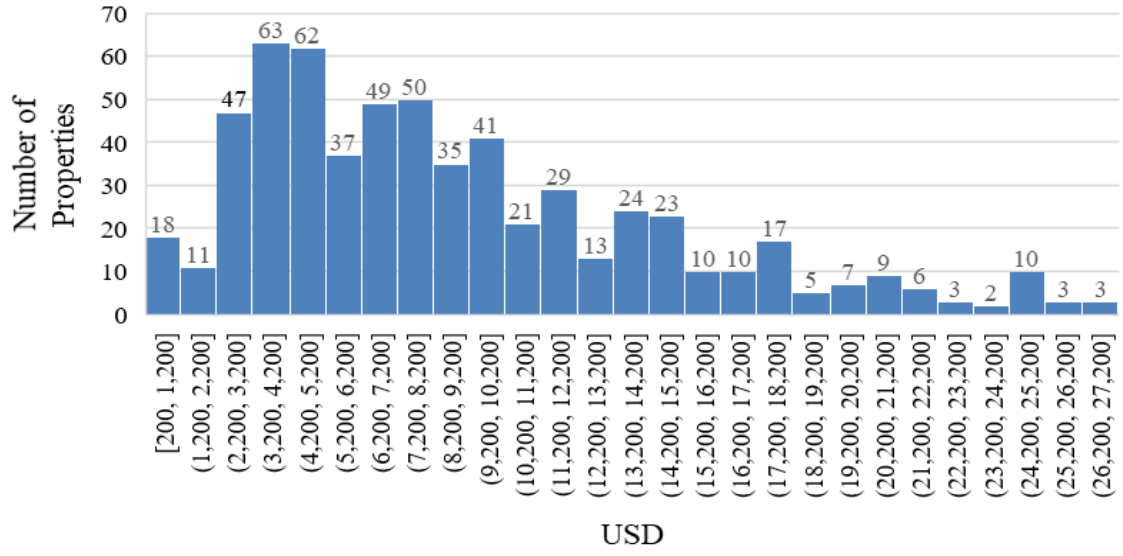
Assessed Land Value



Note. n =676.

Figure 31

Assessed Land Value, 90% of Samples

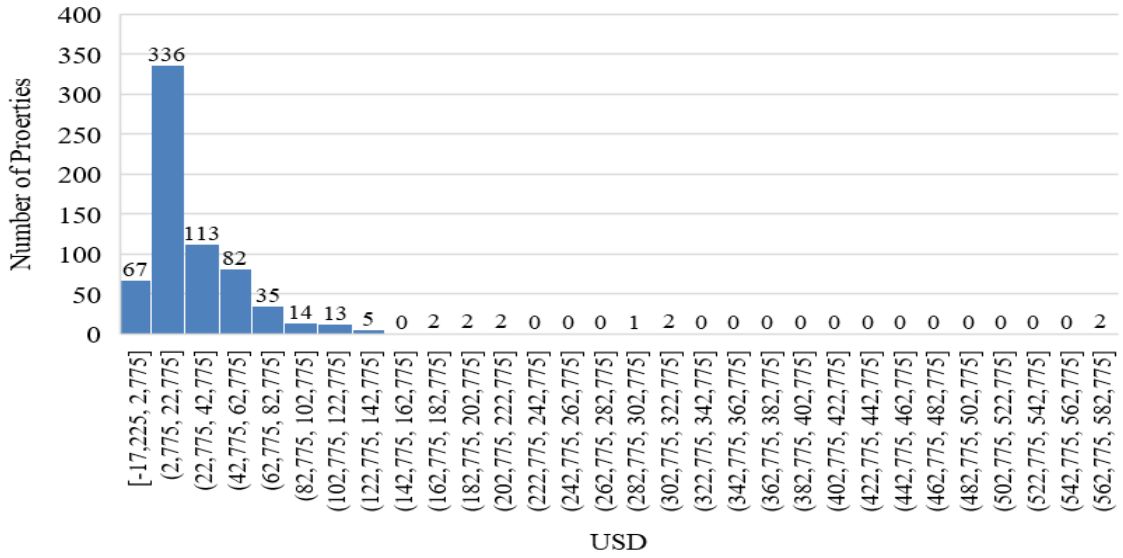


Note. n =608.

Figures 32 (n = 676) and 33 (n = 608) are frequency distribution histograms of RQ2‘s independent variable that shows the possible economic benefit to a bidder that receives a tax deed. Figure 32 (n = 676) was identical to the full population, Figure 6, “Population Possible Economic Benefit from Deed Acquisition” as the sample for this research question excludes incomplete or missing data, such as no-bids. Figure 32, “Economic Benefit” can be examined more closely by eliminating the top 10% of the values, which creates a more detailed representation (see Figure 33). One property out of the sample, if sold for the assessed value of the land and buildings, would result in an economic loss to the high bidder of -17,225 USD, the next lowest value being -1,890 USD. Two intervals, 2,775 – 5,275 USD and 5,275 – 7,775 USD contain the highest frequency properties, 77 and 71 records respectively, accounting for 21.9% (148/676) out of the sample and population.

Figure 32

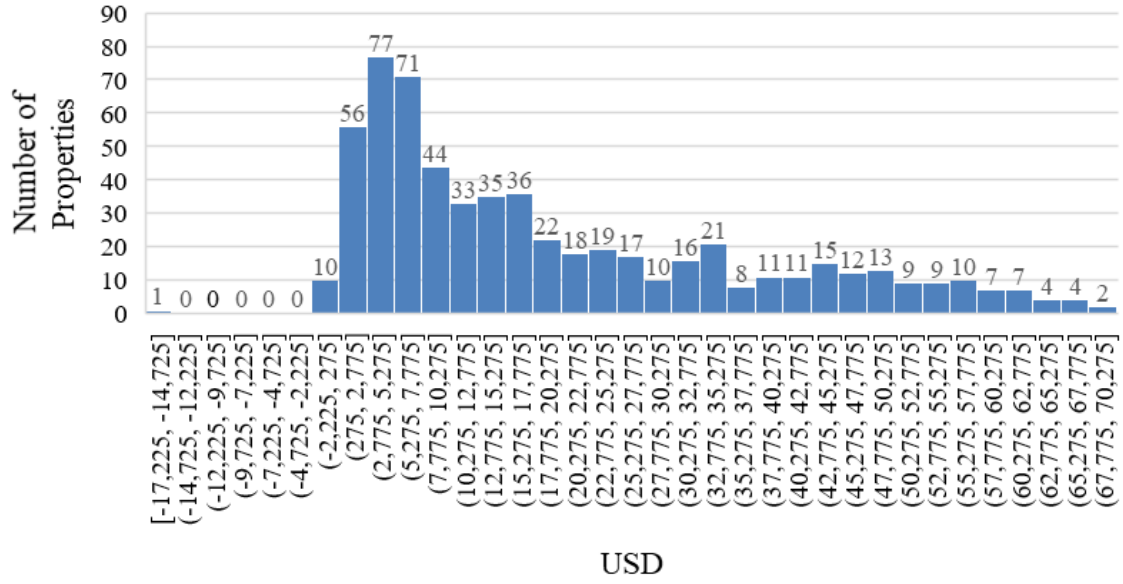
Economic Benefit



Note. n =676.

Figure 33

Economic Benefit, 90% of Samples



Note. n =608.

Table 17 shows the descriptive statistics of the continuous model variables for RQ2. Two of the variables' statistics are identical to the information discussed previously in the "Population Descriptive Statistics" section. Model variables High Bid and Economic Benefit, n = 676 and N = 843 have the same results as 176 records that did not have a bid within the total population, equaling the sample size used in this section after they were removed. Values for the starting bid within this sample are similar to those used for RQ1, increasing by 90 records from n = 586 to n = 676. A large variation was evident as the standard deviation was 1,995, or 55.4% (711/1,284) greater than the mean. The coefficient of variation (CV) was 1.55 (1995/1284). A CV > 1 confirms the existence of high dispersion within the population (Ospina & Marmolejo-Ramos, 2019). A CV > 1 exists for all four continuous variables within this sample. The assessed value of the land only for properties within this sample has a range of 311,895 USD (312,095 – 200). Both the mean, 14,296 USD, and the median, 8,305 USD show a skew shifted to the lower values of the sample, similar to all continuous variables in RQ1 and RQ2. The possible economic benefit, calculated by subtracting the high bid from the assessed value of the property, has a large range of 592,034 USD (574,809 – (-17,225)). The maximum value shows the upside potential of a high bidder that earns a deed could be as much as 574,809 USD. Only 1.0% (7/676) of the high bidders that could earn a deed would result in an economic loss to that bidder, up to 17,225 USD.

Table 17

Descriptive Statistics for Continuous Model Variables, RQ2

Variable	Minimum	Maximum	*M*	*Mdn*	*SD*
Starting bid	154	24,787	1,284	712	1,995
High bid	178	240,000	11,658	2,600	27,347
Land value	200	312,095	14,926	8,305	26,048
Possible economic benefit	-17,225	574,809	30,209	16,149	46,664

Note. $n = 676$.

Multiple Binary Logistic Regression Statistical Assumptions

The groundwork for statistical assumptions for RQ2 was similar to RQ1. The sample size was equal to the population after accounting for missing data. There was no randomization of these data as the full population was captured for the 2017 Florence County, South Carolina, delinquent tax sale. Data from the full population, yielding the effect size, eliminates the requirements for a confidence interval (Lakens, 2022). Although the entire population was known, identifying and understanding any violations of statistical assumptions for RQ2 are important for this model and potential relationships to the other 45 counties in South Carolina and different auction years. A multiple binary logistic regression model was the optimum model for RQ2 as it predicts a categorical outcome, the dichotomous dependent variable of receiving a tax deed or not, and is a function of predictors that are both categorical and continuous (Field, 2018). Normality and homoscedasticity are not required as the binary dependent variable is limited to two observed values (Field, 2018; Mertler et al., 2021). Assumptions for logistic regression include the following: 1) dependent variable was binary; 2) observations are independent; 3) no extreme outliers; 4) multicollinearity does not exist between independent variables;

5) sample size was sufficiently large; 6) a linear relationship exists the between logit transformation of the dependent variable and the continuous independent variables (Field, 2018; Mertler et al., 2021; Ranganathan et al., 2017).

Statistical Testing and Analysis

Validating the assumptions of these data for multiple binary logistic regression allows for hypothesis testing to determine the degree of relationships between receiving a deed and seven independent variables from the 2017 delinquent tax sale in Florence County, South Carolina, sampling the entire population. A result of the binary logistic regression model was mathematically predicting future outcomes, although a larger sample was required compared to multiple linear regression to properly represent all response categories (Mertler et al., 2021). Each of the six assumptions for logistic regression in the previous section has been tested with an analysis of findings.

Dependent Variable was Binary. Figure 22, "Obtaining a Tax Deed by a High Bidder" illustrates the binary nature of the dependent variable of receiving a tax deed. At a delinquent tax sale in Florence County, South Carolina, properties are subject to an auction in which the highest bidder becomes a lienholder should they be the highest bid. The sample of $n = 676$ includes all properties that received a bid, in which the property was redeemed by the original owner; thus the high bidder does not receive a deed, or the property was not redeemed and the high bidder receives the deed, assuming that the bidder retrieves the deed to the real estate through the Florence County Treasurer's Office. This yes/no outcome confirms that the dependent variable was dichotomous. The assumption that the dependent variable was binary appears to have been fully met.

Observations Are Independent. The predictor variables' observations should be independent of each other. A visual inspection of the dataset shows that none of the data are paired. There should be no matched or repeated data in the sample as well. To test independence between variables, Spearman's rho was used to evaluate possible relationships. All correlation coefficients that are equal to or greater than .7 or equal to or less than -.7 are deemed to be significant (Schober et al., 2018). Results that exceed these values in magnitude would be considered highly correlated and one of the variables of the pair would be considered for deletion from the model (Mertler et al., 2021). Table 18 shows that there are no values that violate the stated conditions, thus the observations are independent. The assumption that observations are independent appears to have been fully met.

Table 18

Correlation Coefficient Between Independent Variables

Statistic	Variable	Model Attribute	Deed received by high bidder	Taxes due from before 2016	Starting Bid	High bid	12% of the final bid is less than starting bid	2018 assessed land value	Structure is on property	Possible economic benefit to high bidder
Spearman's rho	Deed received by high bidder	Correlation coefficient	1.000	-.100[a]	-.073[b]	-.162[a]	.111[a]	-.116[a]	-.076[b]	-.173[a]
		Sig. (2-tailed)	.	.004	.034	<.001	.004	<.001	.027	<.001
		N	843	843	843	676	676	843	843	676
	Taxes due from before 2016	Correlation coefficient	-.100[a]	1.000	-.047	-.051	.083[b]	-.194[a]	-.193[a]	-.052
		Sig. (2-tailed)	.004	.	.175	.182	.031	<.001	<.001	.181
		N	843	843	843	676	676	843	843	676
	Starting bid	Correlation coefficient	-.073[b]	-.047	1.000	.631[a]	-.073	.411[a]	.634[a]	.695[a]
		Sig. (2-tailed)	.034	.175	.	<.001	.058	<.001	<.001	<.001
		N	843	843	843	676	676	843	843	676
	High bid	Correlation coefficient	-.162[a]	-.051	.631[a]	1.000	-.672[a]	.562[a]	.536[a]	.668[a]
		Sig. (2-tailed)	<.001	.182	<.001	.	<.001	<.001	<.001	<.001
		N	676	676	676	676	676	676	676	676
	12% of the final bid is less than starting bid	Correlation coefficient	.111[a]	.083[b]	-.073	-.672[a]	1.000	-.377[a]	-.210[a]	-.324[a]
		Sig. (2-tailed)	.004	.031	.058	<.001	.	<.001	<.001	<.001
		N	676	676	676	676	676	676	676	676
	2018 assessed land value	Correlation coefficient	-.116[a]	-.194[a]	.411[a]	.562[a]	-.377[a]	1.000	.111[a]	.536[a]
		Sig. (2-tailed)	<.001	<.001	<.001	<.001	<.001	.	.001	<.001
		N	843	843	843	676	676	843	843	676
	Structure is on property	Correlation coefficient	-.076[*]	-.193[a]	.634[a]	.536[a]	-.210[a]	.111[a]	1.000	.687[a]
		Sig. (2-tailed)	.027	<.001	<.001	<.001	<.001	.001	.	<.001
		N	843	843	843	676	676	843	843	676
	Possible economic benefit to high bidder	Correlation coefficient	-.173[a]	-.052	.695[a]	.668[a]	-.324[a]	.536[a]	.687[a]	1.000
		Sig. (2-tailed)	<.001	.181	<.001	<.001	<.001	<.001	<.001	.
		N	676	676	676	676	676	676	676	676

[a]Correlation is significant at the 0.01 level (2-tailed).
[b]Correlation is significant at the 0.05 level (2-tailed).

176

No Extreme Outliers. Descriptive statistics of the dataset show high values of variation, indicating numerous observations that are statistically distant from the mean. The observations furthest from the mean have not been eliminated from the sample as the sample size was equal to the population. These data also represent a small percentage of the population, $N = 843$. The assumption for extreme outliers has been checked against Mahalanobis and Cook's distance statistics, as shown in Table 19 (Leys et al., 2018). The maximum allowable Mahalanobis value was 22.46, based on 6 degrees of freedom and a critical alpha value of .001 (Tabachnick & Fidell, 2013). The observed maximum Mahalanobis distance of 241.53 exceeds the acceptable value of 22.46, indicating a violation of this assumption. Cook's distance requires a value of < 1 to confirm that there are no influential outliers in the sample (Dhakal, 2017). Additionally, a value of 4/n is a cutoff point, yielding a value of .006 (4/676) for this study (Leone et al., 2019). Cook's Distance has an observed value of .045, passing the assumption based on Dhakal (2017), but failing the assumption based on Leone et al. (2019). Figure 34 shows a scatterplot of Cook's Distance with the observation values clustered at 0, but with 2.8% (24/843) > .01 considered to be outliers as they are above .005 (4/843). The assumption that there are no extreme outliers appears to have not been met.

Table 19

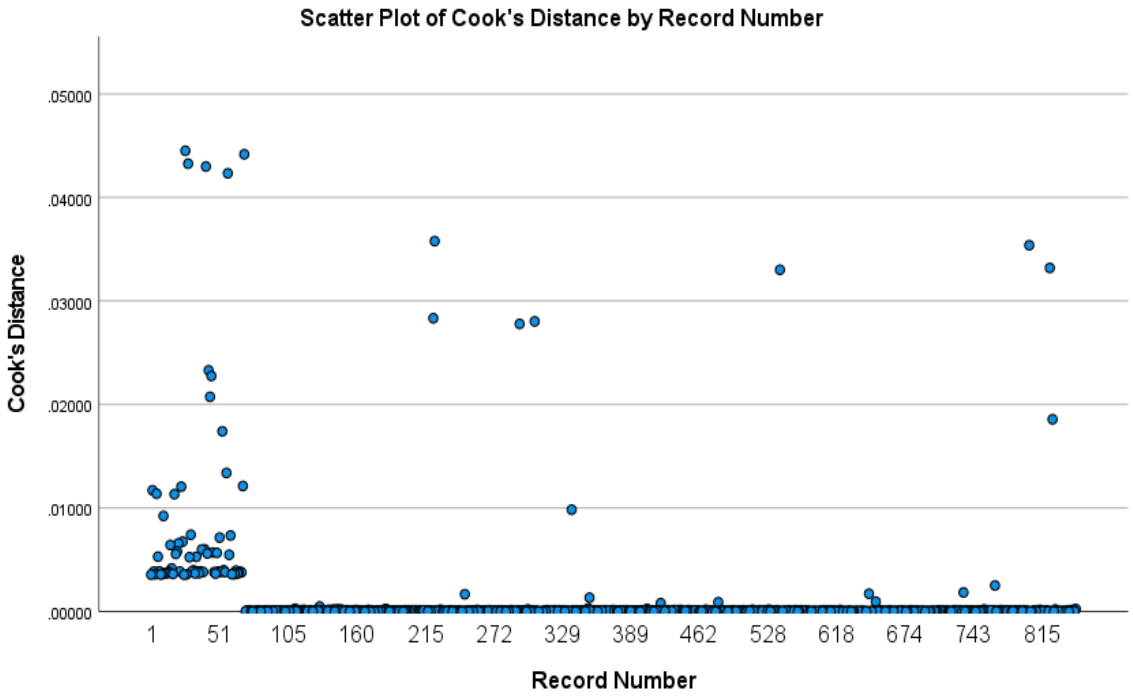
Multivariate Outlier (Residuals) Statistics

Statistic	Minimum	Maximum	*M*	*SD*	*n*
Mahal. Distance	1.288	241.530	6.990	19.495	676
Cook's Distance	.000	.045	.001	.005	676

Note. Dependent variable: deed received by high bidder.

Figure 34

Cook's Distance



Multicollinearity does not Exist Between Independent Variables.

Multicollinearity was tested by using tolerance and variable inflation factor (VIF) to evaluate if two or more independent variables are highly correlated (Field, 2018). If tolerance has a value of < .10 or VIF has a value of > 10, then a high degree of collinearity exists (Marcoulides & Raykov, 2019). Table 20, Collinearity Statistics, shows that there are no tolerance values $\leq$ .342 and there are no VIF values greater than 2.923. The assumption that multicollinearity does not exist between independent variables appears to have been fully met.

Table 20

Collinearity Statistics

Model	Variable	Collinearity Statistics	
		Tolerance	VIF
1	(Constant)		
	Taxes due from before 2016	.984	1.016
	Starting Bid	.373	2.680
	High Bid	.442	2.264
	12% of the Final Bid was Less than Starting Bid	.649	1.542
	2018 Assessed Land Value	.486	2.059
	Structure was on Property	.684	1.462
	Possible Economic Benefit to High Bidder	.342	2.923

Note. VIF = Variable inflation factor.

Sample Size. Logistic regression should have a sample size larger than linear regression to obtain conclusions from the fitted model (van Smeden et al., 2019). Field (2018) states that each independent variable should have at least 50 observations for logistic regression. Bujang et al., (2018), state that 15 observations per independent variable represent the minimum but recommend the total sample size equal to a minimum of 500. The calculation for the total sample was $n = 100 + 50i$ plus a minimum of 50 events per variable (EPV). The variable "i" was the number of independent variables in the final model. The threshold needed for this study has i = 7 where 7*50 = 350, 350+100 is 450 plus 50 yielding a total 500. The model used exceeds the calculated threshold with a minimum of 676 EPV and a total sample of 4,732 (676*7) (Bujang et al., 2018). Further, van Smeden et al., (2019) argue that values as low as EPV $\geq$ 10 represent valid but minimal sample size. The assumption of sample size appears to have been fully met.

Linear Relationship. Continuous independent variables should have a linear relationship with the dependent variable after the dependent variable undergoes a logit transformation. A Box-Tidwell transformation will indicate if there is a linear relationship, using continuous independent variables only. Table 21 shows the transformation variables, "trXXX", and their significance values. The transformation of the Starting Bid and High Bid values are $\geq .05$ ($p < .05$) indicating a relationship that was not significant. The logit transformation, as applied to the 2018 Assessed Land Value and Possible Economic Benefit to High Bidder, is < .05, indicating they are significant and do not meet the linearity of the logit requirements. The assumption that a linear relationship exists appears to have been partially met.

Table 21

Linear Relationship, Variables not in the Equation

Model	Variables	Score	*df*	Sig.
Step 0	Starting Bid	2.668	1	.102
	High Bid	3.378	1	.066
	2018 Assessed Land Value	7.017	1	.008
	Possible Economic Benefit to High Bidder	6.983	1	.008
	trSB	2.385	1	.122
	trHB	2.890	1	.089
	trALV	6.096	1	.014
	trPEV	5.964	1	.015
Overall Statistics		24.349	8	.002

Hypothesis Testing

To approach RQ1, "Do relationships exist between or among receiving a tax deed for nonredeemed tax sale properties in Florence County, South Carolina, and taxes being

due prior to 2016, starting bid, highest/final bid, if 12% of the highest/final bid was less than the starting bid, assessed land value, if a structure was on the property, and the economic benefit to the high bidder?", a multiple binary logistic regression analysis was conducted to evaluate the prediction of a bidder at the 2017 Florence County, South Carolina, delinquent tax sale receiving a tax deed as a function of taxes being due prior to 2016, starting bid, highest/final bid, if 12% of the highest/final bid was less than the starting bid, assessed land value, if a structure was on the property, and the possible economic benefit to the high bidder. Table 22 shows that 676 records were used in the model from $N = 843$, with 167 cases being excluded listwise. The missing cases were due to a lack of an initial bid from the auction attendees, which caused the high bid, 12% of the highest/final bid was less than the starting bid, and economic benefit to the high bidder to have missing data.

Table 22

Case Processing Summary

Unweighted cases		*N*	%
Selected cases	Included in analysis	676	80.2
	Missing cases	167	19.8
	Total	843	100.0
Unselected cases		0	.0
Total		843	100.0

Note. If weight was in effect, see classification table for the total number of cases.

Logistic regression was performed to ascertain the effects of seven independent variables on the response variable, receiving a tax deed from the 2017 Florence County, South Carolina delinquent tax sale. The possible explanatory variables were taxes being

due prior to 2016, starting bid, highest/final bid, if 12% of the highest/final bid was less than the starting bid, assessed land value, if a structure was on the property, and the economic benefit to the high bidder. The logistic regression model was statistically significant, $\chi 2(7) = 41.931$, $p < .05$, shown in Table 23.

Table 23

Omnibus Tests of Model Coefficients

Model		Chi-square	*df*	Sig.
Step 1	Step	41.931	7	<.001
	Block	41.931	7	<.001
	Model	41.931	7	<.001

Table 24 shows that the Hosmer-Lemeshow goodness-of-fit was not significant ($p > 0.05$), indicating the model was correctly fitted and specified (Htway, 2016). Table 25 shows the predictive capacity of the model with values of the -2 log Likelihood = 403.702 and the pseudo measure of effect, Nagelkerke R square = .125. The -2 log Likelihood addresses how much variation occurs in the model that cannot be accounted for while being dependent upon the sample size. The greater the values, the less accurate the model (Montgomery et al., 2021). The Nagelkerke statistic can be interpreted as 12.5% of the variability in the dependent variable and was accounted for by the independent variables based on maximum likelihood estimation (Boateng & Abaye, 2019). Table 26 shows the statistical significance of the independent variables. Model variables starting bid, highest/final bid, 12% of the final bid was less than the starting bid, and possible economic benefit to high bidder was shown not to be significant ($p > 0.05$);

however, the independent variables taxes being due prior to 2016, assessed land value, and if a structure was on the property were found to be significant ($p > 0.05$).

Table 24

Hosmer and Lemeshow Test

Step	Chi-square	*df*	Sig.
1	10.478	8	.233

Table 25

Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	403.702[a]	.060	.125

[a]Estimation terminated at iteration number 7 because parameter estimates changed by less than .001.

Table 26

Independent Variable Statistical Significance

Model	Variable	B	*SE*	Wald	*df*	Sig.	Exp(B)	95% C.I. for EXP(B) Lower	Upper
Step 1	Taxes due from before 2016	1.802	.668	7.275	1	.007	6.064	1.637	22.469
	Starting bid	.000	.000	.237	1	.626	1.000	1.000	1.000
	High bid	.000	.000	.247	1	.619	1.000	1.000	1.000
	12% of the final bid was less than starting bid	.334	.454	.543	1	.461	1.397	.574	3.402
	2018 assessed land value	.000	.000	10.184	1	.001	1.000	1.000	1.000
	Structure was on property	-.853	.392	4.726	1	.030	.426	.197	.919
	Possible economic benefit to high bidder	.000	.000	.029	1	.865	1.000	1.000	1.000
	Constant	-1.460	.498	8.588	1	.003	.232		

Note. Variable(s) entered on step 1: Taxes due from before 2016, Starting Bid, High Bid, 12% of the Final Bid was Less than Starting Bid, 2018 Assessed Land Value, Structure was on Property, Possible Economic Benefit to High Bidder.

Controlling for starting bid, highest/final bid, if 12% of the highest/final bid was less than the starting bid, assessed land value, if a structure was on the property, and the possible economic benefit to the high bidder, the predictor variable, *taxes being due prior to 2016* in the logistic regression analysis, was found to contribute to the model. Key statistics include the standardized B = 1.802, *SE* = .668, Wald = 7.275, $p < .05$. The estimated odds ratio favored a positive relationship of more than six-fold Exp (B) = 6.064, 95% CI [1.637, 22.469] for every one unit increase of receiving a tax deed to the independent variable of taxes being due prior to 2016 (Htway, 2016).

Controlling for taxes being due prior to 2016, starting bid, highest/final bid, if 12% of the highest/final bid was less than the starting bid, if a structure was on the property, and the economic benefit to the high bidder, the predictor variable, *assessed*

land value in the logistic regression analysis, was found to contribute to the model. Key statistics include the standardized B = .000, *SE* = .000, Wald = 10.184, $p < .05$. The estimated odds ratio was 1:1, Exp (B) = 1.000, 95% CI [1.000, 1.000] resulting in parity relative to receiving a tax deed to the independent variable assessed of land value (Htway, 2016).

Controlling for taxes being due prior to 2016, starting bid, highest/final bid, if 12% of the highest/final bid was less than the starting bid, assessed land value, and the economic benefit to the high bidder, the predictor variable, *if a structure was on the property* in the logistic regression analysis, was found to contribute to the model. Key statistics include the standardized B = -.853, *SE* = .392, Wald = 4.726, $p < .05$. The estimated odds ratio favored a decrease of receiving a tax deed of nearly 58% Exp (B) = .426, 95% CI [.197, .919] for every one unit increase to a structure being on the property (Htway, 2016).

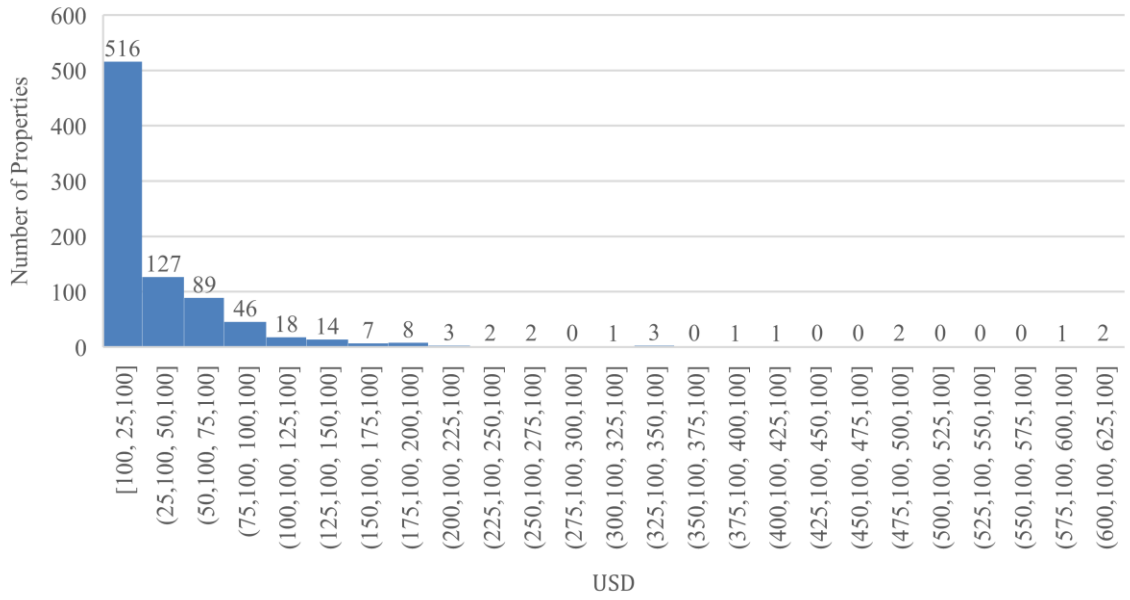
Additional Findings

Hypothesis testing for RQ1 and RQ2 did not require descriptive statistics for the market value of each property's combined land and building assessment. Notwithstanding the foregoing, investigating these values yields a deeper understanding of the delinquent tax properties that went to auction in 2017. Across 843 properties, the total value of the land only was 11,463,658 USD. Buildings on the property account for an additional 20,719,713 USD totaling 32,183,370 USD of taxable property in which tax payments to Florence County, South Carolina, were not paid. Figure 35 shows that 61.2% (516/843) of the properties were valued at less than 25,100 USD and 76.3% (643/843)

were less than 50,100 USD. Removing the highest 10% of the data reveals that 31.1% (262/843) of the properties were assessed at less than 8,100 USD. Table 27 shows the high variation for land only (1.8 times the mean), buildings only (2.2 times the mean), and the combined assessment for land and buildings together (1.7 times the mean).

Figure 35

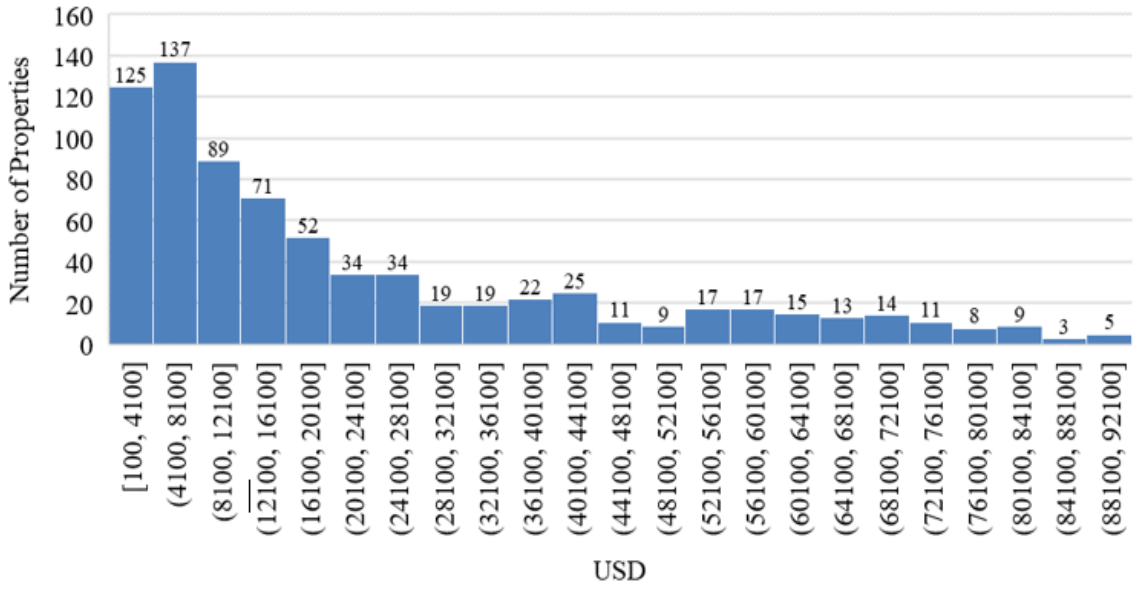
Assessed Market Value, Land and Buildings, All Properties



Note. N =843.

Figure 36

Assessed Market Value, Land and Buildings, All Properties, 90% of Population



Note. n =759.

Table 27

Descriptive Statistics Assessed Market Value, Land and Buildings, All Properties

Variable	*N*	Minimum	Maximum	*M*	*Mdn*	*SD*
Land only	843	$100	$312,095	$13,599	$7,900	$23,879
Buildings only	843	0	545,495	24,579	0	53,249
Land and building total	843	100	624,809	38,177	16,050	63,586

Summary

The 2017 Florence County, South Carolina delinquent tax sale contained 843 specific properties that were available for auction on October 2-3, 2017. No fewer than 586 records totaling 2,344 (586*4) data points were used for the multiple regression model in RQ1 and no fewer than 676 records totaling 5,408 (676*8) data points were used in the binary logistic model for RQ2. There were 30,348 (10,959 + 17,703+1,686)

total data cells generated as a result of the data collection required for this study. The sampling values for both research questions exceeded the minimum sample size of 498 required by G*power calculations for confidence level, significance level, and effect size. Sampled data were evaluated prior to model processing to determine the appropriateness using descriptive statistics, statistical assumptions, testing, and analysis.

RQ1 showed a statistically significant relationship to exist between the amount of interest earned by a high bidder at the 2017 Florence County, South Carolina, delinquent tax sale as a function of starting bid, highest bid, and days elapsed until the property was redeemed using a multiple linear regression model. RQ2, using a multiple binary logistic regression model, showed that obtaining a tax deed by a high bidder at the same tax sale was positively correlated to the property having taxes due prior to 2016 and 12% of the highest/final bid being less than the starting bid while negatively correlated to having a structure on the property. Starting bid, highest bid, assessed land value, and the possible economic benefit to the high bidder did not show a statistically significant relationship to receiving a tax deed. An interpretation of these results is presented in Chapter 5 along with the limitations of this study, followed by ten recommendations for future research and resulting implications for positive social change based on these data and findings.

Chapter 5: Discussion, Conclusions, and Recommendations

The purpose of this quantitative, nonexperimental, explanatory correlational study was to develop an optimum model to be used by the delinquent tax auction attendee to yield a higher probability of maximizing the rate of return to the lienholder of interest earned, earning a tax deed, or both. A 100% sampling rate of 843 individual properties was obtained from the Florence County, South Carolina, delinquent tax sale that occurred on October 2-3, 2017. Public, secondary source data were used in the form of hard copies provided by the Florence County, South Carolina, Treasurer's Office from their internal digital records.

The nature of the study included a multiple regression model to determine the relationship between the amount of interest earned when participating in a delinquent tax auction with three predictor variables: (a) starting bid value, (b) high bid value, and (c) the number of elapsed days from the tax sale to the date of property redemption. All three independent variables demonstrated a statistically significant relationship on how much interest was earned by the high bidder. The study also used a multiple binary logistic model to determine the relationship between receiving a tax deed and seven predictor variables: (a) whether taxes were also due prior to 2016, (b) starting bid value, (c) highest/final bid value, (d) whether 12% of the highest/final bid was less than the starting bid, (e) assessed land value, (f) whether a structure was on the property; and (g) the possible economic benefit to the high bidder. Two of the seven predictor variables were found to have a positive contribution to the model: properties having taxes due prior to 2016 and 12% of the highest/final bid was less than the starting bid. One of the seven

predictor variables was shown to have a negative contribution to the model: having a structure on the property. The remaining four of seven predictor variables did not significantly contribute to the model.

Interpretation of Findings

Each of the two research questions presented in this study was evaluated based on how they confirm, disconfirm, or extend the body of knowledge within the quantitative management discipline. Results have undergone further analysis and interpretation with a focus on individual investors to increase the likelihood of attaining their stated goals when attending a delinquent tax auction. Two goals exist for investors: (a) maximize ROI based on interest earned and (b) obtain a tax deed earning economic value by subtracting their high bid value from the market value of the property.

The 2017 Florence County, South Carolina, delinquent tax sale was completed in the form of an auction, similar to other government entities 2,000 years ago, but with additional detail, breadth, and speed through the evolution of technology (Jiang, 2021; Milgrom, 2019; Morcillo, 2021). No deviations were found from the requirements of the South Carolina Code of Laws, Title 12, Taxation (n.d.) when examining the dataset. The type of auction that was conducted for the tax sale was an English Auction, consisting of bid values gradually increasing until only one bidder was actively participating (Ganguly & Chakraborty, 2008). The 843 properties of the 2017 for Florence County, South Carolina, auction had an aggregate value of 1,079,405 USD in past-due taxes and fees. A total of 7,880,651 USD was collected at the auction where properties received a bid. For properties without a bid, 211,215 USD was still owed and remained uncollected at the

cessation of auction activities. Of the 75 properties in which a deed was earned, regardless of whether it was retrieved by the new owner or not, the additional benefit received by the county above the taxes and penalties due was 335,798 USD. This represents a 59.0% greater amount received by Florence County, South Carolina, than the outstanding property taxes and fees owed to them by the original taxpayers. In the fiscal year 2017, the operating budget for Florence County, South Carolina, was 56,557,358 USD with 31.7% (17,915,089/56,557,358) of the revenue from property taxes based upon the ad valorem rate of 75.6 mills, tax collector's costs and fees, and delinquent taxes (Florence County Financial Transparency, n.d.). This revenue generation was almost 20% less than what other municipalities experienced in 2016 but higher than in 1999 when property tax-related revenues amounted to 44.6% of municipalities' budgets (Fisher, n.d.; Tax Policy Center, n.d.).

Investors at tax sales that conduct research have a strategy, and set goals are more successful compared to attendees that participate without adequate preparation (Kurakova & Khomyak, 2016). A mathematical model earning interest can be demonstrated with the three predictor variables found in this study to be statistically significant. The starting bid and the number of days elapsed after redemption are out of the control of the bidder, but the amount of the high bid was not. The savvy bidder should understand what starting bids and high bids are most likely to lead to earning interest (Cheng, 2020). Of the 843 properties that went to auction, 69.5% (586/843) earned interest. If a bid was received, eliminating no-bids, this value increased to 86.7% (586/676). This increase results in attendees earning interest on almost 9 out of 10 properties they bid on, on average. The

number of deeds received by investors amounted to 8.2% (69/843) of all properties that went to auction. Eliminating no-bids, this value increased to 10.2% (69/676). This results in attendees expecting to earn approximately one deed for every 10 properties they are high bid on, on average. Increasing the probability of receiving a tax deed by an investor can be attained by the positive correlation to the property having taxes due prior to 2016, ensuring that (high bid * .12) was less than the starting bid, while only bidding on property that does not have a structure on it based on the predictor variables in the model that were deemed significant. Understanding and using these relationships to maximize ROI will yield a competitive advantage, concepts characterized by modern management theory as exhibited by Ahlstrom (2014), Pryor and Taneja (2010), Hamel (2007), Olum (2004), and Rana et al. (2016).

Interest Earned From a Tax Sale, RQ1

The first research question explored whether relationships exist between or among interest earned for redeemed tax sale properties in Florence County, South Carolina, and the starting bid, highest bid, and time elapsed until the property was redeemed. The alternative hypothesis, H_a, for this research question was that the amount of interest earned may be predicted from the starting bid, high bid, and elapsed number of days for redemption after the tax sale in a nonrandom fashion. The predictive nature of the multiple linear regression model yielded that a statistically significant relationship existed between the three predictor variables and the response variable. Table 13, ANOVA, shows the degree of the observed effect at the $p < .05$ level [$F_{(3, 585)} = 625$, $p < .001$]. The F value was >> 1, demonstrating that the variation between the sample means was large

compared to the variation in each of the samples. This observation was acceptable as the full population was used as a sample, sufficiently satisfying a significant fit of the model and the population for the ratio of variance. The linear fit of the model was further characterized by the R^2 value of .763 shown in Table 14, Model Summary, indicating that the coefficient of determination yields a strong effect size. Combined with ANOVA results, the three predictors account for 76.3% of the variation, in which 23.7% of the variation was not explained. The addition of other predictor variables could decrease this variation and is discussed in the Recommendations for Future Research section of this chapter.

The starting bid was found to be a statistically significant predictor of the amount of interest earned by an investor at a delinquent tax sale. Bland et al., (2005) state that lower starting bids historically have increased participation rates at auctions, but the results from the 2017 Florence County, South Carolina tax sale, indicate contradictory data. The 586 records used in RQ1 show that the lowest half of the starting bid by dollar value has 35.2% (103/293) of the high bid equal to the starting bid. This means that only one bidder participated in the sale of the property. The second half of starting bids, in ascending order, showed 19.5% (57/293) of the high bids equal to the starting bid. A rate of 1.8:1 was observed in the number of bids that had only one bid when evaluating the lowest 50% of starting bids to the higher 50% of starting bids. One bid on a property at the tax sale indicates a low participation rate as there were no competitive bids, deviating from other types of auctions such as eBay that experience more competition with a lower starting value, as suggested by Bland et al., (2005).

The highest bid was found to be a statistically significant predictor of the amount of interest earned by an investor at a delinquent tax sale. The amount of interest was calculated based on a percentage of the bid, up to the value of the starting bid, allowing for a very clear relationship between interest earned and high bid. This was not a completely linear relationship because the maximum interest paid cannot exceed the value of the starting bid, which reduces the percent of the interest paid to the high bidder. It was in the best interest of the municipality to drive values higher, as they would earn more profits, given that the delinquent taxpayer pays the additional interest if redeemed, not the county. Florence County, South Carolina, for example, employed professional auctioneers, which supports Wu's (2020) research regarding higher profits and competitive bidding. In contrast, if counties wanted to fully maximize profits, then online bidding would be created to widen the number of participants, as Bourron (2021) suggested, but this has not yet occurred across any of South Carolina's 46 counties. McGee and Levin (2019) suggested that the satisfaction of winning may be more important than a high economic cost, but the results of the 2017 Florence County auction appear to be contradictory. All of the redeemed properties that earned interest (n = 586) as well as all other properties that received a bid (n = 676) had high bids of less than the assessed market value property in default.

The number of elapsed days from when the auction was conducted to when the property was redeemed by the original owner was found to be a statistically significant predictor of the amount of interest earned by an investor at a delinquent tax sale. Similar to the high bid, this relationship to interest earned was easily understood as the interest

rate increases from 3%–12% based on how many days the original owner redeems the property after the tax sale, up to the value of the starting bid. This process is completely out of the owner's control, but these data show that 45.6% (267/586) of the properties were redeemed after 275 days, earning up to 12% ROI. Some bidders may have a strong aversion to loss, which drives their strategy of not bidding above the maximum interest payout, limiting the number of bidders after the interest threshold has been reached (Foster, 2020). On average, the investor who seeks interest can expect the property to be redeemed with an average rate of return of 7.4%, including the properties that were capped at the starting bid value should the interest payout calculation be greater than the initial bid. This will allow the bidder to decide whether a return that averages 7.4% with low risk is acceptable to them, as compared to other investment vehicles, as noted by Cheng (2020). Modern management processes, specifically mathematical modeling, have been in use for almost 80 years (Pardaev, 2019). Understanding these data from the 2017 Florence County, South Carolina, delinquent tax sale provides options for investors and allows for better decisions on how to invest. For outliers, this model correctly predicted that if the high bid was 125,000 USD or larger, or the starting bid was 13,098 USD or larger, or if the interest earned was 6,600 USD or above, then there was a 100% likelihood of one or both residuals being greater than 3 standard deviations from the mean.

Deed Received From a Tax Sale, RQ2

The second research question explored whether relationships exist between or among receiving a tax deed for nonredeemed tax sale properties in Florence County,

South Carolina, and taxes being due prior to 2016, starting bid, highest/final bid, if 12% of the highest/final bid was less than the starting bid, assessed land value, if a structure was on the property, and the economic benefit to the high bidder. The alternative hypothesis, H_a, for this research question was that receiving a tax deed from a delinquent tax sale may be predicted should taxes be due prior to 2016, starting bid, highest/final bid, if 12% of the highest/final bid was less than the starting bid, assessed land value, if a structure was on the property, and the economic benefit to the high bidder in a nonrandom fashion. The predictive nature of the multiple logistic regression model demonstrated that a statistically significant relationship exists between three of the seven predictor variables, as shown in Table 26, Independent Variable Statistical Significance.

Controlling for the six independent variables other than *taxes being due prior to 2016* in the logistic regression analysis, it was found that this predictor variable contributed to the model. Key statistics include the standardized B = 1.802, *SE* = .668, Wald = 7.275, $p < .05$. The estimated odds ratio favored a positive relationship of more than six-fold Exp (B) = 6.064, 95% CI [1.637, 22.469] for every one unit increase of receiving a tax deed to the independent variable of taxes being due prior to 2016 (Htway, 2016). Controlling for the six independent variables other than *assessed land value* in the logistic regression analysis, it was found that this predictor variable contributed to the model. Key statistics include the standardized B = .000, *SE* = .000, Wald = 10.184, $p < .05$. The estimated odds ratio was 1:1, Exp (B) = 1.000, 95% CI [1.000, 1.000] resulting in 1:1 parity relative to receiving a tax deed to the independent variable assessed of land value (Htway, 2016). Controlling for the six independent variables other than *if a*

structure was on the property in the logistic regression analysis, it was found that this predictor variable contributed to the model statistics included the standardized B = -.853, *SE* = .392, Wald = 4.726, $p < .05$. The estimated odds ratio favored a decrease of receiving a tax deed of nearly 58% Exp (B) = .426, 95% CI [.197, .919] for every one unit increase to a structure being on the property (Htway, 2016). The remaining four independent variables' influence on the model is inconsequential as they are insignificantly different from zero.

Table 25, Model Summary, shows a Cox & Snell measurement, a pseudo-R^2 value, that describes the proportion of variance explained, yielding .06 (Riley et al., 2021). Nagelkerke's R^2 was the adjusted value of Cox & Snell's value and was more informative, as the upper bound was 1, unlike Cox & Snell where the upper bound was < 1. The Nagelkerke statistic accounts for 12.5% of the variability in the dependent variable from the independent variables based on a maximum likelihood estimation (Boateng & Abaye, 2019). The Hosmer and Lemeshow Test had a significance value of .233, indicating that the model was correctly fitted and specified (Htway, 2016).

A positive correlation to the model was demonstrated if taxes were due on the property prior to 2016 in addition to the current tax year. This relationship is understandable as it indicates that the same property was part of the previous year(s) auction but did not have a bid and that the original owner did not redeem it. Another alternative was that there was a bid but the bidder did not pay for the property at the end of the day the auction was held. In this instance, the bidder would be subject to a 500 USD fine for not paying in full. The 2017 Florence County, South Carolina, delinquent

tax sale resulted in 80.2% (676/843) of the properties receiving a bid. Eleven properties that had taxes owed on them from previous years represented 1.6% (11/676) of the properties that received bids. These 11 properties had 45.5% (5/11) of their deeds awarded to the high bidder, were redeemed by the current owner in 36.4% (4/11) of the instances, and had the tax sale canceled in 18.2% (2/11) of the cases. Should an investor want to earn a deed to a property, they could focus only on properties that had taxes on them that remained unpaid from the previous year(s), as the investor would have a 45.5% chance of receiving the deed compared to a 10.2% (69/676) chance of receiving a deed across all the properties that were bid on. In 80% (4/5) of the properties obtained by the high bidder, the starting bid was equal to the high bid, averaging 934 USD per property, but with an assessed property value of 6,218 USD, a 566% (5,284/934) average ROI when no other costs are included. Including all five properties, the average high bid was 1,087 USD compared to a starting bid average of 1,005, an 8.2% (82/1,005) average premium over the starting bid. These five properties were assessed at 7,355 USD on average, yielding a 577% (6268/1,087) average return when no other costs are included.

The literature reviewed in Chapter 2 discussed general auction results and strategies such as jump bidding but lacked the specificity of delinquent tax sale winning probabilities and results (Dodonova & Khoroshilov, 2019; Sommervoll, 2020). Various authors have also suggested ways in which the number of bidders can be increased, such as Bourron (2021) via digital technology use and Dardick (2020) with how to increase representation in urban areas. These articles, similar to much of the literature, have a

broad focus rather than evaluating the actual data from auctions using mathematical modeling.

A negative correlation to the model was demonstrated if there was a structure present on the property. The 69 properties that had their deed transferred to a new owner had a structure on the property 33.3% (23/69) of the time. This indicates that 67.7% (46/69) were considered vacant land. Comparing this to the full population of 676 properties that received a bid, 50.6% (342/676) of these properties had a structure on them, validating the relationship that few properties that had a deed delivered to new owners as a percentage of the overall population. This is understandable as the structure could suffer additional damage by the time the deed was delivered to the new owner, reducing the number of bidders given the additional risk. Not all bidders take the time to inspect each property, so they may be unsure of where the property is located, the condition it may be in, or if drug use from a homeless population was evident, reducing value (Kondo et al., 2018). Should a building be vacant, the likelihood of gun violence and medical emergencies increases, as noted by Sivak et al. (2021), which increases the risk to the investor if they have not physically viewed the property and area. Of the 843 properties that went to auction, 46.0% (388/843) had at least one structure on each property. All delinquent properties are published a minimum of 3 weeks before the tax sale, which had 1,583 properties, resulting in 46.7% (740/1,583) being redeemed prior to the auction date. A large number of properties with structures present would be difficult to physically visit throughout Florence County, South Carolina, increasing the importance of creating a model that narrows the field of viable properties based on the

investors' specific strategies, as noted by Campbell-White (2021). Existing owners also redeem these properties at a higher frequency, as 54.7% (309/586) of all properties redeemed had a structure on them, which corresponds to a rate of 1.6:1 (54.7:33.3) compared to bidders that received a deed with a structure on the property.

Limitations of the Study

Four areas of limitations associated with this study have been identified. First, the largest possible contributor to errors was the substantial amount of manual data entered into spreadsheets resulting in inaccuracies. Second, the model assumptions for multiple linear and logistic regressions were not completely satisfied. Third, the economic gain via interest or receiving a tax deed has additional financial burdens that are not covered in the model. Finally, the generalizability to other counties within South Carolina or other states exhibits several drawbacks.

Data Entry

The study used 10,959 manual entries of data into an Excel spreadsheet from secondary source data. These data were the basis of additional calculations to generate the dependent and independent variables uploaded to SPSS Version 28.0.1.0. (142) for statistical analysis. Data entry errors have been widely studied and vary considerably in literature. Mays and Mathias (2019) found that 3.7% of 6,930 entries had discrepancies compared to their actual value, but noted that researchers have identified error rates between 1.01 and 10.2%, leading to type I and/or type II errors. These findings indicate that an unaudited account of the data used in this study could have between 111 (1.01%*10,959) and 1,118 (10.2%*10,959) entry errors with an expectation of 405

(3.7%*10,959) errors present. Entry errors most commonly take the form of incorrect data inputs, formatting, and transposition, coupled with a lack of error correction checks (Zhang et al., 2019). Data entered in this study were screened for outliers that were not valid data and cross-checked with the physical documents obtained from the Florence County Treasurer's Office. A comparison to the source document total such as the Bidder's Journal could not be completed as the Florence County, South Carolina, data included mobile homes in their summary as well as real property. The number of properties that went to auction had starting bids, the number of high bids, the number of properties that had a structure on them, and the number of properties redeemed were cross-checked with the secondary source documents and confirmed. A likelihood of approximately 400 data entry errors may exist based on current literature, but none of these are beyond 3 standard deviations from the mean of any predictor variable, as each value was rechecked and verified. The steps taken to minimize the size and scope of data entry errors also will reduce the possibility of experiencing a type I or type II error in this study. Using digital sources and exporting the data directly to Excel or SPSS Version 28.0.1.0. (142) would minimize data entry errors, but this option was not available.

Assumptions

The sample in this study was the full population of the 2017 Florence County, South Carolina delinquent tax sale. The complete dataset was captured, but when examining the assumptions required for multiple linear regression and multiple binary logistic regression, several requirements were not fully met. For both models, outliers were evident. Due to the large sample size of $n > 500$, the influence of these outliers on

the model was reduced. Additional descriptive statistics in the form of visual presentation and quantitative data after eliminating 10% of the most extreme data points provided insight into the population without using parametric models. For the multiple linear regression model, multivariate normality and the homoscedasticity assumptions appear to have not been fully met. For the multiple binary logistic regression model, the assumption that a linear relationship exists appears to have been partially met. The entire population was known and measured, which eliminates the requirements for a confidence interval and basis for generalization, therefore minimizing the impact of the unmet assumptions (Lakens, 2022). These two models offer reasonable insight into the significance of the predictor variables, although the research questions could be evaluated using additional nonparametric, distribution-free tests where no assumptions are required.

Unaccounted Financial Impact

This study's focus was on the amount of interest earned by an investor when attending a tax sale as well as the likelihood of receiving a tax deed. These data were obtained directly from secondary source county-level documents from which ROI was calculated as well as the possible economic benefit to the high bidder. Numerous additional costs are associated with earning income from a tax sale. Implicit costs that may be incurred when earning interest or obtaining a deed include the preliminary research by an investor leading up to the delinquent tax sale. After the list of properties that will take part in the delinquent tax auction is published, investors may spend time organizing the data in a spreadsheet, looking up the properties on the county website, physically visiting the properties, or generating a list of possible properties to bid on

along with maximum bid values. These actions represent an opportunity cost to the investor that could involve hundreds of hours depending on the extent of the investors' research. For the amount of interest earned by a high bidder, explicit costs consist of transportation fees to the auction, charges for certified funds on the day of the auction, and transportation costs to return to the county treasurer's office to receive a check for the redeemed property. These activities and distances vary by county. For example, a successful bidder must return to the treasurer's office to receive the value of their bid and interest earned on a redeemed property in Florence County, South Carolina, but the check would be mailed to them from the Delinquent Tax Manager in Darlington County, South Carolina. Explicit costs associated with obtaining a deed are more numerous compared to implicit costs. Once notified that the deed was ready to be picked up at the treasurer's office, the new owner will have to pay for recording feeds, state fees, county fees, and current year property taxes.

Using the 2017 tax sale as an example, the high bid covered the cost of the 2016 and 2017 taxes that were past-due. Since the deed needed to be prepared, it typically takes a minimum of 3 months after the redemption time of 1 year and 1 day has passed for the legal documentation to be finalized, likely putting the date of the new deed to be received sometime in 2019. 2018 property taxes need to be paid prior to receiving the deed. Should the investor decide to sell the property, the assessed value may not be realized as the deed has a defect and must be sold with a quit claim or limited warranty deed, not a general warranty deed, reducing the marketability of the property. Additional

fees paid to a real estate attorney for closing as well as to a Realtor® should also be considered by investors electing to sell property acquired from a tax sale.

Generalizability

Creating a model that was robust and quantitative can be difficult given the varying degree of emotional and/or financial positions of the bidders in attendance. A bidder may own property adjacent to a parcel that was being sold at auction, for example. In this instance, the bidder may be willing to pay an acquisition premium that cannot be predicted by the model using the independent variables selected. The repeatability of a homogenous group of bidders was unlikely, with first-time bidders accounting for up to 50% of the potential investors at a tax sale. The potential for large variations in bidder background, demographics, and strategies reduces this study's generalizability to future auctions within Florence County, South Carolina, exceeded by the less generalizability to the other 45 counties in South Carolina and exceeded further by other lienholder states within the United States. Other factors that reduce generalizability outside of the models presented include how the auctions are managed by the county, the number of people participating, current and expected economic growth of the area, macroeconomic factors such as prevailing interest rates, and existing tax rates of the municipality. Without all the assumptions being fully met for the two models, the generalizability was subject to additional scrutiny as it relates to tax sales in future years within Florence County, South Carolina, the rest of the state, and other tax lien states.

Recommendations for Further Research

This study sufficiently met the purpose of identifying specific variables that can be statistically quantified as having a significant relationship to the amount of interest earned at a delinquent tax sale and increasing the odds ratio of receiving the deed to property in the form of a tax deed. The gap in knowledge filled by this study is not complete. Additional predictor variables can be added to improve the models, less understood tax sale processes and operations can be explored, and clearer net economic benefits to the investor and community can be researched along with many other topics. The following list for further research represents smaller but important possible gaps in current research that should be considered for supplementary topics and examination.

1. Assessed vs. market value of a property. Assessments of real property are made by the tax assessor, typically every 5 years. Examining how this compares to actual market value over time for all properties that were part of a tax sale could determine if the property assessments were under-, fair- or overvalued compared to actual market value.
2. Auction uniformity and methodology. Each of the 46 counties in South Carolina is free to establish how they conduct their tax sales within the confines of State statutes. In 2022, all auctions are in-seat with none online. Exploring if municipalities are considering a digital platform could provide insight as to how future auctions may be administered. Investigating if there has been a conscious decision to avoid online bidding to allow local residents an advantage, resulting in property ownership remaining in the community,

could also be part of this research. Comparisons between counties and their populations could also be made to test validity and generalizability, as performed via a t-test/ANOVA (Trochim & Donnelly, 2008). The economic model, characterized by predictor variables that are significant and influential, may not be valid for all counties should differences between the populations and other variables be statistically significant.

3. Bidder demographics. How many bidders partake in placing bids, the total amount spent by the bidder, and having a high bid compared to the number of registered bidders would show the dispersion of high bids across all attendees. Should this be a longitudinal study, it could also be compared to prevailing interest rates, stock market performance, and other macroeconomic factors such as the labor participation and unemployment rates.
4. Bidding dynamics and strategies. The number of bids received for each property at the tax sale vs. the starting bid and assessed value relative to the highest bid can be explored. Does a higher number of bids correlate to property that was in higher demand, thus reducing the likelihood of receiving a tax deed due to higher property value? Very few articles address how different bidding strategies affect the outcome of real estate auctions in terms of final selling price and the risk of overpaying for the asset, as noted by Hungria-Gunnelin (2018).
5. Forfeited Land Commission (FLC) sales. Properties that do not receive bids during the auction process are transferred to the FLC, comprised of county-

level administrators typically including the Country Treasurer and Delinquent Tax Manager. No academic literature was found regarding this entity nor the types of properties that end up being overseen by the FLC. The FLC may take title to the property and attempt to offload the property at a later date. Most properties are in very poor condition and bidders may feel the value of the property is less than the initial starting bid. Examining why some properties do not receive any bids could also be explored within the same context.

6. Fraud commission and prevention. County-level administrators of the delinquent tax sale do not track investor purchases or possible collusion between multiple bidders over multiple years. Investigation of possible fraud from coordinated bidding activity could be explored to determine if they have been instances of properties being purchased with an entity purposely defaulting on the mortgage only to have a collaborating partner be the high bidder and acquiring the property with all mortgages on the property dismissed. Should the collaborating partner be the high bidder, the owner does not redeem the property and the partner acquires the title. Should the partner not be the high bidder, the property could be redeemed and the same process could proceed the following year.
7. Property redemption timing. This study showed some descriptive statistics such as Figure 16 showing when properties were redeemed. Every 3 months after the auction the interest rate increases by 3% to a max of 12% of the highest bid, assuming the interest amount does not exceed the starting bid.

Characterizing exactly when properties are redeemed would help an investor better manage their anticipated ROI and cash flow.

8. Model enhancements. Additional predictor variables could aid in explaining more than the 76.3% of variance that was accounted for, as shown in the results of the RQ1 model. New predictor variables for RQ1 or RQ2 could include if the current owner has lost property through the delinquent tax sale process in the past, how many bids were received on the property, how high above or below the assessed value was the final bid, and if the property was zoned residential, commercial, farm, or other.
9. Multi-property delinquency by the same owner. For multiple properties at the delinquent tax sale held by the same owner, the likelihood of the owner redeeming all, none, or a partial amount could be explored.
10. Redemption rate of properties without bids. The redemption rate of properties that did not receive could be explored. For these records, if the owner does not redeem the property, no investor bid on it and it was not purchased via the FLC, then the owner will still retain the title. For the tax sale in 2017, 98.8% (165/167) of the properties that did not receive a bid also had taxes owed from 2016 or earlier. How does this compare to the percentage of properties redeemed that had bids and what is the likelihood of a bid when a property has multiple years of past due taxes?
11. Tax deed impact on property valuation. How much of a reduction in market value takes place when a property was sold via a tax deed (quit claim or

limited warranty deed) compared to being sold with a general warranty deed? This would provide insight into the true economic gain (or loss) to an investor when participating in a delinquent tax sale. The investor may take advantage of the South Carolina Code of Laws, Title 12, Taxation (n.d.) section 12-51-160 which states after two years has elapsed from the auction date that tax deed is considered to be a good title. Legal counsel may argue that this statute conflicts with the 10-year statute of limitations making a tax lien unenforceable if filed by the South Carolina Department of Revenue, section 12-54-120 of the South Carolina Code of Laws, Title 12, Taxation (n.d.). If an investor waiting to convert a tax deed to a general warranty deed after 2 years compared to 10 years could significantly impact their strategy, should it involve the reselling of real estate.

Implications for Social Change

The opportunity for positive social change using the results of this study is encouraging. The descriptive statistics generated by using the sample data clearly show the economic advantages afforded to all participants of a delinquent tax sale, regardless of investor SES. The delinquent tax sale process, once understood by persons that may have been marginalized in the past, offers an investment vehicle that can be low risk with a moderate amount of research without the need for large sums of money to be readily available. Research on properties that are part of a delinquent tax sale can be done online, through publicly available computers at a local library, or through a smartphone. Martin (2021) estimated that approximately 92% of all United States households have access to a

computer, tablet, or smartphone based on the United States Department of Commerce findings in 2018. Vogels (2021) states that 76% of adults with low SES, living in a household with an income of less than 30,000 USD, have access to a smartphone. These data indicate that online research comprised of looking up properties on a county website to determine their location and assessed value was feasible for the majority of adults living in poverty.

Financial advantages of delinquent tax sales to an auction participant, which were also the dependent variables explored in this study, include earning interest of up to 12% on their investment or receiving a tax deed in which they could sell, keep for speculation, or maintain for their own use. In 2013, King et al. (2019a) held that 8.5% of all United States households did not have a bank account, with 30% of these households having income levels in the lowest 10% of all households across the United States. Without access to banking, financial independence through investing has been unlikely. Individuals that are considered low-income are typically risk-averse regarding financial decisions (Loibl, 2017). Participating in a delinquent tax sale can guarantee an ROI of between 3 and 12%, assuming the value of the final bid was not excessively high. At a 3% ROI, the interest earned is a minimum of 50 (3/0.06) times greater than the current average savings account interest rate of 0.06%, with the potential of being up to 200 (12/0.06) times greater (Carrns, 2022). Table 28 shows 8 of the 10 lowest final bids by dollar value for the properties that were part of the 2017 Florence County, South Carolina delinquent tax sale. These 8 properties were redeemed by their original owners during the fourth quarter after the auction, all earning an ROI of 12% on a high bid of between 181

and 201 USD. Table 28 shows that even with limited funds available for investing, extremely high returns can be realized compared to current market rates.

Table 28

Interest Earned, Lowest Final Bid

Map-Block-Parcel	Starting bid (USD)	Final bid (USD)	Property redemption date	Interest earned on redeemed property (USD)	Interest earned on redeemed property (% ROI)
430-05-051	181	181	9/10/2018	22	12.0%
70013-06-015	184	184	10/2/2018	22	12.0%
1682-03-014	189	189	9/26/2018	23	12.0%
46-03-035	190	190	9/26/2018	23	12.0%
80009-03-026	198	198	9/26/2018	24	12.0%
80026-01-071	201	201	8/20/2018	24	12.0%
90114-07-008	201	201	9/26/2018	24	12.0%
90114-07-009	201	201	9/26/2018	24	12.0%

Note. ROI = return on investment.

The remaining two lowest final bid values resulted in the high bidder taking possession of the property via a tax deed (see Table 29).

Table 29

Deed Received, Lowest Final Bid

Map-Block-Parcel	Starting bid (USD)	Final bid (USD)	Assessed market value (USD)	High bidder deed acquisition date	Possible economic benefit (USD)	Possible economic benefit (% ROI)
70007-04-006	178	178	400	3/14/2019	222	125%
90127-01-021	194	194	600	2/25/2019	406	209%

Note. ROI = return on investment.

The high bidders realized a high economic gain of between 125 and 209%, although the additional costs would be incurred when attempting to sell the property.

Ownership of a personal residence is less likely in the Black community, compared to other demographics, with 42% owning their own home compared to Hispanics at 47%, Asians at 58%, and White at 73% in the United States (Acolin et al., 2019). An important aspect of home ownership is wealth building, which results in 3,000 – 14,000 USD economic benefit to the owner per year, on average (Sharp et al., 2020). A plausible solution for an individual to be lifted from low-income status could be to participate in a delinquent tax sale with the possibility of earning interest significantly above market rates as shown in Table 28 or having the opportunity to earn a tax deed for property at a price less than half the market value (see Table 29). Should the property not have a structure on it, a used manufactured home could potentially be located on the premises, eliminating the need to pay rent to a landlord and instead, giving an opportunity to build equity. Referring to Table 28, if the 8 properties were not redeemed, the high bidder would have earned a deed on property that was worth 3,081 USD representing a 1,496% (2,888/193) return on their investment of 193 USD, on average. The advantages for positive social change are ample based on this analysis, although financial literacy would be a concern for those not familiar with the auction process, potential proceeds, and investing metrics.

Conclusions

Existing literature has an abundance of information on how auctions operate, the collection of taxes by the government, the impact of distressed properties within a community, and mathematical modeling to achieve optimum ROI. A void exists when these topics are examined collectively, resulting in limited data and the lack of research specific to delinquent tax auctions. Evaluating statistically significant predictor variables

that demonstrate a relationship to either the amount of interest earned for redeemed property or receiving a deed from participating in a delinquent tax auction, as well as characterizing the outcome of every property subject to a sale, allows investors to better formulate a strategy to meet their desired goals. The findings of this study demonstrate the importance of the starting bid, high bid, and the number of days a property is redeemed after a delinquent tax sale as they relate to the total interest earned. The findings also demonstrate the importance of additional taxes being due from prior years at the time of the tax sale, if 12% of the high bid exceeds the starting bid, and if a structure exists on the property relative to an investor receiving a tax deed.

This study attempts to fill the void in existing literature specific to delinquent tax sales and expand the body of knowledge by analyzing and summarizing the full breadth of all 843 properties that were part of the 2017 Florence County, South Carolina delinquent tax sale. This inquiry provides cogent evidence of statistically significant and descriptive statistics instrumental in gaining an understanding of specific factors that drive response outcomes in a delinquent tax sale. A complete dataset of approximately 30,000 cells of information from direct data entry and quantitative derivation served as the foundation from secondary source government data to realize these outcomes. I hope that the transparency and presentation of the results found in this study will help the participants of delinquent tax sales make better economic decisions, county administrators hold more efficient auctions, and the original owners of properties that may be impacted by the delinquent tax sale process fully realize the possible ramifications of their actions or inactions.

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Appendix A: Planned Research Design Questions

1. What was the relationship between the average interest earned for redeemed tax sale properties in Florence County, South Carolina, and the initial bid of the property at a delinquent tax sale?
2. What was the relationship between the average interest earned for redeemed tax sale properties in Florence County, South Carolina, and the highest bid of the property at a delinquent tax sale?
3. What was the relationship between the average interest earned for redeemed tax sale properties in Florence County, South Carolina, and the number of months after tax sale owner redeems property?
4. What was the relationship receiving a tax title (deed) from a delinquent tax sale and the highest bid at tax sale?
5. What was the relationship receiving a tax title (deed) from a delinquent tax sale and the property market value (by Florence County Tax Assessor)?
6. What was the relationship receiving a tax title (deed) from a delinquent tax sale and the property market value (actual selling price by new owner)?

Appendix B: 2017 Florence County Delinquent Tax Sale Properties, Example

TAXPAYER		MAP-BLOCK-PARCEL/LOCATION	--- DESCRIPTION --- LOTS	ACRES	BLDGS	DISTRICT
A-1 STORAGE LLC	S	1012-01-215 KINGSBURY PARK L 15P&16	1		4	10
AAA ENTERPRISES INC	S	90083-01-014 POWER ST LOT 3	1		1	14
AAA INVESTMENTS INC	S	90129-10-013 4TH & MARS BLUFF LOT 84	1			14
ABRAHAM ALICE DEAS	S	121-01-036 SUMTER ST EXT & STOKES	1		1	10
ABRAHAM WILBUR ESTATE	S	90106-01-038 UNION ALLEY	1		1	13
ABRAMS ROBERT T	S	434-05-099 OFF S DEERFIELD RD	1			50
ABRAMS ROBERT THALMER	S	50006-06-007 ELM ST	1			51
ACKERMAN MYRTLE LEE (LE) &	S	112-03-132 ST HWY 84	1			30
ADAMS MISSOURI WILLIAMS	S	80005-06-013 GLADYS ST L 73	1			32
**CURRENT OWNER: 1117 PATTERSON ST FLORENCE		1471-01-014			OTHER	
ADDISON NEOMI S	S	1471-01-014 L 14 CARVER PLACE ANNEX	1		1	11
ADM OF VETERANS AFFAIRS	S	90097-01-022 LOT 6-E WILSON RD	1		1	14
ALASA ROSA AS TRUSTEE FOR	S	432-05-189 DIAMOND LAKES LOT 57	1			51
**CURRENT OWNER: BURGESS BETTY GAMBLE		220-03-119			OTHER	
ALBAN SANDRA FILYAW	S	220-03-119 OLD GEORGETOWN RD TRK B	1			30
ALEXANDER SANDRA & STONEY	S	187-03-088 RIVER OAKS PH#1 LOT#23	1		1	30
ALFORD CARL LARUE	S	80028-05-011 W MAIN ST	1		1	32
ALFORD CARL LARUE &	S	80004-11-033 INDEPENDENCE AVE	1		1	32
ALLEN DEBORAH	S	90114-13-003 LT 15 MAXWELL	1			11
ALLEN DOUGLAS F	S	217-02-023 OFF ALLEN RD	1			22
ALLEN MICHELLE ETAL	S	187-03-029 ST HWY 72	1		1	30
ALLEN SYLVIA MAE	S	90104-11-001 S GAILLARD ST LOT 13	1			14
ALLISON ALLEN	S	428-05-081 REESE RD LOT B	1			50
ALLISON BESSIE	S	90085-07-003 L 10 BLK A-2 FRASER ST	1		1	11
ALLISON BRUCE	S	400-02-023 RIVER RD #1 LOT 10	1			20
ALSTON TAWANDA Y	S	58-04-036 FERMAN'S PL LT 3	1			40
ALTMAN FARRELL J JR	S	60007-05-004 LOTS 1-6 J TRADE ST	1			21
ALTMAN JAMES O ETAL	S	60007-05-007 PT LTS 4&5-H TRADE ST	1		1	21
ALTMAN RHONDA LEWIS	S	433-05-084 OFF HWY 111	1		2	50
**CURRENT OWNER: ALTMAN TERESA		109-01-067				
ALTMAN ROY L	S	109-01-067 MEADOW PRONG RD LOT#2	1		1	13
ALTMAN WILLIAM &	S	90021-10-006 2ND LOOP RD & LEE DR	1		2	10
AMERICAN CAPITAL MORTGAGE	S	70010-01-046 B J MANOR SUBD LOT 16	1			41
AMERSON KAREN L &	S	70007-14-003 MARKET & KEITH	1		1	41
ANDERSON THOMAS L EST	S	167-31-030 HWY 378		9		32
ANDERSON THOMAS WILLIAM	S	167-31-026 HWY 378 (BUS)	1			32
ANDREWS JAMES H & BETTIE D	S	80022-05-013 LYERLY ST L 118A	1		1	32
ANDREWS JENNIFER W (LE OF	S	90012-01-010 LILLIAN DR LOT 15	1		2	10
**CURRENT OWNER: PIERCE LOUELLA &		90072-10-028				
ANDREWS LOUIS ESTATE	S	90072-10-028 PRESTON ST	1		1	11
APPLEWHITE KENYATTA &	S	90131-01-019 L 1-F MIRIAM AVE	1		1	14
ARD DARLENE	S	145-01-101 I-95	1		1	10
ARD EVELYN	S	385-02-087 OFF ST HWY 66	1		1	23
ARD EVELYN	S	385-02-090 OFF ST HWY 66	1			23
ARD J KENNETH &	S	1221-01-260 WINDSOR FOR PH#V LOT#16	1		1	10
ARD JAMES CARL JR	S	90009-02-005 LAKEWOOD LOT 67	1		2	10
ASHBY BUILDERS LLC	S	90073-15-004 W EVANS ST	1		1	11
ASHBY BUILDERS LLC	S	90073-15-005 W EVANS ST	1		1	11
ASHBY BUILDERS LLC	S	90073-15-006 COIT & EVANS	1		2	11
ASHBY BUILDERS LLC	S	90073-15-007 N COIT ST	1		1	11
ASHBY BUILDERS LLC	S	90073-15-020 N COIT ST	1		1	11
AUSTIN GENERAL	S	90059-04-004 LOT 399 INGRAM ST	1			11
AVANT CHRISTOPHER & PEGGY A	S	440-05-084 HWY 442	1		1	50
AVENT FRANK H ETAL	S	2382-02-001 CC OF SC LOT 1-I	1			14
AVIN WALLACE L SR &	S	90133-02-018 DANVILLE LOT 14 PT 13	1		3	13
BACKUS MARGARET &	S	90059-07-017 INGRAM ST LOT 411	1		1	11
BACON DENISE D	S	339-01-008 BETHEL RD	1		3	14
BACOTE TERETHA & MELISSA	S	153-01-233 OFF HWY 52	1		1	13
BAKER BENNY	S	90059-12-003 CANNON ST LOTS 200-201	1		1	11
BAKER BOBBIE JEAN	S	70016-01-035 LOT 38 COLONIAL HGTS	1		1	41

Appendix C: Bidder Receipt Journal, Example

FLORENCE COUNTY SOUTH CAROLINA DELINQUENT TAX SALE: 2017 10:00 A.M. OCTOBER 02, 2017
BIDDER RECEIPT JOURNAL 10/02/17 PAGE: 9

M-B-P	TAXPAYER NAME		NOTICE#	TAX/FEES	
BIDDER#: 0945 ARGENT NOIR, LLC					
RECEIPT#: 2017-000027 DATE/TIME PAID: 17/10/02 16:16			RECEIPT AMOUNT:	30,200.00	
33-04-163			16009184	280.59	
33-04-163			17009263	142.30	*CURRENT YEAR
-MBP TOTAL-	BID AMT:	3,400.00			
48-03-003			16028549	127.85	
48-03-003			17028691	19.89	*CURRENT YEAR
-MBP TOTAL-	BID AMT:	3,600.00			
103-01-429			16003617	489.49	
103-01-429			17003631	333.64	*CURRENT YEAR
-MBP TOTAL-	BID AMT:	5,000.00			
103-01-431			16003619	434.56	
103-01-431			17003633	285.98	*CURRENT YEAR
-MBP TOTAL-	BID AMT:	5,000.00			
103-01-432			16003620	324.71	
103-01-432			17003634	190.65	*CURRENT YEAR
-MBP TOTAL-	BID AMT:	2,700.00			
104-01-198			16015309	434.56	
104-01-198			17015398	285.98	*CURRENT YEAR
-MBP TOTAL-	BID AMT:	2,700.00			
104-01-230			16033452	280.77	
104-01-230			17033614	152.52	*CURRENT YEAR
-MBP TOTAL-	BID AMT:	1,800.00			
109-01-018			16013695	233.73	
109-01-018			17013793	111.50	*CURRENT YEAR
-MBP TOTAL-	BID AMT:	6,000.00			

==RECEIPT TOTAL==	RECEIPT AMT	CASH RECEIVED	CHECKS RECEIVED	CHANGE	
	30,200.00	.00	30,200.00	.00	
BID AMOUNT: 30,200.00	DELINQUENT TAX:	2,606.26	CURRENT YR.TAX:	1,522.46	BIDS LESS TAX: 26,071.28

BIDDER#: 0926 GEE MICHAEL					
RECEIPT#: 2017-000028 DATE/TIME PAID: 17/10/02 16:17			RECEIPT AMOUNT:	1,550.00	
102-01-132			16013659	356.98	
102-01-132			17013756	218.63	*CURRENT YEAR
-MBP TOTAL-	BID AMT:	636.00			
90060-05-016			16006553	132.74	
90060-05-016			17006596	55.06	*CURRENT YEAR
-MBP TOTAL-	BID AMT:	310.00			
90118-08-013			16013670	325.45	
90118-08-013			17013767	218.46	*CURRENT YEAR
-MBP TOTAL-	BID AMT:	604.00			

==RECEIPT TOTAL==	RECEIPT AMT	CASH RECEIVED	CHECKS RECEIVED	CHANGE	
	1,550.00	1,550.00	.00	.00	
BID AMOUNT: 1,550.00	DELINQUENT TAX:	815.17	CURRENT YR.TAX:	492.15	BIDS LESS TAX: 242.68

Appendix D: Redeemed Properties, Example

4/06/22 REDEEMED PROPERTIES FROM 10/02/17 THROUGH 10/03/18 PAGE: 114

M-B-P	TAXPAYER NAME	NOTICE#	TAX/FEES	MTG.SEARCH FEE (*IN TAX/FEE)

CASH RECEIVED: 19,656.83 CHECKS RECEIVED: .00 CHANGE: 19,198.79
BIDDER#: 0936 COTTLE JOY DAWN & BULLOCH HUNTER BID AMT: 409.00 HOW PAY:

TAX SALE: 2017-01 RECEIPT#: 2017-000598
DATE/TIME PAID: 18/09/26 15:26 AMOUNT: 564.96 USERID: AMOORE WSID: T4

1682-04-002	MOORE S A & CO INC	16-049539	296.61	.00	
1682-04-002	MOORE S A & CO INC	17-049692	296.61	.00	

TOTAL TAX/FEE: 408.96 8% INTEREST: 156.00 REDEMPTION AMOUNT: 564.96 MTG.SEARCH FEE: .00
CASH RECEIVED: 19,198.79 CHECKS RECEIVED: .00 CHANGE: 18,633.83
BIDDER#: 0936 COTTLE JOY DAWN & BULLOCH HUNTER BID AMT: 1,300.00 HOW PAY:

TAX SALE: 2017-01 RECEIPT#: 2017-000603
DATE/TIME PAID: 18/09/26 15:27 AMOUNT: 227.85 USERID: AMOORE WSID: T4

116-31-079	MOORE S A & CO INC	16-049530	185.52	.00	
116-31-079	MOORE S A & CO INC	17-049683	185.52	.00	

TOTAL TAX/FEE: 203.37 8% INTEREST: 24.48 REDEMPTION AMOUNT: 227.85 MTG.SEARCH FEE: .00
CASH RECEIVED: 17,431.06 CHECKS RECEIVED: .00 CHANGE: 17,203.21
BIDDER#: 0964 DUBOSE LUTHER T BID AMT: 204.00 HOW PAY:

TAX SALE: 2017-01 RECEIPT#: 2017-000604
DATE/TIME PAID: 18/09/26 15:28 AMOUNT: 775.34 USERID: AMOORE WSID: T4

46-03-157	MOORE S A & CO INC	16-049520	362.62	.00	
46-03-157	MOORE S A & CO INC	17-049673	362.62	.00	

TOTAL TAX/FEE: 535.34 8% INTEREST: 240.00 REDEMPTION AMOUNT: 775.34 MTG.SEARCH FEE: .00
CASH RECEIVED: 17,203.21 CHECKS RECEIVED: .00 CHANGE: 16,427.87
BIDDER#: 0936 COTTLE JOY DAWN & BULLOCH HUNTER BID AMT: 2,000.00 HOW PAY:

TAX SALE: 2017-01 RECEIPT#: 2017-000605
DATE/TIME PAID: 18/09/26 15:31 AMOUNT: 467.13 USERID: AMOORE WSID: T4

46-03-033	MOORE S A & CO INC	16-049516	204.62	.00	
46-03-033	MOORE S A & CO INC	17-049669	204.62	.00	

TOTAL TAX/FEE: 239.13 8% INTEREST: 228.00 REDEMPTION AMOUNT: 467.13 MTG.SEARCH FEE: .00
CASH RECEIVED: 16,427.87 CHECKS RECEIVED: .00 CHANGE: 15,960.74
BIDDER#: 0964 DUBOSE LUTHER T BID AMT: 1,900.00 HOW PAY:

TAX SALE: 2017-01 RECEIPT#: 2017-000606
DATE/TIME PAID: 18/09/26 15:31 AMOUNT: 533.85 USERID: AMOORE WSID: T4

47-03-103	MOORE S A & CO INC	16-049526	331.28	.00	
47-03-103	MOORE S A & CO INC	17-049679	331.28	.00	

TOTAL TAX/FEE: 476.61 8% INTEREST: 57.24 REDEMPTION AMOUNT: 533.85 MTG.SEARCH FEE: .00

Appendix E: Properties Without Winning Bids, Example

FLORENCE COUNTY SOUTH CAROLINA DELINQUENT TAX SALE: 2017 10:00 A.M. OCTOBER 02, 2017
PROPERTIES WITHOUT WINNING BIDS PLACED 10/02/17 PAGE: 17

M-B-P	TAXPAYER NAME	NOTICE#	TAX/FEES		
80010-12-006	CURRY WILLETTE C ETAL	16015279	955.92		
80010-12-006	CURRY WILLETTE C ETAL	17013710	751.17		*CURRENT YEAR
-MBP TOTAL-	DEL.TAX/FEE: 2,988.93	CUR.YR.TAX:	751.17	BID AMT:	.00
80015-07-003	GRIMSLEY A LEE	16027796	409.59		
80015-07-003	GRIMSLEY A LEE	17027900	263.30		*CURRENT YEAR
-MBP TOTAL-	DEL.TAX/FEE: 469.59	CUR.YR.TAX:	263.30	BID AMT:	.00
80017-08-005	THOMAS BEN HEIRS	14067395	218.10		
80017-08-005	THOMAS BEN HEIRS	15067189	56.18		
80017-08-005	THOMAS BEN HEIRS	16067216	168.70		
80017-08-005	THOMAS BEN HEIRS	17067428	54.41		*CURRENT YEAR
-MBP TOTAL-	DEL.TAX/FEE: 502.98	CUR.YR.TAX:	54.41	BID AMT:	.00
80017-08-012	GRAHAM LEROY	16026229	607.27		
80017-08-012	GRAHAM LEROY	17026312	453.63		*CURRENT YEAR
-MBP TOTAL-	DEL.TAX/FEE: 667.27	CUR.YR.TAX:	453.63	BID AMT:	.00
80017-08-016	THOMAS JULIA	16067357	194.31		
80017-08-016	THOMAS JULIA	17076420	.00		*CURRENT YEAR
-MBP TOTAL-	DEL.TAX/FEE: 254.31	CUR.YR.TAX:	.00	BID AMT:	.00
80018-02-007	DOZIER BARBARA JEAN	16017953	246.82		
80018-02-007	DOZIER BARBARA JEAN	17064255	150.95		*CURRENT YEAR
-MBP TOTAL-	DEL.TAX/FEE: 306.82	CUR.YR.TAX:	150.95	BID AMT:	.00
80018-05-008	COCKFIELD IDA MARGARET ETAL	12012010	409.21		
80018-05-008	COCKFIELD IDA MARGARET ETAL	13012054	164.49		
80018-05-008	COCKFIELD IDA MARGARET ETAL	14012111	283.49		
80018-05-008	COCKFIELD IDA MARGARET ETAL	15012053	167.83		
80018-05-008	COCKFIELD IDA MARGARET ETAL	16012062	295.23		
80018-05-008	COCKFIELD IDA MARGARET ETAL	17012150	162.36		*CURRENT YEAR
-MBP TOTAL-	DEL.TAX/FEE: 1,380.25	CUR.YR.TAX:	162.36	BID AMT:	.00
80019-02-002	FULTON BENJAMIN	08077886	1,309.23		
80019-02-002	FULTON BENJAMIN	09076439	1,482.11		
80019-02-002	FULTON BENJAMIN	10023361	1,226.60		
80019-02-002	FULTON BENJAMIN	11023315	1,479.12		
80019-02-002	FULTON BENJAMIN	12023481	1,552.90		
80019-02-002	FULTON BENJAMIN	13023493	1,662.47		
80019-02-002	FULTON BENJAMIN	14023589	1,610.77		
80019-02-002	FULTON BENJAMIN	15023569	1,639.00		
80019-02-002	FULTON BENJAMIN	16023538	1,508.99		
80019-02-002	FULTON BENJAMIN	17023612	1,223.28		*CURRENT YEAR
-MBP TOTAL-	DEL.TAX/FEE: 13,531.19	CUR.YR.TAX:	1,223.28	BID AMT:	.00
80020-01-011	KIRBY D KEELS	16038753	255.58		
-MBP TOTAL-	DEL.TAX/FEE: 315.58	CUR.YR.TAX:	.00	BID AMT:	.00
80021-12-005	WILLIAMS JAMES E	10060050	273.73		
80021-12-005	WILLIAMS JAMES E	11073025	332.84		
80021-12-005	WILLIAMS JAMES E	12073184	499.63		
80021-12-005	WILLIAMS JAMES E	13073099	352.38		
80021-12-005	WILLIAMS JAMES E	14073302	498.83		

Appendix F: Data Entry Gantt Chart

Research Project Plan for "Developing an Economic Value Model for Delinquent Tax Auctions in South Carolina"
Doctoral Capstone, Walden University, IRB approval number is 04-05-22-1015495
PhD Candidate and Researcher: J. Wacker
Last Update: 22 May 2022

Complete
Behind
Pending

Task	Owner	Planned Start Date	Planned End Date	Duration, Days	Complete?
Gain IRB approval to begin research	IRB / LM	22-Mar	4-Apr	14	Y
Contact Flo Cty Treasurer for meeting	JDW	4-Apr	5-Apr	2	Y
Flo Cty Treasurer Confirms meeting	LWC	5-Apr	7-Apr	3	Y
Meet with Flo Cty Treasurer	JDW/LWC	8-Apr	8-Apr	1	Y
Agree on plan to start collecting 2017 Del. Tax Data	JDW/LWC	8-Apr	8-Apr	1	Y
Adjust sampling plan, if needed	JDW	9-Apr	9-Apr	1	Y
Build Gantt Chart for research data collection and entry	JDW	9-Apr	10-Apr	2	Y
Adjust Gantt Chart to reflect data collection timing	JDW	10-Apr	10-Apr	1	Y
Adjust Gantt Chart to reflect data entry timing	JDW	10-Apr	10-Apr	1	Y
Generate Phases of Data Collection/Data Entry	JDW	10-Apr	10-Apr	1	Y
Start Phase 1 of 3, Data Entry of Bidder's Journal (Hardcopy) from Florence County					
Build spreadsheet, input data "2017DelTaxMaster"	JDW	7-Apr	9-Apr	3	Y
Enter 150 lines, Bidder Receipt Journal	JDW	9-Apr	9-Apr	1	Y
Enter 150 lines, Bidder Receipt Journal	JDW	10-Apr	10-Apr	1	Y
Enter 150 lines, Bidder Receipt Journal	JDW	11-Apr	11-Apr	1	Y
Enter 100 lines, Bidder Receipt Journal	JDW	12-Apr	12-Apr	1	Y
Enter 100 lines, Bidder Receipt Journal	JDW	13-Apr	13-Apr	1	Y
Enter remaining lines, Bidder Receipt Journal	JDW	14-Apr	14-Apr	1	Y
Make-up days for any lines not entered	JDW	15-Apr	16-Apr	2	Y
Complete Phase 1 entries: All 676 properties entered	JDW	16-Apr	16-Apr	1	Y
Confirm entries are valid, check, rectify errors	JDW	16-Apr	16-Apr	1	Y
Review notes of process, use in Chapters 4,5	JDW	17-Apr	17-Apr	1	Y
Capture Questions for Flo Cty Treasurer	JDW	17-Apr	17-Apr	1	Y
Start Phase 2 of 3, Data Entry of Redeemed Properties (Hardcopy) from Florence County					
Enter 100 lines, Redeemed Properties File	JDW	20-Apr	20-Apr	1	Y
Enter 100 lines, Redeemed Properties File	JDW	21-Apr	21-Apr	1	Y
Enter 100 lines, Redeemed Properties File	JDW	22-Apr	22-Apr	1	Y
Enter 100 lines, Redeemed Properties File	JDW	23-Apr	23-Apr	1	Y
Enter 100 lines, Redeemed Properties File	JDW	24-Apr	24-Apr	1	Y
Enter remaining lines, Redeemed Properties File	JDW	25-Apr	25-Apr	1	Y
Make-up day for any lines not entered	JDW	26-Apr	26-Apr	1	Y
Update spreadsheet to show properties not redeemed	JDW	26-Apr	26-Apr	1	Y
Confirm entries are valid, check, rectify errors	JDW	26-Apr	26-Apr	1	Y
Document redeemed properties: Unknown # of entries	JDW	26-Apr	26-Apr	1	Y
Enter 75 lines, Properties Without Winning Bids Placed	JDW	27-Apr	27-Apr	1	Y
Enter 75 lines, Properties Without Winning Bids Placed	JDW	28-Apr	28-Apr	1	Y
Enter 17 lines, Properties Without Winning Bids Placed	JDW	1-May	1-May	1	Y
Confirm No Bid Properties: 167	JDW	2-May	2-May	1	Y
Confirm total properties, 676 + 167 = 843, rectify errors	JDW	2-May	2-May	1	Y
Review notes of process, use in Chapters 4,5	JDW	3-May	3-May	1	Y
Capture Questions for Flo Cty Treasurer	JDW	3-May	3-May	1	Y
Start Phase 3 of 3, Data Entry: Florence County Online Tax Inquiry (843 properties)					
Enter 100 lines, Website Search	JDW	3-May	3-May	1	Y
Enter 100 lines, Website Search	JDW	4-May	4-May	1	Y
Enter 100 lines, Website Search	JDW	5-May	5-May	1	Y
Enter 100 lines, Website Search	JDW	6-May	6-May	1	Y
Enter 100 lines, Website Search	JDW	7-May	7-May	1	Y
Enter 100 lines, Website Search	JDW	8-May	8-May	1	Y
Enter 100 lines, Website Search	JDW	9-May	9-May	1	Y
Enter 100 lines, Website Search	JDW	10-May	10-May	1	Y
Enter 43 lines, Website Search	JDW	11-May	11-May	1	Y
Confirm total properties, rectify errors	JDW	11-May	11-May	1	Y
Review notes of process, use in Chapters 4,5	JDW	11-May	11-May	1	Y
Capture Questions for Flo Cty Treasurer and email her	JDW	11-May	11-May	1	Y
Receive feedback from Asst. Dep. Treasurer	PH / JDW	12-May	13-May	2	Y