

The Cost of Delinquent Property Tax Collection

Three Essays in Local Public Finance

BY

Joshua J. Miller

B.B.A., University of New Mexico, 2000

M.B.A., College of Santa Fe, 2002

M.A., University of Illinois at Chicago, 2009

THESIS

Submitted as partial fulfillment of the requirements
for the degree of Doctor of Philosophy in Economics
in the Graduate College of the
University of Illinois at Chicago, 2012

Chicago, Illinois

Defense Committee:

Nathan Anderson, Chair and Advisor

Rebecca Hendrick, College of Urban Planning and Public Affairs, UIC

Robert Kaestner

David Merriman

Joseph Persky

This thesis is dedicated to JJ and Paetyn.

ACKNOWLEDGMENTS

I would like to thank my thesis committee—Nathan Anderson, Rebecca Hendrick, Robert Kaestner, David Merriman, Joseph Persky --for their unwavering support and assistance. I would also like to acknowledge Nathan Anderson, who oversaw the development of the proposal and made contributions important to the conduct of the study.

I am very grateful for the support provided by the Institute of Government & Public Affairs, Lincoln Institute of Land Policy, and the University of Illinois at Chicago Department of Economics.

TABLE OF CONTENTS

<u>CHAPTER</u>	<u>PAGE</u>
1. INTRODUCTION	8
1.1. Background and Motivation	8
2. CROSS STATE VARIATION IN DELINQUENT PROPERTY TAX COLLECTION POLICIES	
2.1. Introduction	10
2.2. The Delinquent Property Tax Collection System.....	10
2.3. Delinquent Property Tax Collection Policies – United States.....	11
2.3.1. Penalties.....	11
2.3.2. Interest Fees.....	12
2.3.3. Tax Lien Sales....	13
2.3.4. Tax Foreclosure.....	15
2.4. Equity, Efficiency, and Simplicity.....	16
2.5. Conclusion.....	19
2.6. Cited Literature.....	20
2.7. Appendix.....	21
3. THE RESPONSIVENESS OF PROPERTY TAXPAYERS TO DIFFERENCES IN PENALTIES AND INTEREST FEES: EVIDENCE FROM OREGON AND WASHINGTON STATE	
3.1. Introduction	51
3.1.1. Property Tax Delinquency Costs – Oregon.....	54
3.1.2. Property Tax Delinquency Costs – Washington State.....	55
3.1.3. Comparison of Property Tax Delinquency Costs.....	55
3.2. Literature Review	57
3.3. Property Tax Delinquency Decision.....	58
3.4. Data Sources and Variable Construction	60
3.5. Empirical Methods and Results	63
3.6. Conclusion	65
3.7. Cited Literature	66
3.8. Appendix	68
4. THE RESPONSIVENESS OF PROPERTY TAXPAYERS TO TAX LIEN SALES: EVIDENCE FROM OHIO	
4.1. Introduction	72
4.1.1. Ohio - Tax Lien Sales.....	74
4.1.2. Tax Lien Sale Adoption	75
4.1.3 Tax Lien Sale Costs – Delinquent Property Taxpayer.....	76
4.2. Literature Review	78
4.3. Data Sources and Variable Construction	80
4.4. Empirical Methods and Results	83
4.4.1. Identification Strategy	84
4.4.2. Fixed Effect and First Difference.....	88
4.5. Conclusion	91
4.6. Cited Literature	93
4.7. Appendix	94

TABLE OF CONTENTS (CONTINUED)

<u>CHAPTER</u>	<u>PAGE</u>
5. THE RESPONSIVENESS OF INVESTORS TO DIFFERENCES IN TAX LIEN SALE AUCTION DESIGN: EVIDENCE FROM ILLINOIS	
5.1. Introduction	100
5.1.1 Tax Lien Sale Auction Design	103
5.2. Literature Review	105
5.3. Theoretical Model	106
5.3.1. English Auctions	109
5.3.2. First Price Sealed Bid	113
5.4. Data Sources and Variable Construction	114
5.5 Empirical Methods	116
5.6. Results	119
5.7. Conclusion	122
5.8. Cited Literature	123
5.9. Appendix	125
VITA	135

LIST OF TABLES

<u>TABLE</u>		<u>PAGE</u>
I.	Table 2.3 – Delinquent Property Tax Collection Policies by State.....	21
II.	Table 2.3.3. – Tax Lien Sales by State.....	22
III.	Table 3.1.3.1. – Property Tax Delinquency Costs, Oregon & Washington State.....	69
IV.	Table 3.1.3.2. – Combined Penalties and Interest Fees, Oregon & Washington State.....	69
V.	Table 3.4 – County Descriptive Statistics, Oregon & Washington State.....	70
VI.	Table 3.5 – Empirical Results, OLS, Oregon & Washington State.....	71
VII.	Table 4.1.2 – Tax Lien Sale, Adoption, Ohio.....	94
VIII.	Table 4.1.3 – Property Tax Delinquency Costs, Ohio.....	95
IX.	Table 4.3.1 – County Descriptive Statistics, Ohio.....	96
X.	Table 4.3.2 – Municipality Descriptive Statistics, Ohio.....	97
XI.	Table 4.3.3 – Tax Lien Sale, Financial Effect, Ohio.....	98
XII.	Table 4.4.2 – Empirical Results, Fixed Effect and First Difference, Ohio.....	99
XIII.	Table 5.1.1 – Tax Lien Sale Auction Designs, Illinois.....	125
XIV.	Table 5.3 – Comparative Statistics.....	126
XV.	Table 5.4.1 – Descriptive Statistics I, Illinois.....	127
XVI.	Table 5.4.2 – Descriptive Statistics II, Illinois.....	128
XVII.	Table 5.4.3 – Descriptive Statistics III, Illinois.....	129
XVIII.	Table 5.6.1 – Empirical Results, Logit, Cook County.....	130
XIX.	Table 5.6.2 – Empirical Results, Logit, Collar Counties.....	131
XX.	Table 5.6.3 – Empirical Results, OLS, Cook County.....	132
XXI.	Table 5.6.4 – Empirical Results, OLS, Collar Counties	133
XXII.	Table 5.6.5 – Empirical Results, OLS, Censored.....	134

LIST OF FIGURES

<u>FIGURE</u>	<u>PAGE</u>
1. Figure 3 – Property Tax Delinquency Rates, Oregon & Washington State, 2000 to 2010...	68
2. Figure 5 – Cook and the Collar Counties.....	125

1. INTRODUCTION

1.1. Background and Motivation

Property tax delinquency can be costly for local governments and taxpayers. There are four important state government policies that affect the cost of property tax delinquency for taxpayers; penalties, interest fees, tax lien sales, and time to tax foreclosure.

Penalties are a one-time fee applied to a tax bill when not paid on time. Interest fees are recurring, applied to a tax bill the duration of delinquency. Tax lien sales introduce additional penalties, uncertain interest fees, and private tax foreclosure. Private tax foreclosure is more costly and faster than public tax foreclosure.

The first section of the dissertation documents state differences in penalties, interest fees, tax lien sales, and time to tax foreclosure. Higher penalties and interest increase the costs of property tax delinquency for delinquent taxpayers. The second section estimates the responsiveness of taxpayers to differences in penalties and interest fees. The third section estimates to what extent property tax delinquency is affected by tax lien sale induced changes in interest rates charged to delinquent taxpayers. The final section estimates the responsiveness of interest rates to differences in tax lien sale auction design.

The dissertation contributes to the literature because it is the first to describe cross-state variation in four important delinquent tax collection policies; penalties, interest fees, tax lien sales, and tax foreclosure. The dissertation is the first to estimate the responsiveness of taxpayers to differences in penalties, interest, and tax lien sales. The dissertation is the first to estimate the responsiveness of interest rate differences in tax lien sale auction design.

Property tax delinquency, the untimely payment of property taxes, is administratively and financially costly for local governments. Local governments cut services or raise taxes when property tax delinquency is high. Delinquent property tax bills require notification and monitoring. Penalties, interest fees, and tax lien sale policies set many decades in the past do not adequately cover costs for local governments. Estimating the responsiveness of taxpayers to penalties, interest fees, and tax lien sales is an important first step in designing policies which adequately cover property tax delinquency costs for local governments.

2. CROSS STATE VARIATION IN DELINQUENT PROPERTY TAX COLLECTION POLICIES

2.1. Introduction

The frequency and duration of property tax delinquency has increased significantly during the Great Recession. Many local governments struggle with excessive delinquent property tax balances. For example, the estimated total delinquent property tax balance in 2011 for the city of Philadelphia was \$472 million; approximately 19 percent of all properties in 2011 had a delinquent property tax balance (Kekstra, 2011).

The purpose of this paper is to document state variation in the application of four delinquent property tax collection policies. The four policies are penalties, interest fees, tax lien sales, and tax foreclosure. Documenting variation in these policies is important as local governments consider policy alternatives.

First, this paper describes how these four delinquent property tax collection policies function as a delinquent property tax collection system. Next, variation in the application of these policies by state is described. Finally, the benefits and costs of various delinquent property tax collection systems are considered. The paper provides policy makers with the first detailed examination of delinquent property tax collection policies.

2.2. The Delinquent Property Tax Collection System

Penalties, interest fees, tax lien sales, and tax foreclosure policies function as a system. When a taxpayer becomes delinquent a lien is placed on the property. A lien is an encumbrance placed on property to secure payment of delinquent taxes. The lien is either held by the local government or sold to private investors in a tax lien sale.

After the lien is placed on the property, penalties are added to the delinquent tax bill. Interest fees are applied monthly until the total delinquent balance paid in full. In the case of prolonged delinquency, property ownership rights are forcibly transferred to the lienholder through a process called a tax foreclosure.

2.3. Delinquent Property Tax Collection Policies – United States

Delinquent property tax collection systems vary in to the application of the four common policies penalties, interest fees, tax lien sales, and tax foreclosure. The application of policies are typically determined by state legislatures and uniformly applied by all local governments within a state. State legislatures choose penalties and interest fees, whether to conduct tax lien sales, and tax foreclosure procedures.

To draw a meaningful comparison of delinquent property tax policies by state are provided in table 2.3. The table lists policies applied to the typical taxpayer in each state in 2011. A typical delinquent property taxpayer is defined as an owner-occupier of residential property with the state median tax bill. Property tax delinquency is typically of duration less than one year. In cases where differences exist within state, features from the most populous taxing jurisdiction are presented. The table highlights variation in the application of policies by state.

2.3.1. Penalties

Penalties are a one-time fee applied to a tax bill when the tax bill is not paid on time. Penalties are typically applied as a percentage of the delinquent tax bill as reported in table 2.3. Penalties are charged in 29 states and the District of Colombia. For example in South Carolina delinquent property tax bills incur a penalty of three percent of the annual tax bill if paid one to

17 days delinquent, 10 percent of the annual tax bill 18 to 62 days delinquent, and 15 percent of the annual tax bill if paid any time after 63 days of delinquency. Penalties for South Carolina are reported as 15 percent. The typical taxpayer in South Carolina with a median delinquent property tax bill of \$756 incurred penalties of 15 percent or \$113.40 for one year of delinquency. In states that charge penalties, the most common, found in 11 states, is 10 percent.

2.3.2. Interest Fees

Interest fees also reduce the cost of delinquent property tax collection by discouraging short-term property tax delinquency and generating revenue from long-term property tax delinquency. Interest fees, unlike penalties, are charged in all states. With the exception of Alaska and Alabama, interest fees are based on a simple interest rate calculation. Alaska compounds interest monthly whereas Alabama compounds interest daily. Interest fees are reported in table 2.3 as a simple interest rate applied during the first year of delinquency.

A simple interest rate is applied to the annual property tax bill and not on interest accrued. For example, New Hampshire charges a simple interest rate of 1.5 percent per month or 18 percent per year. The interest fee charged on a delinquent median property tax bill of \$4,660 for one month of delinquency is 1.5 percent of the annual tax bill or \$69.90, two months is three percent or \$139.80, and three months is 4.5 percent or \$209.70. The most common interest fee, found in 18 states, is a 12 percent.

Six states set interest rates on a yearly basis. Alaska sets interest rates five percentage points above the federal funds rate. Colorado sets interest rates 9 percentage points above the federal funds rate. Kansas officials at the state level determine interest rate whereas in New

York City the interest rate is determined by the city council. Ohio sets interest fees three percentage points above the federal funds rate. Utah sets interest fees six percentage points above the federal funds rate with a minimum interest fee of 7 percent and a maximum of 10 percent.

2.3.3. Tax Lien Sales

Tax lien sales reduce the cost of delinquent property tax collection by discouraging short-term property tax delinquency and privatizing tax foreclosure. Tax foreclosure is the most costly part of the delinquent property tax collection system.

Local governments in all states place liens against property with delinquent tax bills. In 26 states¹ and the District of Columbia liens are sold by local governments to private investors in a tax lien sale. The tax lien sale column of table 2.3 indicates whether tax lien sales were conducted by the largest taxing jurisdiction within the state in 2011.

A tax lien sale is the sale delinquent property taxes by a local government to a private investor. When a property taxpayer becomes delinquent, a lien is placed against the property. The lien represents a collateralized receivable but not direct ownership. In a tax lien sale, investors pay the delinquent property tax bill to the government. In return, investors receive the property lien and the right to payment of the delinquent tax bill plus penalties and interest fees. In the case of prolonged property tax delinquency the investor obtains the property in tax foreclosure.

¹ In Massachusetts small municipalities conducted tax lien sales in 2011. However the majority of delinquent taxpayers are not subject to sales. Statute permits the use of tax lien sales in California and Nevada but no local governments within these states conducted tax lien sales in 2011. California, Massachusetts, and Nevada are not listed as a tax lien sale state in table 2.3 or table 2.3.3.

Tax lien sales are costly to delinquent taxpayers in two ways. The first is through additional penalties applied to delinquent property tax bills on property included in the sale. The second is through the privatization of the tax foreclosure process. Private initiated tax foreclosures are thought to occur more rapidly than public initiated tax foreclosures and are more costly to property owners (Rittenhouse, 2011).

Table 2.3.3 provides the basic features of tax lien sales in each state. Tax liens are sold to private investors in three ways; negotiated sales, lottery, and auctions. A majority of delinquent taxpayers in two states, New York and Texas, were subject to negotiated sales in 2011. In New York City officials negotiate with large firms to administer the entire portfolio of liens. Once the portfolio is transferred, the delinquent taxpayer owes delinquent taxes, penalties, and interest fees to the new lienholder, not to the city. In Texas, counties negotiate with local attorneys to administer the entire portfolio of liens. Once the portfolio is transferred, the delinquent taxpayer makes payment of the delinquent tax bill, penalties, and interest fees directly to the local attorney, not to the county government.

Kentucky and Wyoming sell annually, individual liens through a lottery. In both states investors are physically present the day of sale. In Wyoming, investors are assigned numbers which are drawn to determine whom has first right to purchase the lien. If the first investor drawn chooses not to purchase the lien, a second investor is drawn and given the right to purchase the lien. The process is repeated until the lien is sold. A slightly more involved lottery is conducted in Kentucky.

The method of tax lien sale in 22 states and the District of Columbia is auction. Auctions of individual liens are conducted in all instances with the exception of Maryland and Ohio. In

Maryland, investors are permitted to enter sealed bids on individual liens or multiple liens. In Ohio, county treasurers auction the entire portfolio of liens annually.

The most prevalent auction, used in 15 states and the District of Columbia, is the overbid method. Investors compete for the right to purchase liens by entering bids in whole dollars. Generally the minimum bid allowed is the delinquent property tax bill, penalties, and interest fees. The investor willing to pay the highest amount above the minimum bid wins the right to purchase the lien.

Arizona, Florida, Illinois, and New Jersey auction individual liens using the interest rate method. Investors compete for the right to purchase liens by entering bids corresponding to the interest rate charged to delinquent taxpayers. The investor willing to accept the lowest interest rate for paying the delinquent tax bill and penalties wins the right to purchase the lien.

Iowa, Nebraska, and Rhode Island auction individual liens using the percent ownership method. Investors compete for the right to purchase liens by entering a percentage bid between 100 and 0 representing the ownership stake of the property in the case of tax foreclosure. The investor willing to accept the lowest ownership stake in the property wins the right to purchase the lien.

2.3.4. Tax Foreclosure

Tax foreclosure is costly for local governments. Tax foreclosure is a legal proceeding where the payment of property taxes is enforced through the sale of property or transfer of ownership. The cost of delinquent property tax collection depends on the complexity of tax foreclosure and the duration of delinquency permitted prior to the completion of tax foreclosure.

Tax foreclosure is also costly for delinquent taxpayers because of court fee and court appearances. State laws dictate when local governments are allowed to begin the tax foreclosure process. Table 2.3 provides, by state, the maximum length of time, in years, of property tax delinquency permitted prior to the start of tax foreclosure.

For example, in the state of New Mexico property with three or more years of continuous property tax delinquency is seized by the New Mexico State Taxation & Revenue Department and sold at public auction. The length of delinquency allowed in New Mexico prior to tax foreclosure is three years. A slightly more involved example is a tax lien sale state such as Indiana. In Indiana liens are sold after six months of continuous property tax delinquency. When the lien is sold, property owners have one year to pay the delinquent tax bill, penalties, and interest fees. After an additional year of delinquency, lien holders are permitted to initiate tax foreclosure proceedings. The length of continuous property tax delinquency allowed in Indiana prior to tax foreclosure is 1.5 years.

2.4. Equity, Efficiency, and Simplicity

Using the criteria of equity, efficiency, and simplicity it is possible to compare delinquent property tax collection systems. The preferred set of policies is equitable in the distribution of tax burden, efficient as measured by economic growth and simple in taxpayer compliance and government administration. A delinquent property tax collection system includes penalties, interest fees, tax lien sales decision, and tax foreclosure.

Delinquent property tax collection system is equitable provided societal notions of fairness are achieved. For example a delinquent property tax collection system would be equitable provided an elderly residential property owner in County A with a delinquent tax bill

of \$2,000 faces the same penalties, interest fees, and tax foreclosure as an elderly residential property owner in County B with the same delinquent tax bill. Non-tax lien sale states promote equity when penalties, interest fees, and tax foreclosure policies are directed by state law and uniformly applied by all local governments. An example of such a state is Kansas whereby taxpayers face the same delinquent tax collection system regardless of county. An interest rate of 7 percent per year is applied to the delinquent tax bill and three years of delinquency are allowed prior to start of tax foreclosure proceedings. Additionally elderly, disabled, and disabled veterans are provided tax relief programs to alleviate the cost of property tax delinquency. Tax lien sales are not equitable as penalties, interest fees, and tax foreclosures often vary by local government and tax lien investor.

A delinquent property tax collection system is efficient provided a set of alternative policies does not raise the same revenue while increasing economic growth. An example of an efficient delinquent property tax collection system would be one that provides local governments with tax revenue sooner, delinquent taxpayers with interest fees equal to the borrowing costs, and promotes the most productive property use. Property tax revenue contributes to the economic growth of the community by allowing local governments to fund essential functions such as schools, fire, and police services. The more predictable and sooner property tax revenue is realized the better the local government is able to design and implement policies which promote economic growth.

The interest fees charged to delinquent taxpayers promotes economic growth by allowing taxpayers to use the property as collateral in borrowing against the delinquent tax bill. Property tax delinquency has been used by farmers and residential property owners as a form

of credit during economic recessions (Olson and Lachman 1976; Conrad and DeBoer 1988a). Delinquent tax bills are typically repaid during periods of economic expansion.

An efficient delinquent property tax collection system promotes the most productive property use by identifying and forcing the sale of under-utilized property. There exists a strong negative correlation between property tax delinquency and investments in property. Furthermore the decision to not pay all current and future property tax payments is a decision to abandon the property (White 1986). The forced transfer of property to owners willing to pay property taxes in a timely fashion and make investments in the property promotes economic growth.

Tax lien sale states using the interest rate auction method, such as Illinois, promote efficiency in terms of local government revenue, interest fees, and tax foreclosure when compared to non-tax lien sale states. Through the sale of liens to private investors, local governments realize delinquent property tax revenue sooner. In tax lien sales delinquent taxpayers pay weakly lower interest fees to private investors than local governments which are determined in a competitive market. Private investors are thought to force the sale of under-utilized property sooner through tax foreclosure than local governments.

Simplicity of the delinquent property tax collection policy is measured by the ability of taxpayers to comply and administrators to enforce. Non-tax lien sale states promote simplicity. Penalties, interest fees, and tax foreclosure requirements are known by administrators and taxpayers prior to the tax bill becoming delinquent. In tax lien sales penalties varies by investor. In tax lien sales using the interest rate auction method, interest fees often vary by property. In

addition in tax lien sale states local governments must conduct and administer these sales.

Administratively tax lien sale liens are costly.

In choosing delinquent tax collection policies, state and local government officials make a trade between the equity, efficiency, and simplicity. When analyzing qualitatively non-tax lien sale states offer equity and simplicity at the cost of efficiency. Tax lien sale states offer efficiency at the expense of equity and simplicity.

2.5. Conclusion

The first step in understanding the cost of delinquent property tax collection in the United States is to document variation the system of policies employed. This paper is the first to describe the four broad policies and the variation in the application of these policies by state. The policies are compared qualitatively using the criteria of equity, efficiency, and simplicity. Although no set of policies is superior in terms of equity, efficiency, and simplicity, the discussion is informative in understanding the trade-offs made by government officials in determining the appropriate set of delinquent property tax collection policies. The hope is that this paper will facilitate further study of the cost of delinquent property tax collection. The findings of such research would aid not only academics but also local government officials and property taxpayers alike.

2.6. Cited Literature

Kekstra, P. *Special Report: The Delinquency Crisis*. PlanPhilly. August 13, 2011.

O’Flaherty, B. “The Option Value of Tax Delinquency: Theory.” *Journal of Urban Economics* 28, 1990. 287-317.

Rittenhouse, C. D. “The True Cost of Not Paying Your Property Taxes in Ohio.” *University of Dayton Law Review* 36 (2), 2011. 221-247.

White, M. J. 1986. “Property Taxes and Urban Housing Abandonment.” *Journal of Urban Economics* 20, 1986. 312-330.

2.7. Appendix – Property Tax Delinquency Costs by State

Table 2.3
Delinquent Property Tax Collection Policies by State - 2011

State	Penalties	Interest Fees	Tax Foreclosure	Tax Lien Sale	Median Property Tax *
Alabama	-	12%	3.5 years	Yes	\$512
Alaska**	10%	5.25%	2 years	No	\$2,982
Arizona	-	16%	4 years	Yes	\$1,427
Arkansas	10%	10%	3 years	No	\$610
California	10%	18%	5 years	No	\$2,881
Colorado	-	10%	3.25 years	Yes	\$1,446
Connecticut	-	18%	1 year	No	\$4,903
Delaware**	6%	12%	2 years	No	\$1,198
District of Columbia	10%	18%	1.5 years	Yes	\$2,316
Florida	3%	18%	2 years	Yes	\$1,791
Georgia	10%	12%	1 years	No	\$1,447
Hawaii	10%	12%	6 years	No	\$1,396
Idaho	2%	12%	3 years	No	\$1,222
Illinois	-	18%	2.5 years	Yes	\$3,711
Indiana	10%	10%	1.5 years	Yes	\$1,041
Iowa	-	18%	2.25 years	Yes	\$1,652
Kansas	-	7%	3 years	No	\$1,716
Kentucky	-	12%	1.5 years	Yes	\$947
Louisiana	10%	12%	3.5 years	Yes	\$595
Maine**	-	7%	2.5 years	No	\$2,087
Maryland	8%	12%	1.25 years	Yes	\$2,956
Massachusetts**	-	14%	3 years	No	\$3,595
Michigan	4%	12%	3 years	No	\$2,244
Minnesota	10%	10%	3 years	No	\$2,140
Mississippi	-	12%	2.5 years	Yes	\$726
Missouri	7%	18%	4 Years	Yes	\$1,302
Montana	2%	10%	3.5 years	Yes	\$1,549
Nebraska	-	14%	3.5 years	Yes	\$2,319
Nevada	7%	10%	3 years	No	\$1,720
New Hampshire	-	18%	2.5 years	No	\$4,660
New Jersey	-	16%	2.25 years	Yes	\$6,828
New Mexico	5%	12%	3 years	No	\$1,068
New York**	-	18%	2 years	Yes	\$4,090
North Carolina	2%	9%	0.5 year	No	\$1,256
North Dakota	9%	12%	2 years	No	\$1,676
Ohio**	10%	3%	2 Years	Yes	\$1,932
Oklahoma	-	18%	3 years	No	\$894
Oregon	-	16%	3 years	No	\$2,390
Pennsylvania**	2%	18%	4 years	Yes	\$2,316
Rhode Island	-	12%	2 years	Yes	\$3,734
South Carolina	15%	12%	2 years	Yes	\$756
South Dakota	-	10%	3 years	Yes	\$1,713
Tennessee	6%	12%	1.5 years	Yes	\$972
Texas	12%	12%	2.5 years	Yes	\$2,433
Utah	2.5%	7%	5 years	No	\$1,407
Vermont	8%	12%	1.5 years	Yes	\$3,494
Virginia	10%	10%	2 years	No	\$1,919
Washington	11%	12%	3 years	No	\$2,658
West Virginia	-	9%	2 years	Yes	\$548
Wisconsin**	-	18%	1 year	No	\$3,128
Wyoming	3%	15%	4.5 years	Yes	\$1,119

* U.S. Census Bureau - American Community Survey - 2010 Median Real Estate Taxes Owner-occupied housing with a mortgage.

** Data was collected from the largest taxing jurisdiction due to within state variation (New Castle County, DE; Boston, MA; Portland, ME; New York City, NY; Cuyahoga County, OH; Philadelphia, PA; Milwaukee, WI)

Table 2.3.3
Tax Lien Sales by State - 2011

State	Type	Max Interest	Redemption Period
Alabama	Overbid	12%	2.5 years
Arizona	Interest Rate	16%	3 years
Colorado	Overbid	10%	3 years
District of Colombia	Overbid	18%	0.5 year
Florida	Interest Rate	18%	2 years
Illinois	Interest Rate	18%	2.5 years
Indiana	Overbid	10%	1 year
Iowa	Percent Ownership	24%	1.75 years
Kentucky	Lottery	12%	1 year
Louisiana	Overbid	12%	3 years
Maryland	Overbid	20%	0.5 year
Mississippi	Overbid	18%	2 years
Missouri	Overbid	10%	1 year
Montana	Overbid	10%	3 years
Nebraska	Percent Ownership	14%	3 years
New Jersey	Interest Rate	18%	2 years
New York**	Negotiated	18%	1 year
Ohio**	Overbid	18%	1 year
Pennsylvania**	Overbid	18%	3 years
Rhode Island	Percent Ownership	16%	1 year
South Carolina	Overbid	12%	1 year
South Dakota	Overbid	10%	3 years
Tennessee	Overbid	10%	1 year
Texas	Negotiated	-	2 years
Vermont	Overbid	12%	1 year
West Virginia	Overbid	12%	1.5 years
Wyoming	Lottery	15%	4 years

** Data was collected from the largest taxing jurisdiction due to within state variation
(New York City, NY; Cuyahoga County, OH; Philadelphia, PA)

Alabama - Property taxes are payable annually in one installment. A \$5.00 penalty is added to the unpaid tax bill the day after the due date. An interest fee of one percent per month or 12 percent per year is applied to the delinquent tax bill.

County governments conduct tax lien sales six months after the tax bill becomes delinquent. Liens are auctioned individually using the overbid method. Investors compete for the right to purchase liens by entering bids in whole dollars. The minimum bid allowed is the delinquent tax bill and penalties. The investor willing to pay the highest amount above the minimum bid of the delinquent tax bill and penalties wins the right to purchase the lien.

During a three year period of redemption investors earn an interest fee of one percent per month or 12 percent per year. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fee accrued during the three year redemption period the property deed is awarded to the lienholder.

Source: The Code of Alabama – Section 40-5-9/40-10

Alaska – Property taxes are payable annually in two equal installments. A 10 percent penalty is added to each installment if unpaid by the due date. An interest fee of two percent above the prime rate as of April 15 of each year is applied to the unpaid tax bill. The delinquent real property interest rate was 5.25 percent in 2011. Interest is compounded monthly.

Tax lien sales are not conducted in Alaska. If the delinquent taxpayer has not paid the unpaid tax bill, penalties, and interest accrued during a two year period the property deed is awarded to the municipality.

Source: Alaska Statute Title 29 - Chapter 45; Anchorage Municipal Code Title 12 - Chapter 12

Arkansas – Property taxes are payable annually in one installment. A 10 percent penalty is added to the delinquent tax bill the day after the due date. An interest fee of 0.83 percent per month or 10 percent per year is applied to the delinquent tax bill.

Tax lien sales are not conducted in Arkansas. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during a three year period the property deed is awarded to the state.

Source: The Arkansas Code of 1987 Section 23-36-201/23-36-202/23-37-101

Arizona – Property taxes are payable annually in two equal installments. An interest fee of 1.33 percent per month or 16 percent per year is applied to the delinquent tax bill.

County governments conduct tax lien sales 13 months after the tax bill becomes delinquent. Delinquent property included in the sale are assessed a five percent penalty. Liens are auctioned individually using the interest rate method. Investors compete for the right to purchase liens by entering one percentage point bids between 16 and zero percent. The investor willing to accept the lowest interest fee for paying the delinquent tax bill and penalties wins the right to purchase the lien.

During a three year period of redemption investors earn an interest fee agreed to during the auction. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during the three year redemption period the property deed is awarded to the lienholder.

Source: Arizona Revised Statute – Title 42 – Chapter 18

California – Property taxes are payable annually in two equal installments. A 10 percent penalty is added to each installment if unpaid by the due date. An interest fee of 1.5 percent per month or 18 percent per year is applied to the delinquent tax bill.

Tax lien sales are not conducted in California but are permitted by statute. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during a five year period the property deed is awarded to the county.

Source: California Revenue and Taxation Code – Section 2700-2708/3351-3353

Colorado – Property taxes are payable annually in one or two installments. An interest fee, set annually, of nine points above the federal discount rate is applied to the delinquent tax bill. The delinquent real property interest fee was 10 percent in 2011. Interest is compounded monthly.

County governments conduct tax lien sales a few months after the second installment. Liens are auctioned individually using the overbid method. Investors compete for the right to purchase liens by entering bids in whole dollars. The minimum bid allowed is the delinquent tax bill and penalties. The investor willing to pay the highest amount above the minimum bid of delinquent tax bill and penalties wins the right to purchase the lien.

During a three year period of redemption investors earn an interest fee of 10 percent per year. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during the three year redemption period the property deed is awarded to the lienholder.

Source: Colorado Revised Statute 39-10-104.5/39-11

Connecticut – Property taxes are payable annually with the number of installments varying by municipality. An interest fee of 1.5 percent per month or 18 percent per year is applied to the delinquent tax bill.

Tax lien sales are not conducted in Connecticut. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during a one year period the property deed may be awarded to the municipality.

Source: General Statutes of Connecticut – Title 12 – Chapter 204 – Section 12-146/12-157

Delaware – Property taxes are payable annually in one installment. Penalties, interest fees, and tax foreclosure policy vary by municipality. The policies of the largest municipality, New Castle, Delaware, are discussed. A six percent penalty is added to the delinquent tax bill the day after the due date. An interest fee of one percent per month or 12 percent per year is applied to the delinquent tax bill.

Tax lien sales are not conducted in Delaware. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during a two year period the property deed is awarded to the municipality.

Source: The Delaware Code – Title 9 – Chapter 86 to 87

District of Columbia – Property taxes are payable annually in two installments. A 10 percent penalty is added to each installment if unpaid by the due date. An interest fee of 1.5 percent per month or 18 percent per year is applied to the delinquent tax bill.

The District conducts tax lien sales annually for taxes with one year of delinquency. Liens are auctioned individually using the overbid method. Investors compete for the right to purchase liens by entering bids in whole dollars. The minimum bid allowed is the delinquent tax bill and penalties. The investor willing to pay the highest amount above the minimum bid of delinquent tax bill and penalties wins the right to purchase the lien.

During a six month period of redemption investors earn an interest fee of 18 percent per year. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during the six month year redemption period the property deed is awarded to the lienholder.

Source: District of Columbia Official Code 2001 – Division VII. – Title 47 – Chapter 13/13A/42

Florida – Property taxes are payable annually in one installment. A three percent penalty is added to the delinquent tax bill the day after the due date. An interest fee of 1.5 percent per month or 18 percent per year is applied to the delinquent tax bill.

County governments conduct tax lien sales two months after the tax bill becomes delinquent. Liens are auctioned individually using the interest rate method. Investors compete for the right to purchase liens by entering quarter percentage point bids between 18 and zero percent. The investor willing to accept the lowest interest fee for paying the delinquent tax bill and penalties wins the right to purchase the lien.

During a twenty two month period of redemption investors earn an interest fee agreed to during the auction. If the delinquent taxpayer has not paid the delinquent tax bill, penalties,

and interest fees accrued during the twenty two month redemption period the property deed is awarded to the lienholder.

Source: The 2011 Florida Statutes – Title XIV – Chapter 197 – Section 172/432

Georgia – Property taxes are payable annually in installment plans that vary by county. A 10 percent penalty is added to each installment 90 days after the due date. An interest fee of one percent per month or 12 percent per year is applied to the delinquent tax bill.

Tax lien sales are not conducted in Georgia but instead tax deed sales. Tax deeds may be conducted at any time after delinquency occurs. Deeds are auctioned individually using the overbid method. Investors compete for the right to purchase deeds by entering bids in whole dollars. The investor willing to pay the highest amount above the minimum bid of unpaid taxed and penalties wins the right to purchase the deed.

During a one year period of redemption investors earn an interest fee of 20 percent per year. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during the one year period of redemption period the property deed is awarded to the lienholder.

Source: Official Code of Georgia – Title 48 – Chapter 2 – Article 2; Official Code of Georgia – Title 48 – Chapter 4 – Article 5;

Hawaii – Property taxes are payable annually with the number of installments varying by municipality. A 10 percent penalty is added to each installment upon delinquency. An interest fee of one percent per month or 12 percent per year is applied to the delinquent tax bill.

Tax lien sales are not conducted in Hawaii. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during a six year period the property deed may be awarded to the municipality.

Source: Hawaii Revised Statute – Volume 1 – Division 1 - Title 14 – Chapter 246

Idaho – Property taxes are payable annually in one installment or two equal installments. A two percent penalty is added to each installment unpaid after the due date. An interest fee of one percent per month or 12 percent per year is applied to the delinquent tax bill.

Tax lien sales are not conducted in Idaho. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during a three year period the property deed may be awarded to the county.

Source: Idaho Statutes - Title 63 – Chapter 10

Illinois – Property taxes are payable annually in two installments. An interest fee of 1.5 percent per month or 18 percent per year is applied to the delinquent tax bill.

County governments conduct tax lien sales a few months after the tax bill becomes delinquent. Liens are auctioned individually using the interest rate method. Investors compete for the right to purchase liens by entering one percentage point bids between 18 and zero percent. The investor willing to accept the lowest interest fee for paying the delinquent tax bill and penalties wins the right to purchase the lien.

During a 2.5 year period of redemption investors earn an interest fee agreed to during the auction. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and

interest fees accrued during the 2.5 year redemption period the property deed is awarded to the lienholder.

Source: Illinois Compiled Statute – Chapter 35-200 – Title 7 – Article 21

Indiana – Property taxes are payable annually in two equal installments. A 10 percent penalty is added to each installment unpaid after the due date. An interest fee of 0.83 percent per month or 10 percent per year is applied to the delinquent tax bill.

County governments conduct tax lien sales a few months after the second installment. Liens are auctioned individually using the overbid method. Investors compete for the right to purchase liens by entering bids in whole dollars. The minimum bid allowed is the delinquent tax bill and penalties. The investor willing to pay the highest amount above the minimum bid of delinquent tax bill and penalties wins the right to purchase the lien.

During a one year period of redemption investors earn an interest fee of 10 percent per year. In addition if the lien is redeemed no more than six months after the sale a 10 percent penalty must be paid. If the lien is redeemed more than six months after the sale the penalty increases to 15 percent. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during the one year redemption period the property deed is awarded to the lienholder.

Source: Indiana Code – Title 6 – Article 1.1 – Chapter 22 to 24

Iowa – Property taxes are payable annually in two installments. An interest fee of 1.5 percent per month or 18 percent per year is applied to the delinquent tax bill.

County governments conduct tax lien sales a few months after the second installment becomes delinquent. Liens are auctioned individually using the percent ownership method. Investors compete for the right to purchase liens by entering a percentage between 100 and 0 representing the ownership stake of the property in the case of tax foreclosure. The investor willing to accept the lowest ownership stake in the property wins the right to purchase the lien.

During a 1.75 years period of redemption investors earn an interest fee of two percent per month or 24 percent per year. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during the 1.75 years redemption period the property deed is sold at auction.

Source: Iowa Code – Title X – Subtitle 2 – Chapter 445 to 448

Kansas – Property taxes are payable annually in two equal installments. An interest fee of 7 percent per year is applied to the delinquent tax bill. The interest fee is determined each year by the state.

Tax lien sales are not conducted in Kansas. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during a three year period the property deed may be awarded to the county.

Source: Kansas Statute Annotated – Chapter 79 – Article 20/23

Kentucky - Property taxes are payable annually in one installment. If the full tax bill is two months early a two percent discount is applied to the tax bill. A penalty of five percent is

applied to the delinquent tax bill after delinquency. The penalty is increased to 21 percent after 2.5 months of delinquency.

Liens are sold individually using a lottery method following six months of delinquency. At tax sale, numbers are drawn to determine the order in which bills are sold and investors rank. The first investor drawn is permitted to purchase the first lien on their list. The second investor drawn is then permitted to purchase the first lien on their list provided the lien has not already been purchased by the first investor drawn. The process is repeated until all liens are sold.

During a one year period of redemption investors earn an interest fee of 12 percent per year. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during the one year redemption period the property deed is awarded to the lienholder.

Source: Kentucky Revised Statute – Title XI – Chapter 134

Louisiana – Property taxes are payable annually in one installment. A 10 percent penalty is added to the delinquent tax bill after the due date. An interest fee of one percent per month or 12 percent per year is applied to the delinquent tax bill.

County governments conduct tax lien sales a few months after the second installment. Liens are auctioned individually using the overbid method. Investors compete for the right to purchase liens by entering bids in whole dollars. The minimum bid allowed is the delinquent tax bill and penalties. The investor willing to pay the highest amount above the delinquent tax bill and penalties wins the right to purchase the lien.

During a three year period of redemption investors earn an interest fee of 12 percent per year. In addition if the lien is redeemed a five percent penalty must be paid by the delinquent taxpayer. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during the three year redemption period the property deed is awarded to the lienholder.

Source: Louisiana Revised Statute – Title 47

Maine – Property taxes are payable annually. Penalties, interest fees, and tax foreclosure policy vary by municipality. The policies of the largest municipality, Portland, Maine, are discussed. An interest fee of 7 percent per year is applied to the delinquent tax bill.

Tax lien sales are not conducted in Maine. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during a 2.5 year period the property deed is awarded to the municipality.

Source: Maine Revised Statute – Title 36 – Chapter 105 – Subchapter 9

Maryland – Property taxes are payable annually in one installment or two equal installments. A one percent per month penalty is added to each delinquent installment after the due date. An interest fee of 0.67 percent per month or 8 percent per year is applied to the delinquent tax bill.

County governments conduct tax lien sales a few months after the second installment. Liens are auctioned in bulk using the overbid method. Investors compete for the right to

purchase multiple liens by entering sealed bids expressed as a multiple of the full cash value of properties. The investor with the highest multiple wins the right to purchase the lien.

During a one year period of redemption investors earn a 0.67 per month interest fee and one percent per month penalty fee. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during the six month redemption period the property deed is awarded to the lienholder.

Source: Maryland Code – Title 14 – Subtitle 8

Massachusetts – Property taxes are payable annually with the number of installments varying by municipality. Penalties, interest fees, and tax foreclosure policy vary by municipality. The policy of the largest municipality, Boston, Massachusetts, is discussed. An interest fee of 14 percent per year is applied to the delinquent tax bill.

Tax lien sales are not conducted in Boston, Massachusetts. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during a three year period the property deed is awarded to the county.

Source: Massachusetts General Law – Part I – Title IX – Chapter 60

Michigan – Property taxes are payable annually. A four percent penalty is added to the delinquent tax bill after the due date. An interest fee of one percent per month or 12 percent per year is applied to the delinquent tax bill. After two consecutive years of delinquency the interest fee increases to 1.5 per month or 18 percent per year.

Michigan discontinued the use of tax lien sales in 2006. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during a three year period the property deed is awarded to the municipality.

Source: Michigan Legislature – Act 206 of 1893

Minnesota - Property taxes are payable annually in two installments. A two percent penalty is added to the delinquent tax bill after the due date which increases to a maximum of 10 percent at the first year of delinquency. An interest fee of 10 percent per year is applied to the delinquent tax bill. The interest fee is set by statute each year.

Tax lien sales are not conducted in Minnesota. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during a three year period the property deed is awarded to the county. The length of redemption varies by property and homeowner characteristics.

Source: Minnesota Statutes – Chapters 279 to 281

Mississippi – Property taxes are payable annually in one installment. An interest fee of one percent per month or 12 percent per year is applied to the delinquent tax bill.

County governments conduct tax lien sales six months after the taxes become delinquent. Liens are auctioned individually using the overbid method. Investors compete for the right to purchase liens by entering bids in whole dollars. The minimum bid allowed is the delinquent tax bill and penalties. The investor willing to pay the highest amount above the minimum bid of delinquent tax bill and penalties wins the right to purchase the lien.

During a two year period of redemption investors earn an interest fee of 18 percent per year. In addition if the lien is redeemed a five percent penalty must be paid by the delinquent taxpayer. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during the two year redemption period the property deed is awarded to the lienholder.

Source: Mississippi Code of 1972 – Title 27 – Chapters 41/43/45/47

Missouri – Property taxes are payable annually in one installment. A 7 percent penalty is added to the delinquent tax bill after the due date. An interest fee of 1.5 percent per month or 18 percent per year is applied to the delinquent tax bill.

County governments conduct tax lien sales 8 months after the taxes become delinquent. Liens are auctioned individually using the overbid method. Investors compete for the right to purchase liens by entering bids in whole dollars. The minimum bid allowed is the delinquent tax bill and penalties. The investor willing to pay the highest amount above the minimum bid of delinquent tax bill and penalties wins the right to purchase the lien.

During a one year period of redemption investors earn an interest fee of 10 percent per year. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during the one year redemption period the property deed is awarded to the lienholder.

Source: Missouri Revised Statute – Title X – Chapter 139 to 141

Montana – Property taxes are payable annually in two equal installments. A two percent penalty is added to the delinquent tax bill after the due date. An interest fee of 0.83 percent per month or 10 percent per year is applied to the delinquent tax bill.

County governments conduct tax lien sales a few months after the second installment becomes delinquent. Liens are auctioned individually using the overbid method. Investors compete for the right to purchase liens by entering bids in whole dollars. The minimum bid allowed is the balance of the unpaid tax bill and penalties. The investor willing to pay the highest amount above the minimum bid of delinquent tax bill and penalties wins the right to purchase the lien.

During a three year period of redemption investors earn an interest fee of 10 percent per year. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during the three year redemption period the property deed is awarded to the lienholder.

Source: Montana Code Annotated – Title 15 – Chapter 16/17

Nebraska – Property taxes are payable annually in two equal installments. An interest fee of 0.039 percent per day or 14 percent per year is applied to the delinquent tax bill.

County governments conduct tax lien sales six months after the second installment becomes delinquent. Liens are auctioned individually using the percent ownership method. Investors compete for the right to purchase liens by entering a percentage between 100 and 0 representing the ownership stake of the property in the case of tax foreclosure. The investor willing to accept the lowest ownership stake in the property wins the right to purchase the lien

During a three year period of redemption investors earn an interest fee of 14 percent per year. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during the three year redemption period the property deed is awarded to the lienholder.

Source: Nebraska Revised Statute – Chapter 45 – Section 104.1; Nebraska Revised Statute – Chapter 77

Nevada – Property taxes are payable annually in four equal installments. A penalty of four percent is added to the tax bill if the first installment is not paid. The penalty is increased to five percent if the second installment is not paid, six percent if the third installment is not paid, and seven percent if the fourth installment is not paid. An interest fee of 0.83 percent per month or 10 percent per year is applied to the delinquent tax bill.

Tax lien sales are not conducted in Nevada but are permitted by statute. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during a three year period the property deed is awarded to the county.

Source: Nevada Revised Statute – Title 32 – Chapter 361

New Hampshire – Property taxes are payable annually with the number of installments varying by municipality. An interest fee of 1.5 percent per month or 18 percent per year is applied to the delinquent tax bill.

Tax lien sales are not conducted in New Hampshire. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during a 2.5 year period the property deed is awarded to the municipality.

Source: New Hampshire Statute – Title V – Chapter 80

New Jersey – Property taxes are payable annually in four equal installments. An interest fee of 8 percent per year is applied to the first \$1,500 of unpaid tax bill with 18 percent on the remaining balance.

Municipalities conduct tax lien sales a few months after the fourth installment becomes delinquent. Liens are auctioned individually using the interest rate method. Investors compete for the right to purchase liens by entering one percentage point bids between 18 and zero percent. The investor willing to accept the lowest interest fee for paying the delinquent tax bill and penalties wins the right to purchase the lien.

During a two year period of redemption investors earn an interest fee agreed to during the auction. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during the two year redemption period the property deed is awarded to the lienholder.

Source: New Jersey Permanent Statute – Title 54

New Mexico – Property taxes are payable annually in two equal installments. A one percent per month penalty, five percent maximum, is added to the delinquent tax bill after the due date.

An interest fee of one percent per month or 12 percent per year is applied to the delinquent tax bill.

Tax lien sales are not conducted in New Mexico. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during a three year period the property deed is awarded to the state.

Source: New Mexico Statute – Chapter 7 - Article 38

New York – Property taxes are payable annually. Penalties, interest fees, and tax foreclosure policy vary by municipality. The policies of the largest municipality, New York City, New York, are discussed. The interest fee is set annually by the city council. An interest fee of 9 percent per year is applied to the delinquent tax bill on property with an assessed value less than \$250,000. An interest fee of 18 percent per year is applied to the delinquent tax bill on vacant property and property with an assessed value greater than \$250,000.

The City of New York does not offer liens for sale to individual investors or to the general public. Instead the City negotiates with large firms to administer the entire delinquency portfolio with one year or more of delinquency. Once the portfolio is transferred, the delinquent taxpayer then owes the taxes, penalties, and accrued interest to the new lienholder, not to the City. The amount the property owner owes automatically increases once the lien is sold, because the lienholder is entitled to receive a 5 percent penalty on the entire lien amount, plus 18 percent interest, compounded daily and payable semi-annually. Foreclosure can begin within one year after the lien sale date if the delinquent tax bill is not paid the lien in full or entered into an installment agreement with the new lienholder.

Source: New York Real Property Tax Law – Article 11

North Carolina – Property taxes are payable annually in one installment. A two percent penalty is added to the delinquent tax bill after the due date. An interest fee of 0.75 percent per month or 9 percent per year is applied to the delinquent tax bill.

North Carolina discontinued the use of tax lien sales in 1983. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during a six month period the property deed is may be awarded to the county.

Source: North Carolina General Statute – Chapter 105 – Article 26

North Dakota – Property taxes are payable annually in two equal installments. If the full tax bill is paid early a five percent discount is applied to the tax bill. A nine percent penalty is added to the delinquent tax bill after second installment is not paid. An interest fee of one percent per month or 12 percent per year is charged against the delinquent tax bill.

Tax lien sales are not conducted in North Dakota. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during a two year period the property deed is may be awarded to the county.

Source: North Dakota Century Code – Title 57

Ohio – Property taxes are payable annually in two equal installments. A penalty of 10 percent is added to the delinquent tax bill 10 days after the due date. An interest fee of three percent

above the Federal Reserve short-term interest rate is applied to the delinquent tax bill. The delinquent real property interest fee was four percent in 2011.

Counties choose whether to conduct tax lien sales and the type of tax lien sales to conduct. Liens with one year of delinquency are auctioned in bulk using either the interest rate or overbid method. In the interest rate auction investors compete for the right to purchase all liens by entering one percentage point bids between 18 and zero percent. The investor willing to accept the lowest interest fee for paying the delinquent tax bill and penalties wins the right to purchase all liens.

In the overbid auction Investors compete for the right to purchase liens by entering bids in whole dollars. The minimum bid allowed is the balance of the delinquent tax bill and penalties. The investor willing to pay the highest amount above the minimum bid of delinquent tax bill and penalties wins the right to purchase all liens. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during the one year redemption period the property is sold at auction.

Source: Ohio Revised Code – Chapter 5721; Ohio House Bill 371/562

Oklahoma – Property taxes are payable annually in one or two installments. An interest fee of 1.5 percent per month or 18 percent per year is applied to the delinquent tax bill.

Oklahoma discontinued the use of tax lien sales in 2008. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during a three year period the property deed is awarded to the county.

Source: Oklahoma Statutes – Title 68

Oregon – Property taxes are payable annually in one, two, or three installments. A three percent discount is applied to the tax bill for early payment using one installment. An interest fee of 1.33 percent per month or 16 percent per year is applied to the delinquent tax bill.

Tax Lien sales are not conducted in Oregon. If the delinquent taxpayer has not paid the delinquent tax bill and interest fees accrued during a three year period the property deed is awarded to the county.

Source: Oregon Revised Statute – Volume 8 – Title 29 – Chapter 311/312

Pennsylvania – Property taxes are payable annually. Penalties, interest fees, and tax foreclosure policy vary by municipality. The policies of the largest municipality, Philadelphia, Pennsylvania, are discussed. An interest fee of 1.5 percent per month or 18 percent per year is charged.

The Sheriff's Office conducts tax lien sales about one year after taxes become delinquent. Liens are auctioned individually using the overbid method. Investors compete for the right to purchase liens by entering bids in whole dollars. The minimum bid allowed is the delinquent tax bill and penalties. The investor willing to pay the highest amount above the minimum bid of the delinquent tax bill and penalties wins the right to purchase the lien.

During a three year period of redemption investors earn an annual interest fee of 18 percent. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fee accrued during the three year redemption period the property deed is awarded to the lienholder.

Source: The Pennsylvania Code – Title 61; The Philadelphia Code – Chapter 19

Rhode Island – Property taxes are payable annually in four equal installment. Penalties, interest fees, and tax foreclosure policy vary by municipality. The policies of the largest municipality, Providence, Rhode Island, are discussed. An interest fee of one percent per month or 12 percent per year is charged against the delinquent tax bill.

County governments conduct tax lien sales about one year after taxes become delinquent. Liens are auctioned individually using the percent ownership method. Investors compete for the right to purchase liens by entering a percentage between 100 and 0 representing the ownership stake of the property in the case of tax foreclosure. The investor willing to accept the lowest ownership stake in the property wins the right to purchase the lien.

During a one year period of redemption investors earn an interest fee of 10 percent if delinquent taxes are paid in the first six months and one percent per month thereafter. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during the one year redemption period the property deed is awarded to the lienholder.

Source: State of Rhode Island General Laws – Title 44

South Carolina – Property taxes are payable annually in one installment. A penalty of three percent is applied to the unpaid tax bill after delinquency. The penalty is increased to 10 percent after 15 days of delinquency and to 15 percent after two months of delinquency. An interest fee of one percent per month or 12 percent per year is applied to the delinquent tax bill.

County governments conduct tax lien sales about one year after taxes become delinquent. Liens are auctioned individually using the overbid method. Investors compete for the right to purchase liens by entering bids in whole dollars. The minimum bid allowed is the delinquent tax bill and penalties. The investor willing to pay the highest amount above the minimum bid of delinquent tax bill and penalties wins the right to purchase the lien.

During a one year period of redemption investors earn an interest fee of three percent if delinquent taxes are paid in the first three months, six percent is paid from three to six months, 9 percent if paid six to 9 months, and 12 percent is paid thereafter. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during the one year redemption period the property deed is awarded to the lienholder.

Source: South Carolina Code of Laws – Title 12 – Chapter 45/49

South Dakota – Property taxes are payable annually in two equal installments. An interest fee of 0.83 percent per month or 10 percent per year is applied to the delinquent tax bill.

County governments conduct tax lien sales a few months after the second installment becomes delinquent. Liens are auctioned individually using the overbid method. Investors compete for the right to purchase liens by entering bids in whole dollars. The minimum bid allowed is the delinquent tax bill and penalties. The investor willing to pay the highest amount above the minimum bid of delinquent tax bill and penalties wins the right to purchase the lien.

During a three year period of redemption investors earn an interest fee of 10 percent per year. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest

fees accrued during the three year redemption period the property deed is awarded to the lienholder.

Source: South Dakota Codified Laws – Title 10 – Chapter 21 to 26

Tennessee – Property taxes are payable annually in one installment. A penalty of 0.5 percent fee per month or six percent per year is applied to the unpaid tax bill. An interest fee of one percent per month or 12 percent per year is applied to the delinquent tax bill.

County governments conduct tax lien sales a five months after the tax bill becomes delinquent. Liens are auctioned individually using the overbid method. Investors compete for the right to purchase liens by entering bids in whole dollars. The minimum bid allowed is the delinquent tax bill and penalties. The investor willing to pay the highest amount above the minimum bid of the delinquent tax bill and penalties wins the right to purchase the lien.

During a one year period of redemption investors earn an interest fee of 10 percent per year. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during the one year redemption period the property deed is awarded to the lienholder.

Source: Tennessee Code – Title 67 – Chapter 5

Texas - Property taxes are payable annually in one installment. A penalty of six percent is added to the tax bill after delinquency. The penalty increases by one percent each month for a maximum of 12 percent penalty. An interest fee of one percent per month or 12 percent per year is applied to the unpaid tax bill.

Texas counties do not offer liens for sale to individual investors or to the general public. Instead the county negotiates with local attorneys large firms to administer the entire delinquency portfolio of liens with six months or more of delinquency. Once the entire portfolio is transferred, the property owner then owes the delinquent tax bill, charges, and accrued interest fees to the new attorneys, not to the county. The amount the property owner owes automatically increases once the lien is sold, because the lienholder is entitled to receive a 15 to 20 percent penalty of the accumulate delinquency. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during the two year redemption period the property deed is awarded to the lienholder.

Source: Texas Tax Code – Title 1 – Subtitle E

Utah – Property taxes are payable annually in one installment. A penalty of 2.5 percent is added to the delinquent tax bill after two months of delinquency. An interest fee of six percent above the target federal funds rate as of January 1 is applied to the unpaid tax bill. The interest fee must fall within the minimum of 7 percent and a maximum of 10 percent. The delinquent real property interest fee was 7 percent in 2011.

Tax Lien sales are not conducted in Utah. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fee accrued during a five year period the property deed is awarded to the county.

Source: Utah Code – Title 59 – Chapter 2

Vermont – Property taxes are payable annually with the number of installments varying by municipality. An 8 percent penalty is added to the unpaid tax bill 30 days after the due date. An interest fee of one percent per month or 12 percent per year is applied to the delinquent tax bill.

Municipalities conduct tax lien sales a few months after the tax bill becomes delinquent. Liens are auctioned individually using the overbid method. Investors compete for the right to purchase liens by entering bids in whole dollars. The minimum bid allowed is the delinquent tax bill and penalties. The investor willing to pay the highest amount above the minimum bid of delinquent tax bill and penalties wins the right to purchase the lien.

During a one year period of redemption investors earn an interest fee of 12 percent per year. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during the one year redemption period the property deed is awarded to the lienholder.

Source: Vermont Statutes – Title 32 – Chapter 133

Virginia – Property taxes are payable annually with the number of installments varying by municipality. A 10 percent penalty is added to the delinquent tax bill after the due date. An interest fee of 0.83 percent per month or 10 percent per year is applied to the delinquent tax bill.

Tax Lien sales are not conducted in Virginia. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during a two year period the property deed is awarded to the county.

Source: Code of Virginia – Title 58.1 – Chapter 32

Washington – Property taxes are payable annually in two equal installments. A penalty of three percent is added to the tax bill if the first installment is not paid. The penalty is increased to 11 percent if the second installment is not paid. An interest fee of one percent per month or 12 percent per year is applied to the delinquent tax bill.

Tax lien sales are not conducted in Washington. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during a three year period the property deed is awarded to the county.

Source: Revised Code of Washington – Title 84

West Virginia – Property taxes are payable annually in two equal installments. An interest fee of 0.75 percent per month or 9 percent per year is applied to the delinquent tax bill.

Counties conduct tax lien sales a six months after the tax bill becomes delinquent. Liens are auctioned individually using the overbid method. Investors compete for the right to purchase liens by entering bids in whole dollars. The minimum bid allowed is the delinquent tax bill and penalties. The investor willing to pay the highest amount above the minimum bid of delinquent tax bill and penalties wins the right to purchase the lien.

During a one year period of redemption investors earn an interest fee of 12 percent per year. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during the 1.5 year redemption period the property deed is awarded to the lienholder.

Source: West Virginia Code – Chapter 11A

Wisconsin – Property taxes are payable annually in two or three equal installments. An interest fee of 1.5 percent per month or 18 percent per year is applied to the delinquent tax bill.

Tax lien sales are not conducted in Wisconsin. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during a one year period in Milwaukee County and a two year period in all other counties the property deed is awarded to the county.

Source: Wisconsin Statute – Chapter 74

Wyoming – Property taxes are payable annually in one installment or two equal installments. Counties conduct tax lien sales a shortly after the second installment is not paid. A penalty of three percent is added to the delinquent tax bill for liens included in the sale.

Liens are sold individually using a lottery method. The treasurer announces each delinquent property by owner name and amount due. After each announcement, a number is drawn. The participant's number which matches the number drawn has the option to purchase the lien or pass. In the case of a pass, another number is drawn until the lien is purchased. This process is repeated until all liens are sold.

During a four year period of redemption investors earn an interest fee of 15 percent per year. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during the four year redemption period the property deed is awarded to the lienholder.

Source: Wisconsin Statute – Title 39

3. THE RESPONSIVENES OF PROPERTY TAXPAYERS TO DIFFERENCES IN PENALTIES AND INTEREST FEES: EVIDENCE FROM OREGON AND WASHINGTON STATE

3.1. Introduction

Property tax delinquency, the untimely payment of property taxes, is administratively and financially costly for local governments. Local governments cut services or raise taxes when property tax delinquency is high. Delinquent property tax bills require notification and monitoring.

Penalties and interest fees are applied to tax bills in the United States when property taxes are paid late. Penalties and interest fees serve two main functions. The first is to discourage late payment, property tax delinquency. The second is to reduce the cost of unavoidable property tax delinquency, delinquency of taxpayers unwilling or unable to pay. Although penalties and interest fees are found in all 50 states and the District of Colombia, little is known about the responsiveness of property taxpayers to differences in penalties and interest fees. The purpose of this paper is to estimate the responsiveness of property taxpayers to differences in penalties and interest fees.

Estimating the responsiveness of taxpayers to differences in penalties and interest fees is important because property tax delinquency has increased significantly during the Great Recession. Penalties and interest fees policies set many decades in the past do not adequately meet the needs of local governments. For example, Ohio sets interest fees three percentage points above the federal funds rate. The three percent interest fee does not capture the “true” cost of borrowing for the local government or taxpayers. This paper provides policy makers with an estimate of the responsiveness of taxpayers to differences in penalties and interest fees; an essential step in weighing the benefits and costs of alternative policies.

In the United States, penalties and interest fees are set by state governments and applied to delinquent property tax bills by local governments within each state. Variation in penalties and interest fees are observed by state. Ideally, estimating taxpayer responsiveness is accomplished by comparing aggregate measures of property tax delinquency in each state controlling for differences in penalties and interest fees.

There are two possible reasons why a comparison of property tax delinquency by state would not produce an unbiased estimate. The first is the result of non-random selection of penalties and interest fees. It is possible that state legislatures select penalties and interest fees based on unobserved characteristics correlated with property tax delinquency. If states with high levels of property tax delinquency choose high penalties and interest fees, then across-state variation in penalties and interest fees is positively associated with property tax delinquency. Inattentive estimation would imply that higher penalties and interest fees cause higher rates of delinquency.

The second potential bias is the result of differences in the way states measure property tax delinquency. California, for example, measures property tax delinquency of less than one year for real property. Ohio measures property tax delinquency for real and personal property. Comparing different measures of property tax delinquency presents a potential bias of unknown direction and magnitude.

Oregon and Washington State provide the best opportunity to generate an unbiased estimate of the responsiveness of taxpayers to differences in penalties and interest fees. Oregon and Washington State offer comparable measures of property tax delinquency for all counties. Counties do not choose penalties and interest fees. Instead, state legislatures in

Oregon set penalties and interest fees in 1989 which are uniformly applied in all counties. Legislatures in Washington State set penalties and interest fees in 1981 which are uniformly applied in all counties. The comparable county measures of property tax delinquency and uniform application of penalties and interest fees in all counties mitigate potential biases.

The responsiveness of property taxpayers to differences in penalties and interest fees is estimated using county property tax delinquency data in Oregon and Washington State. I estimate property tax delinquency rates in Oregon counties to be 17 percent higher than similar counties in Washington State from 2000 to 2010. The observed variation in county property tax delinquency rates between Oregon and Washington State is explained by time invariant differences in state mandated penalties and interest fees. The results imply that had the largest county in Oregon, Multnomah County, utilized Washington State penalties and interest fees in 2010, the county would have reduced the property tax delinquency by approximately \$11 million.

To understand the magnitude of taxpayer responsiveness to variation in property tax delinquency costs it is worth noting that property tax delinquency is typical of duration less than one year. The largest county in Washington State, King County, estimates of the 2009 property tax delinquency nearly 70 percent was paid within one year. The largest county in Oregon, Multnomah County, estimates of the 2009 property tax delinquency nearly 60 percent was paid within one year. Therefore, focusing on first year property tax delinquency costs the combined penalties and interest fees in Washington State are 44 percent higher than the combined penalties and interest fees in Oregon.

The results suggest that a 44 percent increase in combined penalties and interest fees lead to a decrease in the amount of property tax delinquency by 17 percent. The estimated price elasticity of demand for property tax delinquency is 0.36. It appears the demand for property tax delinquency is rather inelastic. The findings suggest taxpayers choosing property tax delinquency are largely individuals with high personal borrowing rates.

3.1.1. Property Tax Delinquency Costs - Oregon

In Oregon, the annual property tax bill is payable each year on November 15. Taxpayers may elect to pay the tax bill in three equal installments with the first installment due November 15, the second installment due on February 15, and the final installment due on May 15. A discount of three percent is applied if the tax bill is paid in full by November 15; a two percent discount is applied if two-thirds of the tax bill is paid by November 15.

If the taxpayer is unable to pay the tax bill by the due date, interest accrues at a rate of 1.33 percent per month (16 percent per year). Interest fees are applied to the total annual tax bill but not to interest accrued from prior delinquency. For example if a taxpayer is unable to pay any portion of a \$1,000 total annual property tax bill by November 15 an interest fee of 1.33 percent is applied on November 16 resulting in new balance due of \$1,013.33. If the tax bill remains delinquent an additional interest fee of 1.33 percent is applied to the \$1,000 tax bill on December 16 and the total amount due becomes \$1,026.67. Interest fees accrue at a monthly rate of 1.33 percent until tax foreclosure.

If taxes remain unpaid for three years counties initiate tax foreclosure proceedings. Tax foreclosure is the legal process by which a county acquires title to a property for the non-payment of taxes. Once title is acquired by the county, the property is sold.

3.1.2. Property Tax Delinquency Costs - Washington State

In Washington State property taxes are collected in two equal installments. The first installment is due April 30 and the second installment is due October 30. No discount is given for full payment of the tax bill on April 30.

If the taxpayer is unable to make timely payment, interest accrues at a rate of one percent per month (12 percent per year). Interest fees are applied to the total annual tax bill but not to interest accrued from prior delinquency. For example if a taxpayer is unable to pay one half of a \$1,000 property tax bill by April 30 an interest fee of one percent is applied to the total annual tax on May 1 resulting in new balance due of \$1,010. If the tax bill remains delinquent an additional interest fee of one percent is applied to the \$1,000 tax bill on June 1. Interest fees accrue at a monthly rate of one percent until tax foreclosure.

In addition to interest fees Washington State applies penalties for property tax delinquency. A three percent penalty is applied to the total annual tax bill if unpaid one month after the first installment is due on June 1. An additional 8 percent penalty is applied to the total annual tax bill if unpaid 7 months after the first installment is due on December 1. The penalties are only applied during the first year of delinquency and not on interest accrued.

If taxes remain unpaid for three years the counties initiate tax foreclosure proceedings. Tax foreclosure is the legal process by which a county acquires title to a property for the non-payment of taxes. Once title is acquired by the county, the property is sold.

3.1.3. Comparison of Property Tax Delinquency Costs

Delinquent property tax collection policies commonly used in the United States include penalties, interest fees, tax lien sales, and tax foreclosure. These policies effect property tax

delinquency costs. Oregon and Washington State policies are summarized in table 3.1.3.1. The two states do not allow tax lien sales and follow similar tax foreclosure policy, three years of delinquency prior to the start of tax foreclosure proceedings. Oregon and Washington State differ in penalties and interest fees.

Penalties and interest fees are direct substitutes for lenders. Empirical evidence (Massoud, et al. 2011) suggests that credit card companies use penalties and interest fees interchangeably. The study finds an increase in credit card interest rates by one standard deviation reduces late fees by between 7 percent and 20 percent.

Theoretically, penalties and interest fees are direct substitutes for borrowers. Penalties increase the cost of borrowing immediately. Interest fees are penalties applied at a future date. A borrower's discount rate determines the relative price of penalties and interest fees. Table 3.1.3.2 provides combined penalties and interest at each month of delinquency. Penalties and interest fees are higher for Washington State taxpayers from the second month of delinquency to the 32nd month of delinquency.

The relationship between discounts for early payment and property tax delinquency is unknown. Oregon offers a three percent discount for full payment of the annual tax bill at the first installment, whereas Washington State offers no discount for full payment of the annual tax bill at the first installment. It is possible that discounts for early payment are equivalent to interest fees for late payment. However, it is more likely that just taxpayers view discounts for early payment and combined penalties and interest fees for property tax delinquency as separate goods. In which case, taxpayers switch from timely payment to early payment when discounts for early payment are offered and not from delinquency to early payment.

3.2. Literature Review

Previous literature does not provide estimates of the responsive of property taxpayers to differences in penalties and interest fees. Larry DeBoer and James Conrad (DeBoer and Conrad, 1989a) examine the relationship between interest fees, the yield on three month U.S. securities, and property tax delinquency rates. The study finds that in 12 urban Indiana counties from 1969 to 1986 a five percent increase in the interest-penalty spread, the difference between the yield on three month U.S. securities and interest fees, increases the property tax delinquency rate by just over one percentage point. The results suggest taxpayers are responsive to interest fees.

Property tax delinquency fluctuates with economic conditions. Economic indicators found to be correlated with property tax delinquency rates in prior literature include unemployment, income, and property value (DeBoer, 1990). Using selected Indiana counties from 1970 to 1984 it is estimated that that a five percentage point increase in the unemployment rate increases the property tax delinquency rate by 0.5 percentage points (DeBoer and Conrad, 1988a). A related study estimated that a one percent increase in farm income decreases the property tax delinquency rate by 0.5 percentage points. The same study found a five percentage point increase in the value of farm land decreased property tax delinquency by 0.5 percentage points (DeBoer and Conrad, 1988b).

Empirical results estimating the effect of the property tax rates on property tax delinquency rates are less conclusive. Susan Olson and M. Leanne Lachman find property tax rates to be uncorrelated with property tax delinquency rates in Cleveland, Ohio (Olson and Lachman, 1976). The authors argue that properties are abandoned by delinquent taxpayers

prior to tax rates increases making higher or lower tax rates irrelevant. However, in a study of New York City it is estimated that a one percent increase in the property tax rate leads to a two to three percent increase in the share of property tax delinquent buildings (White, 1980).

While prior literature examines determinants of property tax delinquency, no study to date provides an empirical assessment of the responsiveness of property taxpayers to differences in penalties and interest fees. In this paper I control for determinants of property tax delinquency identified in previous literature when estimating the responsive of taxpayers to differences in penalties and interest fees.

3.3. Property Tax Delinquency Decision

Prior literature (Conrad and DeBoer, 1988b; Lake, 1979) finds the most common reasons cited by taxpayers for property tax delinquency is lack of money or declining property value. In this section, I define property tax delinquency as either short-term (lack of money) or long-term (declining property value). I examine the decision of taxpayers to choose short-term delinquency and long-term delinquency. I then explore the relationship between short-term delinquency, long-term delinquency, penalties and interest fees.

Short-term delinquents view the net benefits of property ownership to be positive, but strategically choose delinquency or are unable to pay the tax bill on time due to liquidity constraints. More explicitly, a property taxpayer chooses short-term delinquency when the personal rate of borrowing is greater than property tax delinquency costs. The personal rate, r_i , is the lowest opportunity cost of borrowing unique to individual property taxpayers. Short-term delinquent taxpayers unable to pay the tax bill, due to liquidity constraints, possess an infinite personal borrowing rate. Property tax delinquency costs are common to all taxpayers and

include penalties, p , and interest fees, $(m\pi)$. Penalties are a one-time charge applied as a percentage of the original tax bill. Interest fees increases with time; applied as a simple interest rate. The variable, π , represents the monthly interest rate and the variable, m , represents the number of months a taxpayer chooses to be delinquent.

Short-Term Delinquency Decision:
$$r_i > m\pi + p \quad (1)$$

Equation (1) implies that short-term delinquency decreases with decreases to the personal rate of borrowing. Short-term delinquency decreases with increases to property tax delinquency costs; higher penalties and interest fees.

Take for example a property taxpayer initially able to borrow funds at an annual rate of 17 percent to pay a property tax bill on time. Penalties and interest fees for one year of delinquency are 18 percent. The property taxpayer would be better off borrowing at a 17 percent to pay the property tax bill on time. If the rate of borrowing were to increase to 19 percent, keeping the property tax delinquency cost constant, the taxpayer would be better off strategically choosing short-term delinquency.

Long-term property tax delinquency is a symptom of property abandonment. A property taxpayer chooses to financially abandon property, and therefore long-term property tax delinquency, when benefits of property ownership and the expected equity position at sale are less than the costs of property ownership (Bhutta et al., 2010). The decision by an owner to financially abandon property is a decision to stop all remaining mortgage payments as well as a decision to cease payment on maintenance, insurance, and property taxes. Benefits of property ownership include the stream of rental payments a homeowner foregoes or the stream of rental payments received on investment property. Transaction and stigma costs associated with

financial abandonment may also be considered benefits to property ownership or more explicitly benefits of maintaining ownership. The cost of property ownership includes mortgage payments, maintenance, and property tax payments. The property taxpayer's abandonment decision is presented in equation (2) below.

A taxpayer will choose abandonment, and therefore long-term delinquency, when the net benefits from property ownership and the expected equity position at sale are less than zero. Net benefits are benefits of property ownership less costs of property ownership.

Long-Term Delinquency Decision:
$$NetBenefits + Equity < 0 \quad (2)$$

Equation (2) implies that long-term property tax delinquency will increase due to abandonment with decreases to the net benefit of property ownership or decreases to the expected equity at sale. Long-term delinquency is unaffected by property tax delinquency costs, including changes to penalties and interest fees.

The taxpayer's delinquency decision is important in understanding the responsiveness of taxpayers to differences in penalties and interest fees. Equation (1) suggests that the short-term delinquency decision is effected by penalties and interest fees. Equation (2) suggests the long-term delinquency decision is unaffected by penalties and interest fees. The implication is that not all taxpayers are responsive to difference in penalties and interest fees.

3.4. Data Sources and Variable Construction

To estimate the responsive of taxpayers to differences in penalties and interest fees empirically, data is collected from the Oregon Department of Revenue, Washington State Department of Revenue, Federal Housing Finance Agency, Bureau of Labor Statistics, and U.S. Census Bureau. Data is collected from 2000 to 2010 for Oregon and Washington State.

The Oregon Department of Revenue reports property tax statistics annually. In Oregon, taxes are applied to real property (land, buildings, and improvements) and personal property (farm equipment & machinery, industrial equipment & machinery, material & supplies not for resale). The property tax delinquency rate, the dependent variable, for each of the 36 counties in Oregon is computed by dividing property taxes uncollected by the current year tax levy. Property taxes uncollected include uncollected taxes from prior and current year levies, but do not include interest accrued during delinquency. The current year tax levy excludes credits applied to the tax bill for various tax relief programs and the early payment program available to Oregon property taxpayers.

The Washington State Department of Revenue reports property tax statistics annually. In Washington State taxes are applied to real property (land, buildings, and improvements) and personal business property (equipment, furniture, and machinery). Property taxes uncollected divided by the current year tax levy provides the delinquency rate for each of the 39 counties; the dependent variable. Property taxes uncollected include uncollected taxes from prior and current year levies, but do not include interest or penalties accrued during delinquency. The current year tax levy excludes credits applied to the tax bill for various tax relief programs.

Net benefits of property ownership influence the taxpayer's long-term property tax delinquency decision. Net benefits are a function of rental prices and the costs of property ownership which include property taxes. County level measures of current year property taxes are available through the Washington State Department of Revenue and Oregon Department of Revenue.

The expected equity position when the property is sold influences the individual taxpayer's long-term property tax delinquency decision. Expected equity positions are not easily measured. However, current and prior property values may provide a reasonable proxy for expected equity positions at the county level. The Finance Housing Finance Agency (FHFA) publishes annually a home price index by metropolitan statistical area. The FHFA home price index is estimated using sales price and appraisal data. The FHFA home price index and FHFA one year change in the home price index are used as proxies for the expected equity position. Metropolitan statistical areas are mapped to counties. Counties not included in a metropolitan statistical area are assigned the state non-metropolitan area home price index.

The personal borrowing rate affects the individual taxpayer's short-term property tax delinquency decision. The yield on three month U.S. securities (DeBoer and Conrad, 1989a) is not a valid proxy for the personal borrowing rate during the period of observation, 2000 to 2010. Instead unemployment rate, poverty rate, and median household income statistics provide a proxy for the county level average personal borrowing rate.

The Bureau of Labor Statistics publishes annual labor force estimates. The estimates include unemployment rates for all counties within the United States. Unemployed taxpayers borrow at higher rates than employed taxpayers. Similarly personal rates of borrowing are negatively correlated with household income and poverty rates. Ceteris paribus higher unemployment, higher poverty rates, and lower median household income will lead to more short-term delinquency. Data on poverty and income estimates are drawn from the U.S. Census Bureau. The estimates include the percent of the total population in poverty and median household income.

Table 3.4 provides state level economic and housing descriptive statistics in Oregon and Washington State from 2000 to 2010 including the unemployment rate, median household income, and Federal Housing Finance Agency home price index (HPI). The table shows state level economic and housing descriptive statistics in Oregon and Washington State to be highly correlated.

3.5. Empirical Methods and Results

The aim of the research design is to estimate the responsiveness of taxpayers to differences in penalties and interest fees. Oregon and Washington State provide the best opportunity to generate an unbiased estimate using county level aggregate property tax delinquency data.

The empirical model estimating the effect is provided below;

$$DelinquencyRate_{ct} = \beta_1 W_c + \beta_2 X'_{ct} + \lambda_t + \varepsilon \quad (3)$$

The outcome variable, $DelinquencyRate_{ct}$, is the property tax delinquency rate in county, c , at year, t . The state dummy variable, W_c , is equal to one if the county is located in Washington State and zero if the county is located in Oregon. The state dummy estimates the effect of time invariant differences between states; penalties and interest fees.

X'_t is a vector of economic characteristics for each county year which affect long-term and short-term property tax delinquency. Economic characteristics are necessary controls in estimating the effect of property tax delinquency costs on county property tax delinquency rates. The set of variables controlling for short-term property tax delinquency include the

average annual unemployment rate, average annual poverty rate, and median annual household income. The set of variables controlling for long-term property tax delinquency include the current year property taxes, FHFA home price index, and the one year change in the FHFA home price index. λ_t is the year fixed effect which addresses trends in property tax delinquency common to both states.

Estimation results are provided in table 3.5. The results are presented using three measures of property tax delinquency at the county level; property tax delinquency rates, the natural log of property tax delinquency, and per capita property tax delinquency. Per capita property tax delinquency is computed by dividing property tax delinquency by the population of each county.

The first column estimates that counties located in Washington State experienced a property tax delinquency rate approximately 1.3 percentage points or 17 percent lower than the mean property tax delinquency rate of 7.7 percent for counties in Oregon. The second column, regressing the natural log of property tax delinquency on the full set of control variables, estimates the property tax delinquency to be approximately 16 percent lower in Washington State counties when compared to counties in Oregon. The third column, regressing per capita property tax delinquency on the full set of controls, estimates per capita property tax delinquency to be approximately \$28 lower in Washington counties when compared to Oregon counties. The mean per capita property tax delinquency in Oregon during the period of observation is \$94.

3.6. Conclusion

This study is the first to estimate the responsiveness of taxpayers to differences in penalties and interest fees. I exploit Oregon and Washington State differences in penalties and interest fees and comparable measures of county property tax delinquency. I find property tax delinquency rates of counties in Washington State to be lower than similar counties in Oregon from 2000 to 2010. The findings are robust when using alternative measures of delinquency.

The observed variation in county property tax delinquency rates is explained by time invariant differences in property tax delinquency costs. Time invariant differences include penalties and interest fees. Although it is not possible to examine the component time invariant differences, penalty fees and interest fees move delinquency in the same direction. Here I estimate the joint effect of the two policy components. Oregon counties offer property taxpayers lower property tax delinquency cost, by way no penalties and lower interest fees, and therefore experience more short-term delinquency than similar counties in Washington State.

To understand the magnitude of taxpayer responsiveness to variation in property tax delinquency costs it is worth noting that property tax delinquency is typically of duration less than one year. The results suggest that a 44 percent increase in property tax delinquency costs decreases the amount of property tax delinquency by 17 percent. The estimated price elasticity of demand for property tax delinquency is 0.36. It appears the demand for property tax delinquency is rather inelastic. The findings suggest taxpayers choosing property tax delinquency are largely individuals with high personal borrowing rates.

3.7. Cited Literature

- Alexander, F. S. "Tax Liens, Tax Sales, and Due Process." *Indiana Law Journal* 75, 2000. 747-807.
- Accordino, J. and G. T. Johnson. "Addressing the Vacant and Abandoned Property Problem." *Journal of Urban Affairs* 22 (3), 2000. 301-315.
- Bright, E.M. Taking without compensation in low income areas: Turning tragedy in opportunity. Arlington, Texas: The Center for Economic Research and Service. 1995.
- Bhutta N., J. Dokko, and H. Shan. "The Depth of Negative Equity and Mortgage Default Decisions." Financial and Economic Discussion Series. Divisions of Research & Statistics and Monetary Affairs. Federal Reserve Board, Washington, D.C. 2010-35.
- Carlson, T. L. The Illinois Military Tract: A Study of Land Occupation, Utilization and Tenure. *Illinois Studies in the Social Sciences* 32 (2), 1951. 1-218.
- Conrad, J. and L. DeBoer. "Do High Interest Rates Encourage Property Tax Delinquency?" *National Tax Journal* 41 (4), 1988a. 555-560
- _____. "Rural Property Tax Delinquency and Recession in Agriculture." *American Journal of Agricultural Economics* 70 (3), 1988b. 553-559.
- Conrad, J, L. DeBoer and K. T. McNamara. "Property Tax Auction Sales." *Land Economics* 68 (1), 1992. 72-82.
- DeBoer, L. "Property Tax Delinquency and Tax Sales: A Review of the Literature." *Public Budgeting & Financial Management* 2 (2), 1990. 311-349.
- Foote, C. L., K. Gerardi, and P. S. Willen. "Negative Equity and Foreclosure: Theory and Evidence." *Journal of Urban Economics* 64, 2008. 234-245.
- Lake, R. W. *Real Estate Tax Delinquency: Private Disinvestment & Public Response*. The Center for Urban Policy Research. Rutgers – The State University of New Jersey. 1979.
- Massoud, N., A. Saunders, and B. Scholnick. "The Cost of Being Late? The Case of Credit Card Penalty Fees." *Journal of Financial Stability* 7, 2011. 49-59.
- Mier, C. and A. Kibler. "Delinquent Property Tax Revenue Collection." *Municipal Finance Journal* 32 (2), Summer 2011. 53-61.
- O'Flaherty, B. "The Option Value of Tax Delinquency: Theory." *Journal of Urban Economics* 28, 1990. 287-317.

- Olson, S. and M. L. Lachman. *Tax Delinquency in the Inner City: the problem and its solutions*. Lexington Books. 1976.
- Pointdexter, G. C. *Selling Municipal Property Tax Receivables: Economics, Privatization, and Public Policy in an Era of Urban Distress*. Real Estate Center, Wharton School of the University of Pennsylvania. 1997.
- Swierenga, R. P. "Acres for Cents: Delinquent Tax Auctions in Frontier Iowa." *Agricultural History* 48 (2), 1974. 247-266.
- White, M. J. 1986. "Property Taxes and Urban Housing Abandonment." *Journal of Urban Economics* 20, 1986. 312-330.
- Woodworth, L. D. *Collection of Property Taxes with Special Reference to Real Estate*. 1933.
- Youngman, Joan M. *Alternative Perspectives on Property Taxation*. Lincoln Institute of Land Policy.

3.7.1. Appendix

Figure 3 - Oregon & Washington State
Property Tax Delinquency Rates
2000 to 2010

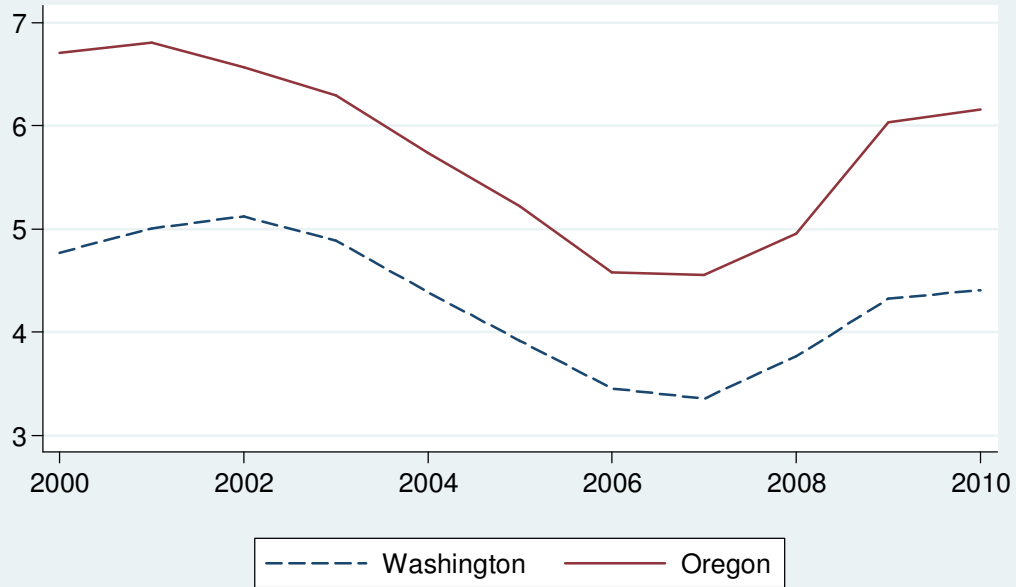


Table 3.1.3.1
Property Tax Delinquency Costs

	<u>Oregon</u>	<u>Washington State</u>
Penalties	None	11.0%
Annual Interest Fee	16.0%	12.0%
Tax Lien Sales	No	No
Tax Foreclosure	3 Years	3 Years

Table 3.1.3.2 - Property Tax Delinquency
Combined Penalties & Interest Fees

<u>Month</u>	<u>Washington State</u>	<u>Oregon</u>	<u>Month</u>	<u>Washington State</u>	<u>Oregon</u>	<u>Month</u>	<u>Washington State</u>	<u>Oregon</u>
1	1%	1.33%	13	24%	17.33%	25	36%	33.33%
2	5%	2.67%	14	25%	18.67%	26	37%	34.67%
3	6%	4%	15	26%	20%	27	38%	36%
4	7%	5.33%	16	27%	21.33%	28	39%	37.33%
5	8%	6.67%	17	28%	22.67%	29	40%	38.67%
6	9%	8%	18	29%	24%	30	41%	40%
7	10%	9.33%	19	30%	25.33%	31	42%	41.33%
8	19%	10.67%	20	31%	26.67%	32	43%	42.67%
9	20%	12%	21	32%	28%	33	44%	44%
10	21%	13.33%	22	33%	29.33%	34	45%	45.33%
11	22%	14.67%	23	34%	30.67%	35	46%	46.67%
1 Year	23%	16%	2 Years	35%	32%	3 Years	47%	48%

Table 3.4
County Descriptive Statistics
Oregon & Washington State - 2000 to 2010

		<u>Oregon</u>		<u>Washington State</u>
Property Tax Delinquency Rate (0 to 100)	Mean	7.7	Mean	5.7
	Standard Deviation	3.1	Standard Deviation	2.6
Unemployment Rate (0 to 100)	Mean	7.9	Mean	7.3
	Standard Deviation	3.1	Standard Deviation	2.2
Median Household Income (Thousand 2010 \$)	Mean	\$44.6	Mean	\$47.7
	Standard Deviation	\$7.4	Standard Deviation	\$7.9
Poverty Rate (0 to 100)	Mean	14.2	Mean	13.9
	Standard Deviation	3.2	Standard Deviation	3.7
HPI FHFA - Home Price Index	Mean	181.7	Mean	166.0
	Standard Deviation	38.3	Standard Deviation	35.4
Property Tax Levy (Millions 2010 \$)	Mean	\$125.3	Mean	\$201.8
	Standard Deviation	\$222.7	Standard Deviation	\$511.8

Sources: Oregon Department of Revenue, Washington State Department of Revenue, Federal Housing Finance Agency, Bureau of Labor Statistics, and U.S. Census Bureau

Table 3.5 - Empirical Results - OLS
Oregon & Washington State

	Property Tax Delinquency Rates	ln(Property Tax Delinquency)	Per Capita Property Tax Delinquency
	(1)	(2)	(3)
Washington State (0 or 1)	-1.3323 *** (0.4814)	-0.1579 ** (0.0758)	-28.3045 ** (13.8311)
Unemployment Rate (0 to 100)	0.7605 *** (0.1203)	0.1219 *** (0.0208)	5.3079 ** (2.5620)
Median Household Income (Thousands \$ 2010)	0.0135 (0.0518)	0.0009 (0.0071)	0.8475 (2.0046)
Poverty Rate (0 to 100)	0.1473 (0.0929)	0.0274 * (0.0145)	0.2919 (2.4331)
HPI FHFA	0.0098 (0.0085)	0.0017 (0.0015)	0.1857 (0.1467)
HPI FHFA - 1 Yr. Change	0.0745 ** (0.0359)	0.0033 *** (0.0044)	0.6571 (1.1075)
ln(Current Year Property Taxes)	-0.3625 * (0.2045)	0.9685 *** (0.0294)	-8.9210 (8.2385)
Year Fixed Effect	Yes	Yes	Yes
N	823	823	823
R-Squared	0.4909	0.9548	0.1599

Notes: Robust standard errors reported. Clustered at County.

-Significant at least 10 percent Level *, 5 percent level **, and 1percent level ***

4. THE RESPONSIVENESS OF PROPERTY TAXPAYERS TO TAX LIEN SALES: EVIDENCE FROM OHIO

4.1. Introduction

In 2011 tax lien sales were conducted in a majority of states and the District of Colombia. A tax lien sale is the sale of delinquent property taxes by a local government to private investors. When a property taxpayer becomes delinquent, a lien is placed against the property. The lien represents a collateralized receivable but not direct ownership of the property. In a tax lien sale, investors pay the delinquent property tax bill to the government. In return, investors receive the lien and the right to repayment of the delinquent taxes plus interest fees.

Although tax lien sale have been used in the United States since 1819 (Carlson, 1951; Swierenga, 1974) and tax lien sales are used in a majority of states, little is known about the responsiveness of taxpayers to tax lien sales. The purpose of this paper is to estimate the responsiveness of taxpayers to tax lien sales.

Estimating the responsiveness of taxpayers to tax lien sales is important because property tax delinquency has increased significantly during the Great Recession. Tax lien sales provide a viable policy alternative to states not conducting tax lien sales in search of immediate property tax revenue. This paper provides policy makers with an estimate of the responsiveness of taxpayers to tax lien sales; an essential step in weighing the benefits and costs of tax lien sales.

In the United States, tax lien sales policy is typically set by state governments and uniformly applied by all local governments within each state. Ideally, estimating taxpayer

responsiveness is accomplished by comparing property tax delinquency in each tax lien sale states to property tax delinquency in non-tax lien sale states.

There are two possible reasons why a comparison of property tax delinquency by state would not produce an unbiased estimate. The first is the result of non-random selection of tax lien sales. It is possible that state legislatures choose tax lien sales based on unobserved characteristics correlated with property tax delinquency. The second potential bias is the result of differences in the way states measure property tax delinquency. California, for example, measures property tax delinquency of less than one year for real property. Oregon measures property tax delinquency for real and personal property.

A recent policy innovation in Ohio provides the best opportunity to generate an unbiased estimate of the responsiveness of taxpayers to tax lien sales. The policy is innovative for introducing the local option, allowing county treasurers the choice of tax lien sales. From 1997 to 2010, nine of Ohio 88 counties conducted at least one tax lien sale. Exploiting the plausibly random timing of adoption and consistent measurement of property tax delinquency by Ohio municipalities potential biases are mitigated.

The responsiveness of property taxpayers to tax lien sales is estimated by comparing annual measures of property tax delinquency across Ohio municipalities. I estimate property tax delinquency to be approximately two percent lower in tax lien sale year when compared to non-tax lien sale years. A two percent reduction evaluated at the mean suggests that municipalities experience \$54,000 reduction in property tax delinquency with the adoption of tax lien sales due to taxpayers paying early to avoid the tax lien sale.

4.1.1. Ohio - Tax Lien Sales

In 1998, Ohio House Bill 371 (HB371) allowed for the first time counties with populations of at least 200,000 to choose tax lien sales. The bill was innovative for introducing the local option, allowing County Treasurers the choice of tax lien sales. In late 2008 House Bill 562 (HB 562) extended the option of conducting tax lien sales to all 88 counties in Ohio. In 2010 Lawrence County became the first county in Ohio with a population of less than 200,000 residents to conduct a tax lien sale.

Ohio tax lien sales are conducted via auction using either an interest rate auction or overbid auction. Tax liens are sold, regardless of auction type, in bundles. A bundle is comprised of all liens eligible for sale. Property tax liens with one year of continuous delinquency are eligible for sale. Property tax liens of elderly, low income, disabled, active duty military, and veterans are ineligible for sale.

In an interest rate auction, investors compete for the right to purchase the bundle of liens by entering quarter percentage point bids between 18 and zero percent. The investor willing to accept the lowest interest rate for paying the total delinquent property tax bill of all liens wins the right to purchase the bundle. For example, in 2010, Franklin County offered a bundle of 1,203 tax liens with a total delinquent tax bill \$6,169,882 using an interest rate auction. The winning investor placed an interest rate bid of 17.25 percent and paid Franklin County \$6,169,882. Delinquent property taxpayers with liens included in the sale pay an interest rate of 17.25 percent during the following year of delinquency. The majority of tax lien sales in Ohio from 1998 to 2010 were conducted using the interest rate auction method.

In the overbid auction investors compete for the right to purchase the bundle by entering bids in dollars. The investor willing to pay the highest dollar value for the bundle wins the auction. Delinquent property taxpayers with liens included in the overbid auctions pay an interest fee of 18 percent during the following year of delinquency. Bids below the delinquent property taxes bill of all liens are accepted. In 2010 Cuyahoga County offered a bundle of 400 tax liens using an overbid auction. The winning investor entered a bid of \$3,665,940 for the bundle of liens. During the period of observation, 1998 to 2010, overbid auctions were conducted by Cuyahoga County, Mahoning County, and Summit County.

4.1.2. Tax Lien Sale Adoption

Selection into tax lien sales is not random. The decision to adopt tax lien sales belong to the County Treasurer; a government official elected once every four years. County Treasurers that perceive positive net benefits from tax lien sales are likely to adopt. Tax lien sale costs include set-up of the first tax lien sale and annual administration. Tax lien sale benefits include the receipt of delinquent property tax revenue sooner and the privatization of tax foreclosure. Tax foreclosure, the forced sale of property for the purposes collecting delinquent property taxes, is costly.

Table 4.1.2 provides descriptive statistics, delinquent property taxes and population, of counties conducting tax lien sales at any point during the period of observation and the mean statistics of all counties not conducted tax lien sales during that time period. Although table 4.1.2 implies county treasurers with higher delinquent property tax balances and higher populations are more likely to ever-adopt tax lien sales, no characteristic observed at the county level predicts timing of adoption including geographic proximity. For example, observed

county characteristics from 1997 to 2010 do not explain well the decision of the Hamilton County Treasurer to adopt tax lien sales in 2008 and Franklin County Treasurer to adopt tax lien sales in 2003 despite the many shared county similarities.

The decision to ever-adopt appears to be explained by the potential benefits from the sale of delinquent property taxes and privatizing tax foreclosure, whereas the timing of tax lien sale adoption appears to be driven by political decisions made by the county treasurers. A County Treasurer is unlikely to adopt tax lien sales when the policy is not supported by voters. This explains the decision at the start of the Great Recession by the treasurers in Lucas County, Montgomery County, and Stark County to suspend tax lien sales. Treasurers in these counties were unwilling to conduct tax lien sales with many property taxpayers and potential voters in financial distress. Understanding the timing of adoption is critical to the identification strategy.

4.1.3. Tax Lien Sale Costs – Delinquent Property Taxpayer

In Ohio, property taxes are payable annually in two equal installments. A penalty of 10 percent is applied to delinquent tax bill 10 days after the installment is due. An interest fee, set annually, of three percent above the Federal Reserve short-term interest rate is applied to the delinquent tax bill. The interest fee was four percent in 2010. If property taxes are delinquent for one or more year, the county government may choose to begin tax foreclosure proceedings.

Table 4.1.3 compares the cost of delinquency for delinquent property taxpayers included in a tax lien sale to delinquent property taxpayers not included in a tax lien sale. Tax lien sales increase the cost of property tax delinquency in four ways; increased notification, penalties, uncertain interest fees, and privatized tax foreclosure.

Prior to a tax lien sale delinquent property taxpayers receives more frequent notifications via mail, publication in the local newspaper, or postings on the county webpage. Notifications are costly to delinquent taxpayers. Franklin County publishes the name and address of the delinquent property taxpayer in the local newspaper a minimum of four times prior to the tax lien sale. Delinquent taxpayers in counties that do not conduct tax lien sales face less frequent notification.

Delinquent property taxpayers included in a tax lien sale are charged penalties between \$100 and \$400 once the lien is sold. Penalties vary by county and year. Delinquent taxpayers in counties that do not conduct tax lien sales are not charged penalties after the first year of delinquency.

Interest fees charged to delinquent taxpayers are higher in the tax lien sale environment. Delinquent taxpayers with liens sold using the overbid auction method are charged an interest fee of 18 percent which is consistently higher than the interest fee charged by the county government. Delinquent taxpayers with liens sold using the interest rate auction method incur an uncertain interest fee between zero percent and 18 percent. The interest fee has consistently been higher than the interest fee charged by the county government. The winning investor in Franklin County in 2010 charged an interest fee of 17.25 percent. The county government interest fee for liens not included in the sale was four percent in 2010.

Delinquent property taxpayers face private initiated tax foreclosure proceedings rather than public initiated tax foreclosure proceedings in the tax lien sale environment. Private lien holders reserve the right to use private attorneys and are permitted to pass “reasonable” fees onto delinquent property taxpayers. Without court approval attorney fees may be as high as

\$2,500 (Rittenhouse, 2011). Private initiated tax foreclosures are thought to occur more rapidly than public initiated tax foreclosures and are more costly to property owners. Prior to the utilization of tax lien sales a typical delinquent property in Cuyahoga County faced tax foreclosure after nine years of continuous delinquency (Olson and Lachman, 1976). Once tax lien sales were adopted private investors pursued tax foreclosure much more rapidly (Rittenhouse 2011).

Tax lien sales increase the cost of property tax delinquency for delinquent taxpayers. The increased cost of property tax delinquency decreases property tax delinquency as taxpayers choose to pay delinquent tax bills sooner. Estimating the responsiveness of taxpayers, the decision of delinquent taxpayers to pay delinquent tax bills sooner, is the focus of this study.

4.2. Literature Review

Previous literature does not estimate the responsiveness of taxpayers to tax lien sales. Although Larry DeBoer and James Conrad (DeBoer and Conrad, 1989a) do much to further the understanding of tax lien sales, the studies examine determinants of property tax delinquency (DeBoer and Conrad, 1989a) and determinants of winning bids at tax lien sale auctions (DeBoer and Conrad, 1989b). Therefore previous literature is helpful in identifying variables other than tax lien sales which are thought to effect property tax delinquency.

Larry DeBoer and James Conrad examine the relationship between interest fees, the yield on three month U.S. securities, and property tax delinquency rates (DeBoer and Conrad, 1989a). The study finds that in 12 urban Indiana counties from 1969 to 1986 a five percent increase in the interest-penalty spread, the difference between the yield on three month U.S.

securities and interest fees, increases the property tax delinquency rate by just over one percentage point. The results suggest taxpayers are responsive to changes in interest fees.

Property tax delinquency fluctuates with economic conditions. Economic indicators correlated with property tax delinquency identified in previous literature include unemployment, income, and property value (DeBoer, 1990). Using selected Indiana counties from 1970 to 1984 it is estimated that that a five percentage increase in the unemployment rate increases the property tax delinquency rate by 0.5 percentage points (DeBoer and Conrad, 1988a). A related study estimates that a one percent increase in farm income decreases the property tax delinquency rate by 0.5 percentage points. The same study finds a five percentage point increase in the value of farm land decreased property tax delinquency by 0.5 percentage points (DeBoer and Conrad, 1988b).

Empirical results estimating the effect of the property tax rates on property tax delinquency rates are less conclusive. Susan Olson and M. Leanne Lachman find property tax rates to be uncorrelated with property tax delinquency rates in Cleveland, Ohio (Olson and Lachman, 1976). The authors argue that properties are already abandoned by delinquent taxpayers when tax rates increase making higher or lower tax rates irrelevant. However, in a study of New York City it is estimated that a one percent increase in the property tax rate lead to two to three percent increase in the share of property tax delinquent buildings (White, 1980).

While prior literature identifies determinants of property tax delinquency, no study to date provides an estimate of the responsiveness of taxpayers to tax lien sales. In this paper I

control for determinants of property tax delinquency in order to estimate the responsiveness of taxpayers to tax lien sales.

4.3. Data Sources and Variable Construction

To empirically test the responsiveness of taxpayers to tax lien sales data is collected from the Ohio Department of Taxation, Bureau of Labor Statistics, U.S. Census Bureau, Ohio Department of Job and Family Services, and local county officials. Data is available at county and municipality from 1997 to 2010. Table 4.3.1 provides descriptive statistics of all 88 counties in Ohio and table 4.3.2 provides descriptive statistics of the 219 municipalities included in the analysis from 1997 to 2010. The table separates descriptive statistics by tax lien sale years and non-tax lien sale years.

The Ohio Department of Taxation reports delinquent property tax balances for real property and public utility personal property as of December 31 of each year as a combined, and inseparable. Delinquent property taxes include delinquent taxes from the current year tax bill, unpaid taxes from all prior year tax bills, penalties, and interest fees accrued during delinquency. Local government officials in tax lien sale counties were contacted to determine the amount of delinquent property taxes paid by private investors in each municipality and in each year; the financial effect of tax lien sales on property tax delinquency. The dependent variable for municipalities in non-tax lien sale county years is the Ohio Department of Taxation measure of property tax delinquency. The dependent variable is constructed for municipalities in tax lien sale years by adding the Ohio Department of Taxation measure of property tax delinquency to delinquent property taxes paid by private investors in each municipality and in each year; the financial effect of tax lien sales on property tax delinquency. Delinquent property

taxes and the financial effect of tax lien sales have been adjusted for inflation using the 2010 consumer price index as the base year.

A tax lien sale reduces property tax delinquency through two effects. The first effect I refer to as the financial effect; the sale of property tax delinquency to private investors. The second effect I refer to as the behavioral effect. When a tax lien sale is announced some taxpayers choose to pay delinquent property taxes early. The purpose of the paper is to estimate the responsiveness of taxpayers to tax lien sales or more precisely behavioral effect of tax lien sales.

The financial effect of tax lien sales includes property tax delinquency sold in tax lien sales and subsequent sales. A subsequent sale is the sale of delinquent taxes on liens sold the previous year. For example, a lien is sold on a delinquent property in 2005 from an unpaid 2004 tax bill. In 2006, if the taxpayer is unable to pay the lienholder and is unable to pay the 2005 tax bill a subsequent sale is held. In a subsequent sale a lien on the 2005 delinquency is offered to the lienholder of the 2004 lien. A lienholder choosing to purchase subsequent liens earn an interest fee of 18 percent.

The Ohio Department of Taxation publishes net property taxes charged for real property and public utility personal property as of December 31 of each year. Net property taxes charged at the municipality is a necessary control as property taxes are thought to determinants of long-term property tax delinquency. Real property includes land, buildings, and improvements for residential, agricultural, commercial, industrial, and mineral property. Public utility personal property includes tangible personal property of electric, rural electric, natural gas, pipeline, water works, water transportation, heating, and telegraph companies. Net property taxes

charged are property taxes due for the current year minus all approved reduction such as the homestead exemption. Net property taxes charges have been adjusted for inflation using the 2010 consumer price index as the base year.

The expected equity position when the property is sold influences the individual taxpayer's long-term property tax delinquency decision. Expected equity positions are not easily measured. However, current and prior property values may provide a reasonable proxy for expected equity positions at the county level. The Ohio Department of Taxation publishes the median sales price of residential property as of December 31 of each year. The measure has been adjusted for inflation using the 2010 consumer price index as the base year. The median sales price of residential property is used as a proxy for the expected equity position. The county median sales price of residential property is used in municipalities where no median residential sale prices are collected.

The personal borrowing rate affects the short-term property tax delinquency decision. The yield on three month U.S. securities (DeBoer and Conrad, 1989a) is not a valid proxy for the personal borrowing rate during the period of observation, 1997 to 2010. Instead unemployment rate, poverty rate, and median household income statistics provide a proxy for the county level average personal borrowing rate.

The Ohio Department of Job and Family Services publish annual labor force estimates for selected municipalities. The estimates include unemployment rates. Unemployed taxpayers borrow at higher rates than employed taxpayers. For municipalities where no data is collected, county unemployment rates obtained from the Bureau of Labor Statistics are utilized. Similarly personal rates of borrowing are negatively correlated with household income and poverty

rates. Ceteris paribus higher unemployment, higher poverty rates, and lower median household income will lead to more borrowing from the local government. Data on poverty and income estimates are obtained from the U.S. Census Bureau. The estimates include the percent of the total population in poverty and median household income.

Local government officials were contacted to determine the years tax lien sales were conducted and the financial effect of each sale. The information was validated through local newspapers where available. Summit County and Stark County were unable to provide the financial effect by municipality but rather provided the county level measures. The tax lien sale financial effect for adopting Ohio counties from 1998 to 2010 are presented in table 4.3.3. Property tax delinquency in Ohio was reduced by approximately \$331 million through the sale of tax liens to private investors, the financial effect of tax lien sales.

4.4. Empirical Methods and Results

The responsiveness of taxpayers to tax lien sales is estimated by regressing annual municipality measures of property tax delinquency. One weaknesses of the Ohio data set is the inclusion of ineligible property tax delinquency. Property tax delinquency of less than one year and property tax delinquency belonging to senior taxpayers is not subject to tax lien sales. The inclusion of ineligible property tax delinquency introduces measurement error which potentially biases the estimation result. It is likely that changes in property tax delinquency between tax lien sale regimes are also influenced by changes in ineligible property tax delinquency. Provided the model specification correctly controls for changes in ineligible delinquency the potential is mitigated.

Another potential bias of the Ohio data set is that property tax delinquency is measured several months after the tax lien sale has been conducted. Property tax delinquency for municipalities conducting tax lien sales does not include property tax delinquency sold to investors. Not including property tax delinquency sold to investors overestimates the responsiveness of delinquent taxpayers to tax lien sales. Property taxpayers allowing property tax delinquency to be sold to investors by definition are not responsive to tax lien sales. To correct this potential bias, property tax delinquency sold to investors has been added to the measure of property tax delinquency for municipalities conducting tax lien sales.

4.4.1. Identification Strategy

In this section, I define the property tax delinquency published in the state of Ohio. I describe how this data is used to identify the responsiveness of taxpayers to tax lien sales, the behavioral effect.

In Ohio, local government faces two possible environments. In the first environment, where $T=0$, the local government does not conduct a tax lien sale. In the second environment, where $T=1$, the local government conducts a tax lien sale.

The following notation is used to describe total property tax delinquency:

- D : Total property tax delinquency
- $D_{E,S}$: Eligible delinquency, short-term
- $D_{E,L}$: Eligible delinquency, long-term
- D_I : Ineligible delinquency

Total property tax delinquency in either tax lien sale environment is a function of ineligible delinquency not legally permitted to be sold at the tax lien sale and eligible delinquency. Further, eligible delinquency is either short-term property tax delinquency or long-term property tax delinquency.

By assumption, total property tax delinquency in the non-tax lien sale environment is equal to the total property tax delinquency in the tax lien sale as given in equation (1) below.

$$E[D | T = 1] = E[D | T = 0] \quad (1)$$

Tax lien sales increase the cost of long-term property tax delinquency and have no effect on the cost of short-term delinquency or ineligible delinquency. Thus, tax lien sales cause a shift from long-term delinquency to short-term delinquency leaving total property tax delinquency unchanged. Therefore, by assumption, ineligible delinquency in the non-tax lien sale environment, where $T=0$, is equal to ineligible delinquency in the tax lien sale environment, where $T=1$, as given in equation (2).

$$E[D_I | T = 1] = E[D_I | T = 0] \quad (2)$$

Total property tax delinquency in the non-tax lien sale environment, where $T=0$, is given by equation (3) below.

$$E[D | T = 0] = E[D_{E,S} | T = 0] + E[D_{E,L} | T = 0] + E[D_I | T = 0] \quad (3)$$

Total property tax delinquency in the tax lien sale environment where $T=1$ is given by equation (4) below.

$$E[D | T = 1] = E[D_{E,S} | T = 1] + E[D_{E,L} | T = 1] + E[D_I | T = 1] \quad (4)$$

Provide equation (1) and equation (2) hold, the difference in total property tax delinquency between the two environments is a function of the difference in short-term eligible delinquency and the difference in long-term eligible delinquency. The identity describing the difference in total property tax delinquency is given by equation (5).

$$\begin{aligned} E[D | T = 1] - E[D | T = 0] = \\ E[D_{E,S} | T = 1] - E[D_{E,S} | T = 0] + E[D_{E,L} | T = 1] - E[D_{E,L} | T = 0] \end{aligned} \quad (5)$$

Hence equation (5) is simplified to reveal the behavioral effect of tax lien sales.

$$E[D_{E,0} | T = 1] - E[D_{E,0} | T = 0] = E[D_{E,1} | T = 1] - E[D_{E,1} | T = 0] \quad (6)$$

The left hand side of equation (6) shows the behavioral effect of tax lien sales to be equal to the difference in short-term eligible delinquency between the two environments. The right hand side of equation (5) shows the behavioral effect of tax lien sales to also be equal to the difference in long-term eligible delinquency.

In Ohio, it is possible to identify the behavioral effect of tax lien sales by observing differences in long-term eligible delinquency, the right hand side of equation (6). In municipalities not conducting tax lien sales, where $T=0$, ineligible delinquency and long-term eligible delinquency are observed as combined and inseparable through the Ohio Department of Taxation. In municipalities conducting tax lien sales, where $T=1$, ineligible delinquency is observed and provided by the Ohio Department of Taxation. In municipalities conducting tax lien sales, where $T=1$, long-term eligible delinquency is observed and provided by local government officials. Long-term eligible delinquency in municipalities conducting tax lien sales, where $T=1$, is sold to private investors and is referred to in this study as the financial effect of tax lien sales.

The empirical strategy used to estimate the behavioral effect, BE, of tax lien sales is given by equation (7). The empirical strategy employed examines the difference in ineligible delinquency and long-term eligible delinquency in non-tax lien sale municipalities to the ineligible delinquency and long-term eligible delinquency in tax lien sale municipalities.

$$[D_{E,L} | T = 1] + E[D_I | T = 1] - E[D_{E,L} | T = 0] - E[D_I | T = 0] = BE \quad (7)$$

Provided the appropriate treatment and control groups are identified, and ineligible delinquency is unaffected by tax lien sales as assumed in equation (3), the accounting identity is further reduced to equation (8).

$$[D_{E,L} | T = 1] - E[D_{E,L} | T = 0] = BE \quad (8)$$

4.4.2. Fixed Effects and First Difference

The goal of the research design is to estimate the responsiveness of taxpayers to tax lien sales. Ohio provides the best opportunity to generate an unbiased estimate. Identification of the effect of tax lien sales is reliable provided the timing of adoption is random. Exploiting the plausibly random timing of adoption at the municipality allows for an identification strategy that compares delinquent property taxes in tax lien sale municipalities, the treatment against the specified control group, delinquent property taxes in non-tax lien sale municipalities.

The fixed effect regression model is shown in equation (9). The purpose of the model is to isolate the effect of tax lien sales on delinquent property taxes.

$$\ln(y_{mt}) = \beta_0 + \beta_1 TS_{mt} + \beta_2 X_{ct/mt} + \lambda_t + e_{mt} \quad (9)$$

The outcome variable, y_{mt} , is the natural log of delinquent property taxes in municipality (m) at year (t). The policy variable of interest TS_{mt} is equal to 1 if the municipality is subject to a tax lien sale at year t and 0 otherwise. TS_{mt} is used to identify the control and treatment groups. The variable $X_{ct/mt}$ includes a set of control variables at the municipality and county identified in as important determinants of delinquent property taxes. λ_t is the year fixed effect which addresses yearly trends in property tax delinquency common to all municipalities. For example, in 2007 the homestead exemption was extended to elderly property owners regardless of income. The expansion of the homestead exemption reduced the number of delinquent taxpayers eligible for tax lien sale in all municipalities.

Control variables included in equation (9) measured at the municipality are unemployment rate, median sales price of residential property and natural log of property taxes. Control variables included in equation (9) measured at the county level include percent

of the population living in poverty and median household income. The median sales price of residential property, property taxes, and median household income are adjusted for inflation and are presented in 2010 dollars.

The data set provides a balanced panel at the municipality-year unit of observation. The 3,066 total observations represent 219 cities in Ohio over a 14 year time period, 1997 to 2010. Municipality-year observations are split into two groups. The first group is municipalities during years in which tax lien sales are held. The first group represents the treatment group. The second group is municipalities during years in which no tax lien sales are held. The second group represents the control.

The decision to include municipalities from ineligible counties in the control group is appropriate given the expansion of tax lien sale eligibility to all Ohio counties in late 2008. Including county ineligible municipalities allows the implications of the policy expansion to be examined.

Table 4.4.2 provides regression results from the fixed effect model specification, equation (9), and first difference model specification, equation (10). The models address concerns that tax lien sale adoption is restricted to population eligible counties prior to 2008 and more likely to be adopted by municipalities with higher levels of property tax delinquency. The benefit of using first difference over a fixed effect model is to account for positive correlation in the error term. It is likely that errors from unobserved municipality characteristics influence errors in subsequent periods.

The tax lien sale policy variable in the fixed effect model specification is large and significant. The results imply delinquent taxpayers are highly responsive to tax lien sales.

Property tax delinquency is estimated to be nearly 11 percent lower in counties conducting tax lien sales. Tests of serial correlation suggest the fixed effect model provides a biased estimate. The Durbin-Watson statistic is 0.744, which is well below the critical value for the lower bound.

To correct for serial correlation in the error term over time, an alternative specification requires that one differences out the correlation. The first difference model specification estimates property tax delinquency to be two percent lower in counties conducting tax lien sales.

Equation (10) provides the first-difference model specification.

$$\Delta \ln(y_{mt}) = \beta_0 + \beta_1 \Delta TLS_{mt} + \beta_2 \Delta X_{ct/mt} + \beta_3 d99_t + \dots + \beta_{14} d10_t + \Delta e_{mt} \quad (10)$$

The outcome variable in equation (10) now measures the change in log property tax delinquency in municipality (m) from period (t-1) to period (t) or $\Delta \ln(y_{mt})$. The policy variable of interest ΔTLS_{mt} is equal to 1 if the municipality conducts a tax lien sale during year t and 0 otherwise. The variable $\Delta X_{ct/mt}$ includes the controls from equation (9) presented as changes in log from period (t-1) to period t.

Equation (10) regression results are provided in column (2) of table 4.4.2. The findings suggest that tax lien sales reduce property tax delinquency by two percent through the behavioral effect. The coefficient on the tax lien sale dummy is significant at the one percent level. The mean level of property tax delinquency for all municipality-year observations from 1997 to 2010 was nearly \$2.7 million. A two percent reduction evaluated at the mean suggests that municipalities experience \$54,000 reduction in property tax delinquency with the adoption of tax lien sales as delinquent taxpayers pay early (behavioral effect).

4.5. Conclusion

This paper is the first to explain the two effects of tax lien sales on property tax delinquency. The paper is also the first to document the financial effect and estimate the behavioral effect of tax lien sales on Ohio municipalities from 1997 to 2010. Exploiting the random timing of tax lien sale adoption by Ohio counties the behavioral effect of tax lien sales on property tax delinquency in Ohio Municipalities is estimated. The findings estimate the behavioral effect of tax lien sales to be two percent off of the mean level of property tax delinquency measured at the municipality.

A two percent decrease in property tax delinquency is not large. The size of the effect is obscured by the inclusion of ineligible delinquency. Instead a more appropriate comparison is to size of the behavioral effect in relation to the financial effect. For example, it is estimated that in 2009 delinquent taxpayers in Franklin County paid \$3,373,000 in delinquent property taxes to avoid the tax lien sale. The county sold \$7,768,000 in delinquent property taxes to a private investor. The estimated delinquent property tax balance eligible for sale in Franklin County in 2009 is \$11,141,000 ($\$3,373,000 + \$7,768,000$), suggesting approximately 30 percent of tax lien sale eligible delinquent property taxes were paid early to avoid the tax lien sale.

The median delinquent tax bill of liens sold at the 2009 Franklin County tax lien sale was \$3,163. Delinquent taxpayers included in the tax lien sale incurred a penalty of \$400 and a 13.75 percent annual interest fee. Delinquent taxpayers not included in the sale incurred no penalty and four percent annual interest fee. Assuming \$3,163 is representative delinquent tax bill for eligible and ineligible liens, it is estimated that combined penalties and interest fees are nearly 660 percent higher for tax lien sale eligible property.

The results suggest that a 660 percent increase in combined penalties and interest fees lead to a decrease in the amount of property tax delinquency by 30 percent. The estimated price elasticity of demand for property tax delinquency is 0.045. It appears the demand for property tax delinquency is rather inelastic. The findings suggest taxpayers choosing property tax delinquency are largely individuals with high personal borrowing rates.

The implications of the study extend beyond Ohio. As of late 2010, 23 states did not widely use or allow tax lien sales. In these states the cost of property tax delinquency for local governments would be reduced with the use of tax lien sales. This study provides government officials a clearer estimate of the tax lien sale benefits. These benefits could be weighed against the political costs of tax lien sales to determine the appropriate policy.

4.6. Cited Literature

- Alexander, F. S. "Tax Liens, Tax Sales, and Due Process." *Indiana Law Journal* 75, 2000. 747-807.
- Allen, H. K. "Collection of Delinquent Taxes by Recourse to the Taxed Property." *Law and Contemporary Problems* 3 (3), 1936. 397-405.
- Carlson, T. L. The Illinois Military Tract: A Study of Land Occupation, Utilization and Tenure. *Illinois Studies in the Social Sciences* 32 (2), 1951. 1-218.
- Conrad, J. and L. DeBoer. "Do High Interest Rates Encourage Property Tax Delinquency?" *National Tax Journal* 41 (4), 1988a. 555-560
- _____. "Rural Property Tax Delinquency and Recession in Agriculture." *American Journal of Agricultural Economics* 70 (3), 1988b. 553-559.
- Conrad, J, L. DeBoer and K. T. McNamara. "Property Tax Auction Sales." *Land Economics* 68 (1), 1992. 72-82.
- DeBoer, L. "Property Tax Delinquency and Tax Sales: A Review of the Literature." *Public Budgeting & Financial Management* 2 (2), 1990. 311-349.
- Lake, R. W. *Real Estate Tax Delinquency: Private Disinvestment & Public Response*. The Center for Urban Policy Research. Rutgers – The State University of New Jersey. 1979.
- Olson, S. and M. L. Lachman. *Tax Delinquency in the Inner City: the problem and its solutions*. Lexington Books. 1976.
- Pointdexter, G. C. *Selling Municipal Property Tax Receivables: Economics, Privatization, and Public Policy in an Era of Urban Distress*. Real Estate Center, Wharton School of the University of Pennsylvania. 1997.
- Swierenga, R. P. "Acres for Cents: Delinquent Tax Auctions in Frontier Iowa." *Agricultural History* 48 (2), 1974. 247-266.
- Rittenhouse, C. D. "The True Cost of Not Paying Your Property Taxes in Ohio." *University of Dayton Law Review* 36 (2), 2011. 221-247.

4.7. Appendix

Table 4.1.2 - Tax Lien Sale - Adoption

Ohio

<u>County</u>	<u>Population (1997)</u>	<u>Delinquent Property Taxes (Thousands 1997 \$)</u>	<u>Tax Lien Sales -Years</u>
Cuyahoga	1,364,453	\$115,567	1999-2001, 2004-2010
Franklin	992,239	\$39,858	2003-2010
Hamilton	831,578	\$38,824	2008-2010
Montgomery	561,228	\$28,948	2005-2008*
Summit	529,158	\$25,275	1998-2010
Lucas	442,299	\$25,388	2006-2008
Stark	365,501	\$14,619	2000-2002, 2004-2007
Mahoning	252,333	\$35,553	2000, 2002-2010
Lawrence	63,684	\$3,222	2010
	Mean Population (1997)	Mean Delinquent Property Taxes (Thousands 1997 \$)	
Non-Adopting Counties	70,102	\$2,257	

Source: Census Bureau; Ohio Department of Taxation

* In 2008 a Tax Lien Sale was held in Montgomery County, however no liens were sold.

Table 4.1.3 - Property Tax Delinquency Costs - Ohio

	<u>County - Tax Lien Sale</u>	<u>County - No Tax Lien Sale</u>
Notification	More frequent notification of the consequences of property tax delinquency through certified mail, news publications, and on-line.	Less frequent notification
Penalty Fee	\$100 to \$400 per lien sold	No Penalty Fee Charged
Interest Fee	0% to 18% in Interest Rate Auction; 18% in Overbid Auction	The interest fee is set annually three percentage points above the Federal short-term interest rate. The interest fee in 2010 was 4%.
Tax Foreclosure	Private Initiated	County Initiated

Table 4.3.1 - County Descriptive Statistics - Ohio

County-Year	# of Obs.		Property Tax Delinquency (Million 2010 \$)	Unemployment Rate	Poverty Rate
No Tax Lien Sale	1,174	Mean	\$7.5	6.6	11.7
		Standard Deviation	\$16.2	2.6	4.4
Tax Lien Sale	58	Mean	\$89.2	6.5	14.1
		Standard Deviation	\$88.5	1.8	2.7
County- Year	# of Obs.		Median Household Income (Thousand 2010 \$)	Residential Median Sales Price (Thousand 2010 \$)	Property Tax Levy (Million 2010 \$)
No Tax Lien Sale	1,174	Mean	\$48.4	\$104.4	\$94.2
		Standard Deviation	\$9.3	\$34.2	\$188.5
Tax Lien Sale	58	Mean	\$47.2	\$128.4	\$947.2
		Standard Deviation	\$4.0	\$18.9	\$711.6

Table 4.3.2 - Municipality Descriptive Statistics - Ohio

Muni-Year	# of Obs.		Property Tax Delinquency (Million 2010 \$)	Unemployment Rate	Poverty Rate
No Tax Lien Sale	2,447	Mean	\$1.8	6.0	11.3
		Standard Deviation	\$5.9	2.4	3.8
Tax Lien Sale	633	Mean	\$6.3	6.3	15.4
		Standard Deviation	\$18.8	2.1	2.1
Muni-Year	# of Obs.		Median Household Income (Thousand 2010 \$)	Residential Median Sales Price (Thousand 2010 \$)	Property Tax Levy (Million 2010 \$)
No Tax Lien Sale	2,447	Mean	\$50.6	\$125.5	\$22.0
		Standard Deviation	\$8.0	\$63.0	\$47.6
Tax Lien Sale	633	Mean	\$46.5	\$167.6	\$58.7
		Standard Deviation	\$3.4	\$79.8	\$115.0

**Table 4.3.3 - Tax Lien Sale - Financial Effect
Ohio**

County	Tax Lien Sales			Millions \$ 2010
	Interest Rate Auction	Overbid Auction	Subsequent Sales	
Cuyahoga	-	1999-2001, 2004-2010	2000-2010	\$101.6
Franklin	2003-2010	-	2004-2010	\$55.2
Hamilton	2008-2010	-	2009-2010	\$13.2
Lawrence	2010	-	-	\$0.5
Lucas	2006-2008	-	2007-2009	\$12.4
Mahoning	2000, 2002-2003	2004-2010	2001, 2003, 2005	\$23.6
Montgomery	2005-2008*	-	2007-2010	\$24.5
Stark	2000-2002, 2004-2007	-	2001-2008	\$15.3
Summit	1998-2009	2010	1999-2010	\$84.4
				<u>\$330.6</u>

Source: Ohio County Treasurers

* In 2008 a Tax Lien Sale was held in Montgomery County. The sale was cancelled when no investors registered.

**Table 4.4.2 - Empirical Results - Fixed Effects and First Difference
Ohio Municipalities**

	Fixed Effect		First Difference	
	(1)		(2)	
	<u>Log (Delinquent Property Taxes)</u>		<u>Δ Log (Delinquent Property Taxes)</u>	
Tax Lien Sale	-0.1085 *** (0.0338)		Δ Tax Lien Sale -0.0226 ** (0.0101)	
Unemployment Rate 0 to 100	0.0213 * (0.0113)		Δ Unemployment Rate 0 to 100 0.0088 * (0.0048)	
Poverty Rate 0 to 100	0.0060 (0.0062)		Δ Poverty Rate 0 to 100 -0.0001 (0.0030)	
Median Household Income (Thousands 2010 \$)	-0.0008 (0.0035)		Δ Median Household Income (Thousands 2010 \$) -0.0011 (0.0021)	
Median Residential Sales Price (Thousands 2010 \$)	-0.0022 *** (0.0007)		Δ Median Residential Sales Price (Thousands 2010 \$) -0.0005 (0.0004)	
Log (Property Tax Levy)	0.8786 *** (0.1095)		Δ Log (Property Tax Levy) 0.3530 *** (0.1098)	
Year Fixed Effects	Yes		Year Fixed Effects	Yes
Municipality Fixed Effects	Yes			
Adj-R	0.9492		Adj-R	0.0513
Obs	3,066		Obs	2,847

++Standard errors clustered at municipality; * p< 0.1.; ** p <0.05; *** p<0.001

5. THE RESPONSIVENESS OF INVESTORS TO DIFFERENCES IN TAX LIEN SALE AUCTION DESIGN: EVIDENCE FROM ILLINOIS

5.1. Introduction

In 2011 the majority of delinquent property taxpayers in 26 states and the District of Colombia were subject to tax lien sales. A tax lien sale is the sale of delinquent property taxes by a local government to private investors. When a property taxpayer becomes delinquent, a lien is placed against the property. The lien represents a collateralized receivable but not direct ownership of the property. In a tax lien sale, investors pay the delinquent property tax bill to the government. In return, investors receive the lien and the right to repayment of the delinquent taxes plus interest fees.

Although tax lien sale have been used in the United States since 1819 (Carlson, 1951; Swierenga, 1974) and tax lien sales are used in a majority of states, little is known about the responsiveness of investors to differences in auction design. The purpose of this paper is to estimate the responsiveness of investors to differences in tax lien sale auction designs. Investors may respond to tax lien sale auction design by changing the decision to bid or changing the bid.

Estimating the responsiveness of investors to differences in auction design is important because property tax delinquency has increased significantly during the Great Recession. Property tax delinquency is costly for local governments and taxpayers. Tax lien sales provide a viable policy alternative to states not conducting tax lien sales in search of immediate property tax revenue. Certain tax lien sale auction designs provide delinquent taxpayers immediate relief in lower interest rates.

In the United States tax lien sales policy is typically set by state governments and uniformly applied by all local governments within each state. Ideally, estimating investor responsiveness is accomplished by comparing property tax delinquency in states using alternative auction designs.

There are two possible reasons why a comparison of property tax delinquency by state would not produce an unbiased estimate. The first is the result of non-random selection of tax lien sale auction design. The second potential bias is the result of differences in the way states measure property tax delinquency. California, for example, measures property tax delinquency of less than one year for real property. Oregon measures property tax delinquency for real and personal property.

A recent policy innovation in Illinois provides the best opportunity to generate an unbiased estimate of the responsiveness of investors to differences in auction design. The policy is innovative for introducing the local option, allowing county treasurers the choice of tax lien sales auction design.

In this paper, I am the first to investigate the effects of tax lien sale auction design on auction revenues and interest fees. To estimate the effect of auction design on these outcomes I compare changes in auction outcomes in counties that switch auction design to changes in auction outcomes in counties that did not switch auction design. Counties switched auction designs during this time period to reduce the number of days needed to sell the increased number of liens. Using administrative data and this difference-in-difference strategy, I find that auction design has large effects on local government revenue and interest fees. Specifically, I

find that a switch in auction design can reduce the average interest rate by as much as 30 percent or nearly \$200 in interest fees for the average delinquent taxpayer.

I examine three auction designs. I refer to these three designs as the English matching, English non-matching, and First Price Sealed Bid designs. The findings suggest that the English non-matching design provides local governments with the greatest amount of revenue and delinquent taxpayers with the lowest interest fees. These results provide local government officials valuable information on the effects of auction design on tax lien sale auction design. Although the results are derived from unique variation in tax lien sale auctions, this paper contributes to the broad empirical literature on the effects of auction design.

While English non-matching design reduces the burden of delinquency for both local governments and delinquent taxpayers, a First Price Sealed Bid produces the opposite result. Consider the example of Cook County which switched from the English matching auction design to the First Price Sealed Bid auction design in 2008, the results indicate switching auction design resulted in seven million dollars in liens being returned to the county for collection from 2008 to 2010 that would have been sold to private investors under the alternative designs. The findings also suggest that the mean delinquent taxpayer in Cook County, with \$3,452 in delinquent property taxes, paid \$69 more in interest fees with the switch to the First Price Sealed Bid auction design during the first year of delinquency.

In the Collar counties, the counties bordering Cook County, there was no observed difference in auction revenue between the English matching and English non-matching designs. However, it was estimated that the mean taxpayer in the English matching auction with an

outstanding delinquency of \$4,947 paid nearly \$200 more in interest fees when compared to similar liens offered in the English non-matching design.

In sum, of the three auction designs considered, the findings suggest that the English non-matching auction is the auction design that both maximizes government revenue and minimizes interest fees charged to delinquent taxpayers. The result is consistent with auction theory suggesting sequential English common value auctions produce higher prices (lower winning interest rate bids) when compared to sequential First Price Sealed Bid common value auctions.

5.1.1. Tax Lien Sale Auction Design

Although the state allows counties to determine their own tax lien sale auction design, in Illinois statute dictates some rules common to all tax lien sale auctions. In all counties, investors bid on individual liens by declaring an interest rate between 18 and zero percent. Bids are entered in whole percentage point increments (i.e. 18, 17, 16, and 15). The investor with the lowest interest rate bid wins the right to pay the delinquent property taxes in exchange for repayment plus interest fees and the property lien as collateral. Interest rate bids of 18 percent represent a low price for investors in which case the investor will earn an 18 percent return on investment during the first year of delinquency. Interest rate bids of zero percent represent a high price in which the investor will earn no return on investment during the first year of delinquency. Liens are offered in sequential order one parcel at a time by municipality and property identification number (PIN). Liens not receiving a bid at auction are returned to the county for collection with the delinquent taxpayer charged an interest fee of 18 percent during the first year of delinquency.

In this paper, auction design varies because of differences in auction type, English or First Price Sealed Bid, and differences in bidding rules, matching or non-matching. Investors face unique auction types and bidding rules depending on which county the auction is conducted. Three auction designs compared in this analysis include English matching, English non-matching, and First Price Sealed Bid. Table 5.1.1 provides a brief description of the three auction designs observed.

In the English matching auction, investors submit a bid by raising a paddle. The auction concludes when only one investor remains or multiple investors with matching bids are unwilling to bid at a lower interest rate. In cases where more than one investor offers the same low bid, a winner is chosen at random by the county treasurer. The overwhelming majority of liens sold to private investors receive more than one bid at the same low rate; often ten or more investors bid the same interest rate.

In the English non-matching auction, investors submit a bid by selecting the desired interest rate on a computer screen. The first investor to select the lowest interest rate bid wins the right to purchase the lien. It is not possible in the English non-matching auction design for more than one investor to register the same interest rate bid.

In the First Price Sealed Bid auction, investors submit bids on-line. If more than one investor bids zero percent the winner is chosen at random. Liens receiving multiple low bids between one percent and 18 percent are reoffered in a second round. A second round low bid by two or more investors between one percent and 18 percent results in the lien being returned the county for collection.

5.2. Literature Review

Although the breadth of auction literature is extensive, no studies examine the responsiveness of investors to differences in tax lien sale auction design. Previous theoretical and empirical literature suggests that auction design affects auction results when investors do not possess strictly private values (Menezes and Monteiro, 2005). This paper expands the literature by examining the responsiveness of investors to differences in tax lien sale auction design. The novelty of this research is the use of administrative data and a difference-in-difference specification to estimate the impact of auction design on auction results.

Two previous studies (DeBoer et al., 1992; Allen et al., 2004) have identified determinants of tax lien sale auction results. Using data from the 1987 tax lien sale held in Marion County, Indiana and parcel characteristics of 1,073 liens offered at auction the authors (DeBoer et al., 1992) examine the probability of a lien selling and winning price; Indiana auctions are conducted in terms of dollars value rather than interest rates. In a separate study (Allen et al., 2004) auction results for 166,316 delinquent parcels in Palm Beach County, Florida from 1982 to 2000 were used to examine potential factors of winning interest rates.

The two studies find delinquent tax bill, assessed value, property use, and property location to be important determinants of the probability of sale and winning bids. Investors use these characteristics to estimate the expected payoff of each lien. The determinants identified in previous studies (DeBoer et al., 1992; and Allen et al., 2004) of delinquent tax bill, assessed value, property use, and property location are necessary controls in this analysis for the identification of the effect of auction design on auction results in this study.

5.3. Theoretical Model

In this section, I argue that tax lien sales are common value auctions and show that the three auction designs affect local government revenue and winning interest rates. The investor bidding strategy is described under each of the three designs. The implications to local government revenue and winning interest rates are discussed.

Tax lien sales are common value auctions because the monetary benefit of lien ownership, which is unknown at the time of bidding, does not vary across investors (Menezes and Monteiro, 2005). My description of the monetary payoff from lien ownership and optimal bidding strategy of investors assumes that there are no non-pecuniary benefits to lien ownership. An example of a non-pecuniary benefit would be additional benefit derived from purchasing a lien on a property close to a relative or in the ideal school district. Liens are almost exclusively purchased as an investment vehicle for large buyers purchasing multiple liens rather than individuals purchasing single liens in the hope of personally occupying the property. In Collar counties, for example, from 2005 to 2010, 97 percent of liens were sold to large investors purchasing 100 or more liens at any one auction.

Deriving the optimal bidding strategy for a sequential common value auction requires a model of the investor's expected payoff. The investor faces two possible outcomes when purchasing a lien: redemption or tax foreclosure. When a lien is purchased the investor pays the delinquent tax bill at time (t) . The payoff from redemption occurs at time period $(t+1)$ whereby the investor receives the delinquent tax bill plus interest fees accrued. In tax foreclosure the investor obtains ownership of the property at time period $(t+2)$. The payoff in tax foreclosure is the property market value at tax foreclosure minus the delinquent tax bill. In

both redemption and tax foreclosure the net payoff is the monetary payoff minus the investor's opportunity cost.

The following notation is used to describe the expected payoff function:

D : Delinquent tax bill

r_{it} : Investor opportunity cost; unique to each investor i

V_{it} : Property market value; estimated with error by each investor i

π_i : Probability of redemption; estimated with error by each investor i

l_i : Lien interest rate bid; unique to each investor i

Equation (1) below provides the probability of redemption which is estimated with error by each investor at the beginning of the auction. Equation (2) provides the payoff with redemption at time period (t+1).

$$\text{Probability of redemption} = \pi_i \quad (1)$$

$$\text{Payoff with redemption} = D(1 + l_i) - D(1 + r_{i(t+1)}) \quad (2)$$

Equation (3) below provides the probability of tax foreclosure which is estimated with error by each investor at the beginning of the auction. Equation (2) provides the payoff with tax foreclosure at time period (t+2).

$$\text{Probability of tax foreclosure} = 1 - \pi_i \quad (3)$$

$$\text{Payoff with tax foreclosure} = V_{i(t+2)} - D(1 + r_{i(t+2)}) \quad (4)$$

The investors' expected payoff at the start of the auction is shown in equation (5). The expected payoff discounted to the beginning of the auction, d , is equal to the probability of redemption multiplied by the payoff in redemption plus the probability of tax foreclosure multiplied by the payoff in tax foreclosure.

$$E^I_{(t)} = \pi_i \frac{D(l_i - r_{i(t+1)})}{(1+d)^{(t+1)}} + (1 - \pi_i) \frac{V_{i(t+2)} - D(1 + r_{i(t+2)})}{(1+d)^{(t+2)}} \quad (5)$$

An investor's interest rate bid is a function of the expected payoff function. Equation (5) demonstrates that the expected payoff of lien ownership is a function of the probability of redemption, the delinquent tax bill, estimated property value at tax foreclosure, and investor's opportunity cost.

In practice, the probability of redemption is unobservable to the investor. An investor's estimate of the probability of redemption varies across properties according to observable property characteristics. The estimated probability of redemption is a function of whether the delinquent taxpayer finds total outstanding liabilities, including the delinquent tax bill and interest fees accrued, to be greater than property value at tax foreclosure. The estimated probability of redemption is affected by the delinquent tax bill, estimated property value at tax foreclosure, and lien interest rate bid.

Table 5.3 of the appendix provides comparative statistics for the probability of redemption with respect to changes in the delinquent tax bill, estimated property market value, and lien interest rate bid. The table also provides comparative statistics for expected payoff with respect to changes in the delinquent tax bill, opportunity cost of investor, estimated property market value, estimated probability of redemption, and lien interest rate bid.

From equation (5) it is possible to solve for the minimum lien interest rate, $\bar{l}_i$, beyond which no investor will bid. This is the lien interest rate which sets the expected payoff to zero.

$$\bar{l}_i = r_{i(t+1)} - \frac{(1 - \pi_i)}{\pi_i} \frac{[V_{i(t+2)} - D(1 + r_{i(t+2)})]}{D(1 + d)} \quad (6)$$

Equation (6) shows that as the probability of redemption approaches one, $\pi_i = 1$, the minimum lien interest rate bid approaches $r_{i(t+1)}$, the one period opportunity cost of the investor. An investor will not bid a lien interest rate below the next best investment alternative when redemption is certain.

Equation (6) also shows as the probability of redemption approaches zero, $\pi_i = 0$, the minimum lien interest rate bid approaches zero provided a positive payoff at tax foreclosure. The payoff with a lien interest rate bid of 18 percent is identical to a lien interest rate bid of zero percent when tax foreclosure is certain. An investor will bid the lien interest rate of zero percent when the probability of tax foreclosure is certain and the expected payoff is positive. A zero percent interest rate bid is thought to provide investors with the greatest probability of winning the right to purchase the lien.

The minimum lien interest rate bid represents the lower bound for investors. In a competitive market such as a common value auction the expected payoff will approach zero and the lien interest rate bid will approach the minimum lien interest rate bid.

5.3.1. English Auction

At English auctions, once the sale begins, investors use the bids of other investors to update estimates of the probability of redemption and estimates of property market value at tax foreclosure. After the market based estimates are established, the only difference in expected payoffs across investors is idiosyncratic opportunity costs.

From figure (5), the expected payoff derived from the market, $E^m_{(t)}$, is provided as follows:

$$E^m_{(t)} = \pi_m \frac{D(l_m - r_{i(t+1)})}{(1+d)^{(t+1)}} + (1 - \pi_m) \frac{V_{m(t+2)} - D(1 + r_{i(t+2)})}{(1+d)^{(t+2)}} \quad (7)$$

The market expected payoff function is used to solve for the minimum lien interest rate bid, $\bar{l}_m$, beyond which no investor will bid when bids are revealed.

$$\bar{l}_m = r_{i(t+1)} - \frac{(1 - \pi_m)}{\pi_m} \frac{[V_{m(t+2)} - D(1 + r_{i(t+2)})]}{D(1 + d)} \quad (8)$$

Theoretically (Milgrom and Weber, 1982; Engelbrecht-Wiggans and Weber, 1983) it has been demonstrated that the English sequential common value auction follow a martingale – the law of one price holds. Empirically the law of one price is not settled (Mezzitti, 2011) as prices of similar goods have been shown to both increase and decrease as the sequential auction proceeds. Regardless, the optimal bidding strategy for all investors in the English sequential common value auction is to bid the market lien interest rate bid. The market lien interest rate is the symmetric Bayesian Nash Equilibrium for all investors.

The two auction designs using the English auction type differ with respect to rules on matching. The English matching design has not been formally modeled in the previous literature, however in observing the 1996 Cook County tax lien sale auction Paul Milgrom (Milgrom, 2004) noted that 80 percent of all liens sold at the maximum interest rate of 18 percent. The poor result of the auction design was attributed to problematic rules on matching.

In the English non-matching auction design the market lien interest rate is the symmetric Bayesian Nash Equilibrium for all investors. An investor lien interest rate bid below the market lien interest rate bid, $\bar{l}_m > \bar{l}_i$, would result in continual overpayment. This phenomenon is referred to as the “winners curse” in auction literature. Rational actors would not be willing to pay more than the market value of any good of common value. An investor lien interest rate bids above the market lien interest rate bid, $\bar{l}_m < \bar{l}_i$, would not win the right to purchase the lien. Therefore investors in the English non-matching auction design would bid the market lien interest rate.

In the English matching design the market lien interest rate bid represents the lower bound as multiple investors are permitted to enter a bid at the market lien interest rate. The pareto optimal solution may be to enter a bid above the market lien interest rate. As an example, imagine three investors with an opportunity cost of three percent. Each investor is willing to purchase the lien for at most three percent when the probability of redemption is high. In the English non-matching design the first investor to three percent wins the right to purchase the lien with one hundred percent certainty. In the English matching design all three investors are able to enter the same bid of three percent and face a one-third probability of winning the right to purchase the lien. The same investors, however, could instead choose to enter a bid of 18 percent and face the same one-third probability of winning the right to purchase the lien. In this scenario the market lien interest rate is not the Pareto optimal bidding strategy.

Collusion is not necessary for the pareto optimal bidding strategy to persist but rather an understanding by investors of auction rules. Reducing lien interest rate bids in English

matching design does not necessarily increase the probability of winning. The bidding strategy in the English matching design is for the investor to equate the marginal cost of reducing the lien interest rate bid with the marginal benefit of reducing the lien interest rate bid. The cost of reducing the lien interest rate bid is a reduction in interest earned. The benefit of reducing the lien interest rate bid is the potential increase in the probability of winning the right to purchase the lien.

Therefore the result is that the bidding strategy in the English non-matching design is the market lien interest rate bid. The bidding strategy in the English matching design is greater than or equal to the market lien interest rate bid.

Hypothesis one: *The interest fee charged to the delinquent taxpayers will be higher in the English matching auction design as the bidding strategy in the English matching auction is to submit a lien interest rate bid greater than or equal to the optimal English non-matching lien interest rate bid.*

Theory provides little insight into the probability of sale in the English non-matching auction and the probability of sale in the English matching auction. One plausible hypothesis is that because the cost of participation (entry fees and research expense) is the same across English auction designs the probability of sale would be unchanged with change in auction design. In other words the same liens will be sold regardless of auction design; English matching or English non-matching.

Hypothesis two: *The probability of sale and therefore local government revenue will be the same in the English matching design and English non-matching design.*

5.3.2. First Price Sealed Bid

In the First Price Sealed Bid auction investors are unable to observe signals. The investors expected payoff function provided in equation (5) does not change during the auction. The minimum lien interest rate bid provided in equation (6) is the bid entered by investors in the First Price Sealed Bid auction. Comparing the minimum lien interest rate bid entered in the First Price Sealed bid auction to the minimum lien interest rate bid entered in the English auction suggests when no matching is allowed the First Price Sealed Bid winning interest rate is lower. When matching is allowed the result is ambiguous.

First Price Sealed Bid to English non-matching: $\bar{l}_i < \bar{l}_m$

First Price Sealed Bid to English matching: $\bar{l}_i \approx \bar{l}_m$

Changing auction type, English to First Price Sealed Bid, in a sequential common value auction would not effect the probability of sale and therefore local government revenue. However, the First Price Sealed Bid design observed introduces a rule which does affect local government revenue. Because a second round low bid by two or more investors between one percent and 18 percent results in the lien being returned the county for collection, local government auction revenue will be lower in the First Price Sealed Bid auction than in auctions using either English design provided tie bids in the second rounds occur. In the English matching

design tie low bids between one percent and 18 percent are awarded to investors based a random assignment. In the English non-matching design tie bids between one percent and 18 percent are not permitted.

Hypothesis three: *The probability of sale in the First-Price Sealed -Bid is lower than the probability of sale in either English auction design.*

5.4. Data Sources and Variable Construction

Data for this study was obtained from government officials in six Illinois counties. Results provided for 30 auctions include liens offered, liens sold, and winning interest rate bids. Delinquent tax bill, estimated market value, property classification, buyer name, and auction order were collected for each lien offered. Descriptive statistics are provided in table 5.4.1, table 5.4.2, and table 5.4.3.

Counties in the dataset are located in the northeast corner of Illinois. The data includes the city of Chicago and suburban communities. The counties are commonly referred to as Cook and the Collar counties. The Collar counties are similar when compared in terms of economic and demographic characteristics. Cook County is the second largest county in the nation and more diverse in terms of economic and demographic characteristics. From 2005 to 2010, 14 auctions were observed using the English matching design, 13 using the English non-matching design, and three using the First Price Sealed Bid design.

In the Collar counties approximately 98 percent of the dollars of property tax delinquency offered at auction were sold. In Cook County 82 percent of the dollars of property

tax delinquency offered at auction were sold. Table 5.4.1 shows that most unsold property was vacant and of little market value. Across all designs and all counties winning interest rates ranged from zero to 18 with a median of zero and mean of six percent.

Because a lien is placed against property, property characteristics have been shown to affect auction results (DeBoer et al., 1992; Allen et al., 2004). Delinquent tax bill, estimated property market value, and property use for each lien offered were collected. In the tax lien sale auction, investors must pay the delinquent tax bill for each lien won. The estimated property market value was computed by multiplying assessed value by three, the inverse of the assessment ratio. Delinquent tax bill and estimated property market value used in the analysis are provided in thousands of inflation adjusted 2010 dollars.

Estimated property market value is also thought to be affected by property location and property use. Property location is controlled for by using the township in which each property resides. In Illinois counties are separated into townships which are smaller geographic units responsible for the assessment of property value for tax purposes. Property use in this dataset is separated into three mutually exclusive categories. The first is residential improved which represents two-thirds of all observation. Residential improved property includes one-family dwelling, multi-family dwelling, condo-units, and apartment buildings. The second is vacant property representing approximately one-quarter of all observations. The third is all other improved property which includes commercial improved and industrial improved.

Tax lien sale investors vary in the number of liens purchased, types of liens purchased, experience, and access to capital (DeBoer and Conrad, 1990). Previous research (Allen et al.,

2004) finds that large volume investors, those purchasing 100 or more liens at any one auction, purchase at lower rates.

To account for investor characteristics which affect winning interest rates buyer names were normalized across auctions. For example, Joseph Johnson of 123 Main Street in St. Charles, IL purchasing liens in the 2007 Kane County tax lien sale was treated as the same investor Joe Johnson of 123 Main Street St. Charles, IL purchasing liens in the 2008 Lake County tax lien sale. Normalizing buyer names was necessary in establishing buyer fixed effects for each lien purchased. There were a total of 831 unique buyer names observed in the dataset. In cases where the lien was returned to the county for collection the county was treated as the buyer with an interest rate of 18 percent.

The price-decline anomaly as observed in the literature (Ashenfelter, 1989; Ashenfelter and Genesove, 1992; Mezzitti, 2011) suggests that auction order effects winning bids. In the case of tax lien sale auctions it is possible that similar liens sold at the beginning of the auction receive different winning interest rate than similar liens sold at the end. To account for this possibility the order in which the lien offered was collected.

5.5. Empirical Methods

Identification of the causal effect of auction design on the probability of sale and interest rate is possible due to variation of auction design across counties and within counties over time. An unbiased estimate of the effect of auction design on auction results is only possible provided the appropriate reference group is identified. Differences in demographic, economic, housing characteristics and tax lien sale administration between Cook and the Collar

counties suggests empirical analysis is best conducted by separating Cook from the Collar counties.

For Cook County the empirical analysis compares auction results from two auctions conducted using the English matching design to auction results from three auctions conducted using the First Price Sealed Bid design. Cook County switched from the English matching auction design to the First Price Sealed Bid in 2008. For the Collar counties the empirical analysis compares auctions results from the English matching design to auction results from the English non-matching design. From 2005 to 2010 two counties used the English matching design during the entire period (Kane & McHenry Counties), two counties used the English non-matching design during the entire period (Will & DuPage Counties), and one county switched from the English matching design to the English non-matching design. Lake County switched from the English matching auction design to the English non-matching in 2007.

The first research question to be addressed is the effect of auction design on the probability of a lien selling at auction to private investors. To estimate the effect a logit model is utilized.² The basic model is provided below;

$$\text{Cook County:} \quad \text{Sold}_i = \beta_1 F_i + \beta_2 X_i' + T_i + \varepsilon \quad (9)$$

$$\text{Collar counties:} \quad \text{Sold}_i = \beta_1 E_i + \beta_2 X_i' + T_i + \varepsilon \quad (10)$$

$$\text{If } \text{Sold}_i > 0$$

$$\text{Sold}_i = 0 \quad \text{Otherwise.}$$

² The Probit regression produces nearly identical results. Logit is reported as tests of Akaike's Information Criterion (AIC) and Schwarz's Bayesian Information Criterion (BIC) indicate Logit to be slightly superior to Probit.

The outcome variable, $Sold_l$, is a dummy variable indicating whether lien l is sold at auction to a private investor. The value of one indicates the lien is sold to an investor and zero when the lien is returned to the county for collection. The variable, E_l , is equal to one if the lien was offered at the English non-matching design and zero otherwise. The variable, F_l , is equal to one if the lien was offered at the First Price Sealed Bid design and zero otherwise. The comparison group for the analysis in both Cook and the Collar counties is liens offered using the English matching design.

X_l' is a vector of property characteristics for lien l . Property characteristics are necessary controls in isolating the effect of auction design on the probability of a lien selling at auction. The variables include the delinquent tax bill, estimated market value, and property use.³ Property use is designated with a dummy variable indicating whether the property is residential improved or vacant. The comparison group is all other property uses including industrial vacant and commercial vacant. A dummy variable equal to one was also included if the lien received a tie bid in the First Price Sealed Bid auction and was reoffered in a second round.

The second research question considers the effect of auction design on the interest rate charged to delinquent taxpayers after the auction. A standard OLS model is used.

I estimate the following regressions;

³ Equalized Value and delinquent tax bill have been adjusted for inflation using the 2010 consumer price index as the base year.

$$\text{Cook County:} \quad \text{Interest}_{it} = \alpha_0 + \beta_1 F_l + \beta_2 X_l + I_l + T_l + \varepsilon \quad (11)$$

$$\text{Collar counties:} \quad \text{Interest}_{it} = \alpha_0 + \beta_1 E_l + \beta_2 X_l + I_l + T_l + \varepsilon \quad (12)$$

The outcome variable, Interest_{it} , is the interest rate of lien l at year t . The remaining variables are consistent with those included in the logit model including auction design, property characteristics, auction order, reoffer, year fixed-effect, and township fixed-effect. The addition to the model is investor fixed-effects, I_l , for each unique buyer name. Liens not purchased at auction by private investors are purchased by the county at 18 percent.

5.6. Results

Results from the empirical model testing the probability of sale on auction design are presented in table 5.6.1 and table 5.6.2. Table 5.6.1 provides the empirical analysis for Cook County comparing auction results from the English matching auction design to the First Price Sealed Bid auction design. The results suggest that liens offered under the First Price Sealed Bid auction design are approximately two percent less likely to sell to private investors than liens offered under the English matching design. The empirical estimate matches the results obtained from analysis of the administrative data. From 2008 to 2010 approximately seven million dollars in liens received a tie bid in the first round but after being reoffered in a second round were returned to the county for collection. Seven million dollars represents roughly two percent of the value of all liens offered during that time period. Table 5.6.2 provides the empirical analysis for the Collar counties comparing auction results from the English matching auction design to the English non-matching auction design. The results suggest the probability

of sale does not change across the English auction designs. The findings provided in table 5.6.1 and table 5.6.2 confirm hypothesis two and three.

The second empirical model, testing interest rates on auction design, is presented in table 5.6.3 for Cook County and table 5.6.4 for the Collar counties. Liens not sold to private investors are sold to the county at 18 percent. This treatment avoids issues with selection of liens and appears to be appropriate given the sale of unsold liens in a secondary market after auction. The Heckman selection model described in most auction literature is not appropriate in this case as all liens are treated sold. In addition utilization of the Heckman selection model for liens sold to private investors does not fully answer the question of the effect of auction design on the delinquent taxpayer experience in regard to interest fees.

The model is presented in each case using three specifications. The first model specification regresses the lien interest rate against a set of control variables including specified fixed effects for all property use categories. The second model specification regresses lien interest rate against a set of control variables including specified fixed effects for residential improved property. The third model specification regresses lien interest rate against a set of control variables including specified fixed effects for vacant and other property. The three model specifications allow the reader to examine variations in the effect of auction design by property use category.

The results in table 5.6.3 estimates that delinquent taxpayers in Cook County pay interest rates one percent higher as a result of the switch to the First Price Sealed Bid auction design when all property is included. This represents an increase in interest fees of 59 percent during the first year of delinquency. The mean taxpayer with an outstanding delinquency of

\$3,452 paid \$69 more in interest fees the first year of delinquency by the county switching to the First Price Sealed Bid auction design.

The results in table 5.6.4 estimates that delinquent taxpayers in the Collar counties pay interest rates two percentage points lower as a result of the switch to the English non-matching auction design when all property is included. This represents a decrease in interest fees of 30 percent. The mean taxpayer with an outstanding delinquency of \$4,947 paid nearly \$200 less in interest fees during the first year of delinquency by the county switching to the English non-matching auction design.

In Cook County under the English matching auction design 68 percent of liens were sold at 0 percent. In Cook County under the First Price Sealed Bid auction design 43 percent of liens were sold at 0 percent. It is possible that auction design affects the number of liens sold at 0 percent.

To estimate the effect of auction design on the probability of a lien receiving a winning interest rate bid of 0 outcome variable is a dummy variable indicating whether the winning interest rate bid is 0. The value of one indicates winning interest rate is 0 percent and zero when the winning interest rate is not 0 percent.

Table 5.6.5 provides the estimate results for both Cook and the Collar counties. It is estimated that 20 percent less likely to receive a 0 percent winning interest rate bid under the First Price Sealed Bid auction design in Cook County. It is estimated that there is no material difference in the likelihood of a 0 percent winning interest rate bid under the English – no matching design in the collar counties.

5.7. Conclusion

Poor economic and housing market conditions throughout the United States suggest analysis of tax collection policy is important. Local governments facing declining revenue from other sources would benefit from an auction design providing the highest revenue in the current period. Delinquent property taxpayers facing high rates of unemployment and declining home values would benefit from an auction design providing the lowest interest rate fee for delinquency. This paper allows policy-makers to calculate the trade-off between designs and make more informed decisions in future changes to design. The results suggest the English non-matching design is superior in producing the highest tax lien sale auction and lowest interest fees of the three designs analyzed.

5.8. Cited Literature

- Allen, M. T., S. Faircloth and A. Nejadmalayeri. "Factors Influencing Interest Rates on Delinquent Property Tax Certificates." *Journal of Real Estate Finance and Economics* 28 (1), 2004. 19-36.
- Ashenfelter, O. "How Auctions Work for Wine and Art." *Journal of Economic Perspectives*. 3 (3), 1989. 23-36.
- Ashenfelter, O. and D. Genesove. "Testing for Price Anomalies in Real-Estate Auction." *American Economic Review* 82 (2), 1992. 501-505.
- Conrad, J. and L. DeBoer. "Do High Interest Rates Encourage Property Tax Delinquency?" *National Tax Journal* 41 (4), 1988a. 555-560
- _____. "Rural Property Tax Delinquency and Recession in Agriculture." *American Journal of Agricultural Economics* 70 (3), 1988b. 553-559.
- _____. "The 1989 Property Tax Sale in Marion County: Results of a Survey of Bidders." Purdue University Department of Agricultural Economics Staff Paper #90-11, 1990.
- Conrad, J, L. DeBoer and K. T. McNamara. "Property Tax Auction Sales." *Land Economics* 68 (1), 1992. 72-82.
- DeBoer, L. "Property Tax Delinquency and Tax Sales: A Review of the Literature." *Public Budgeting & Financial Management* 2 (2), 1990. 311-349.
- Engelbrecht-Wiggans, R. and R. J. "A Sequential Auction Involving Asymmetrically-Informed Bidders." *International Journal of Game Theory* 12 (2), 1983. 123-127.
- Klemperer, P. "Auction Theory: A Guide to the Literature." *Journal of Economic Surveys* 13 (3), 1999. 227-286.
- Klemperer, P. "What Really Matters in Auction Design." *Journal of Economic Perspective*. 16 (1), 2002. 169-189.
- Lusht, K. M. "Order and Price of in a Sequential Auction." *Journal of Real Estate Finance and Economics* 8, 1994. 259-266.
- Milgrom, Paul. *Putting Auction Theory to Work*. Cambridge University Press. 2004.
- Menezes, F. M. and P. K. Monteiro. *An Introduction to Auction Theory*. Oxford University Press. 2005.

Mezzitti, Cluadio. "Sequential Auctions with Informational Externalities and Aversion to Price Risk: Decreasing and Increasing Price Sequences." *The Economic Journal* 121, 2011. 990-1016.

Milgrom, P. R. and R. J. Weber. "A Theory of Auctions and Competitive Bidding." *Econometrica* 50 (5), 1982. 1089-1122.

Milgrom, Paul. *Putting Auction Theory to Work*. Cambridge University Press. 2004.

5.9. Appendix

Figure 5 - Cook and the Collar counties

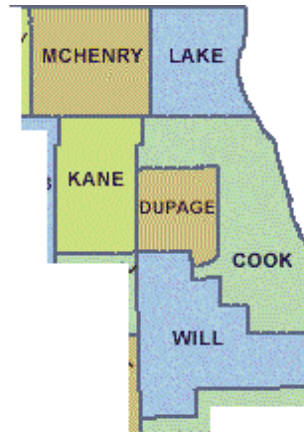


TABLE 5.1.1 - Tax Lien Sale Auction Design

Illinois			
Design	Type	Bid Rules	County-Years
Reference Group	English	Matching allowed.	Cook (2006-2007) Kane (2005-2010) Lake (2005-2006) McHenry (2007-2010)
Treatment Group One	English	Matching not allowed.	DuPage (2007-2010) Lake (2007-2010) Will (2006-2010)
Treatment Group Two	First-Price Sealed-Bid	Winner chosen at random at tie bids of 0 percent. Tie bids between 1 and 18 after second round returned to the county for collection.	Cook (2008-2010)

TABLE 5.3 - Comparative Statistics

This table provides the comparative statistics for the probability of redemption and expected payoff with respect to changes in the variables of interest; where $0 < \pi < 1$, $0.0 \leq l \leq 0.18$, and $0 < \phi < 1$.

Increase in Variable		Probability of Redemption, π	Expected Payoff
D	Delinquent Tax Bill	-	$\sim$
r_{it}	Opportunity Cost of Investor		-
V_{it}	Property Market Value	+	+
π_i	Probability of Redemption		$\sim$
l_i	Lien Interest Rate Bid	-	+

TABLE 5.4.1 - Auction Descriptive Statistics I

Illinois

	Cook County					
	Sold			Unsold		
Initial Offer	No. Liens	Mean Delinquent Tax Bill (\$)^~	Percent Residential Improved	No. Liens	Mean Delinquent Tax Bill (\$)^~	Percent Residential Improved
English - Matching	26,982	\$2,897	76.7%	6,902	\$2,543	12.7%
First Price Sealed Bid	66,631	\$3,453	80.1%	18,644	\$2,389	26.1%
Reoffer	No. Liens	Mean Delinquent Tax Bill (\$)^~	Percent Residential Improved	No. Liens	Mean Delinquent Tax Bill (\$)^~	Percent Residential Improved
First Price Sealed Bid	3,440	\$4,789	82.3%	1,250	\$5,592	89.7%
C						
	Collar Counties					
	Sold			Unsold		
	No. Liens	Mean Delinquent Tax Bill (\$)^~	Percent Residential Improved	No. Liens	Mean Delinquent Tax Bill (\$)^~	Percent Residential Improved
English - Matching	39,398	\$4,315	69.2%	3,591	\$813	2.5%
English - Non-Matching	59,985	\$4,947	73.6%	6,380	\$983	3.7%

~ Adjusted for inflation and presented in 2010 \$

TABLE 5.4.2 - Auction Descriptive Statistics II

Illinois

	Cook County					
	No. Liens		Tax Delinquency ~		Winning Interest Rate*	
	Percent		Percent		Mean	Median
	Offered	Sold	Offered	Sold		
English - Matching	33,884	79.6%	\$95,730.9	81.7%	4.2	0.0
First Price Sealed Bid	89,965	77.9%	\$296,896.1	82.6%	5.1	0.0
	Collar Counties					
	No. Liens		Tax Delinquency ~		Winning Interest Rate*	
	Percent		Percent		Mean	Median
	Offered	Sold	Offered	Sold		
English - Matching	42,989	91.6%	\$172,918.4	98.3%	5.1	3.0
English - Non-Matching	66,365	90.4%	\$303,070.2	97.9%	3.9	3.0

~ Adjusted for inflation and presented in thousands of 2010 \$; * Weighted by inflation adjusted dollars of property tax delinquency.

TABLE 5.4.3 - Auction Descriptive Statistics III
Illinois

	Cook County					
	No. Liens		Tax Delinquency ~		Mean	
	Purchased	Percent	Purchased	Percent	Winning Interest Rate	Delinquent Tax Bill
English - Matching						
Large Buyers (100 or more liens)	25,930	96.1%	\$76,709.5	98.1%	1.7	\$2,958
Meduim Buyers (10 to 99 liens)	816	3.0%	\$1,030.6	1.3%	0.7	\$1,263
Small Buyers (1 to 9 liens)	236	0.9%	\$440.2	0.6%	1.1	\$1,865
First Price Sealed Bid						
Large Buyers (100 or more liens)	68,621	97.9%	\$237,216.5	96.7%	3.1	\$3,457
Meduim Buyers (10 to 99 liens)	1,171	1.7%	\$7,137.0	2.9%	2.4	\$6,095
Small Buyers (1 to 9 liens)	279	0.4%	\$1,003.7	0.4%	2.6	\$3,598
	Collar Counties					
	No. Liens		Tax Delinquency ~		Mean	
	Purchased	Percent	Purchased	Percent	Winning Interest Rate	Delinquent Tax Bill
English - Matching						
Large Buyers (100 or more liens)	26,351	66.9%	\$116,939.6	68.8%	6.3	\$4,438
Meduim Buyers (10 to 99 liens)	12,341	31.3%	\$50,787.9	29.9%	7.0	\$4,115
Small Buyers (1 to 9 liens)	706	1.8%	\$2,271.2	1.3%	7.7	\$3,217
English - Non-Matching						
Large Buyers (100 or more liens)	48,409	80.7%	\$246,262.5	83.0%	4.1	\$5,086
Meduim Buyers (10 to 99 liens)	10,516	17.5%	\$46,729.9	15.7%	4.8	\$4,444
Small Buyers (1 to 9 liens)	1,060	1.8%	\$3,804.7	1.3%	5.4	\$3,589

* Buyer volume was measured at each auction. For example a large buyer in the 2010 Cook County annual tax sale purchased 100 or more liens during that auction not including previous activity.

~ Adjstued for inflation and presented in thousands of 2010 \$

TABLE 5.6.1 - Empirical Results - Logit
Cook County

Y: One if lien was Sold	Coefficient	Δ in Probability	Standard Deviation (S.D.)	Δ in Probability in Δ of One S.D.
First Price Sealed Bid ~	-0.2156** (0.0864)	-0.0166		
Delinquent Tax Bill (\$ Thousands)	-0.0115*** (0.0031)	-0.0009	10.9	-0.3055
Est. Market Value (\$ Thousands)	0.0004*** 0.0001	<0.0000	563.8	0.5477
Residential Improved ~	1.4542*** (0.0610)	0.1290		
Vacant ~	-1.9184*** (0.0903)	-0.2785		
Late Offer ~	-0.3424* (0.1203)	-0.0297		
Reoffered ~	-2.1578* (0.12504)	-0.3451		
Township Fixed Effect	Yes			
N	123,849			
Iterations	5			
Log-Likelihood Function	-122,232.6			
R-Squared	0.3308			

- Robust standard errors reported; ~ dy/dx is for discrete change of dummy from 0 to 1. Tax delinquency weighted.

*** Significant at 1 percent Level; ** Significant at 5 percent level; * Significant at 10 percent level

TABLE 5.6.2 - Empirical Results - Logit
Collar Counties

Y: One if lien was Sold	Coefficient	Δ in Probability	Standard Deviation (S.D.)	Δ in Probability in Δ of One S.D.
English - No Matching ~	-0.1492 (0.1391)	-0.0003		
Delinquent Tax Bill (\$ Thousands)	-0.0005 (0.0011)	<-0.0000	8.3	-0.0144
Est. Market Value (\$ Thousands)	0.0014** (0.0007)	<0.0000	382.3	1.8593
Residential Improved ~	3.2527* (0.2400)	0.0199		
Vacant ~	-1.5954* (0.2658)	-0.0066		
Late Offer ~	-0.6231 (0.1951)	-0.0014		
Township Fixed Effects	Yes			
N	109,354			
Iterations	7			
Log-Likelihood Function	-28,109.6			
R-Squared	0.3798			

- Robust standard errors reported; ~ dy/dx is for discrete change of dummy from 0 to 1 Tax delinquency weighted.

*** Significant at 1percent Level; ** Significant at 5 percent level; * Significant at 10 percent level

TABLE 5.6.3 - Empirical Results - OLS

Cook County

	All Property	Residential	Vacant &
	Coefficient	Improved	Other
Y: Interest Rate	OLS	OLS	OLS
First Price Sealed Bid	0.9661*** (0.0821)	1.2464*** (0.0319)	0.4217** (0.1729)
Delinquent Tax Bill (\$ Thousands)	0.0014 (0.0018)	0.0082 (0.0054)	0.0002 (0.0013)
Est. Market Value (\$ Thousands)	<-0.0000 (<0.0000)	<-0.0000 (0.0001)	<-0.0000 (<0.0000)
Residential Improved	-1.3487*** (0.0594)	- -	- -
Vacant	1.4780*** (0.1094)	- -	- -
Late Offer	0.2991** (0.1328)	0.4856*** (0.0418)	-0.0516 (0.3466)
Reoffered	-0.0970 (0.0809)	-0.0156 (0.0419)	-1.1502*** (0.2345)
Buyer Fixed Effect	Yes	Yes	Yes
Township Fixed Effect	Yes	Yes	Yes
N	123,849	83,767	40,082
R-Squared	0.8543	0.8390	0.8328

Notes: Robust standard errors reported. Tax delinquency weighted.

*** Significant at 1percent Level; ** Significant at 5 percent level; * Significant at 10 percent level

TABLE 5.6.4 - Empirical Results - OLS

Collar Counties

	<u>All Property</u>	<u>Residential</u>	<u>Vacant &</u>
	<u>Coefficient</u>	<u>Improved</u>	<u>Other</u>
Y: Interest Rate	OLS	OLS	OLS
English - No Matching	-1.9892*** (0.0601)	-1.9636*** (0.0539)	-1.8601*** (0.1567)
Tax Delinquency (\$ Thousands)~	-0.0014*** (0.0005)	0.0005 (0.0019)	0.0001 (0.0007)
Est. Market Value (\$ Thousands)	<-0.0000 (<0.0000)	0.0002 (0.0002)	-0.0001*** (<0.0000)
Residential Improved	-0.5689*** (0.0795)	-	-
Vacant	2.3782*** (0.1126)	-	-
Late Offer	-0.3146*** (0.0550)	-0.4400*** (0.0625)	-0.0120 (0.1223)
Buyer Fixed Effect	Yes	Yes	Yes
Township Fixed Effect	Yes	Yes	Yes
N	109,354	71,718	37,636
R-Squared	0.5546	0.4921	0.6134

Notes: Robust standard errors reported. Tax delinquency weighted.

*** Significant at 1 percent Level; ** Significant at 5 percent level; * Significant at 10 percent level

Table 5.6.5 - Empirical Results - OLS
Cook & Collar Counties -Censored Regressions

Y: Interest Rate	Winning Interest Rate = 0		Winning Interest Rate = 0
	Coefficient OLS		Coefficient OLS
English - No Matching	-0.0050*** (0.0010)	First Price Sealed Bid	-0.2022*** (0.0101)
Tax Delinquency (\$ Thousands)~	0.0001 (0.0001)	Tax Delinquency (\$ Thousands)~	-0.0002 (0.0003)
Est. Market Value (\$ Thousands)	<0.0000 (<0.0000)	Est. Market Value (\$ Thousands)	<0.0000 (<0.0000)
Residential Improved	-0.0020 (0.0022)	Residential Improved	0.1914*** (0.0098)
Vacant	0.0034 (0.0026)	Vacant	-0.0783*** (0.0113)
Late Offer	-0.0203*** (0.0018)	Late Offer	-0.0153 (0.0107)
Reoffer	- -	Reoffer	0.0606*** (0.0173)
Buyer Fixed Effect	Yes		Yes
Tax District Fixed	Yes		Yes
N	109,354		123,849
R-Squared	0.6641		0.3653

Notes: Robust standard errors reported. Tax delinquency weighted.

*** Significant at 1percent Level; ** Significant at 5 percent level; * Significant at 10 percent level

VITA

NAME: Joshua J. Miller

EDUCATION: B.B.A., Finance, University of New Mexico, December 2000

M.B.A, Management Information Systems, College of Santa Fe, May 2002

M.A., Economics, University of Illinois at Chicago, May 2009

FIELDS OF INTEREST: Public Economics, Labor and Demographic Economics

EXPERIENCE: Instructor, ECON 370, Department of Economics, University of Illinois at Chicago, Spring 2012

Instructor, ECON 218, Department of Economics, University of Illinois at Chicago, Fall 2011

Instructor, ECON 121, Department of Economics, University of Illinois at Chicago, Spring 2011

Research Assistant to Professor Nathan Anderson, Institute of Government & Public Affairs, University of Illinois at Chicago, 2008 -2010

Instructor, ECON 121, Department of Economics, University of Illinois at Chicago, Summer 2010

Instructor, ECON 120, Department of Economics, University of Illinois at Chicago, Summer 2009

Senior Budget Analyst/Team Leader, Los Alamos National Laboratory – University of California, 2001-2007

Finance Intern, Pulakos & Alongi, Ltd., 1999-2000

PUBLICATIONS: Anderson, Nathan, and Joshua J. Miller. *The Illinois Economy: Taxing Business*. The Illinois Report 2009. Institute of Government & Public Affairs.

VITA (CONTINUED)

HONORS AND AWARDS:	Graduate Student Paper Competition – 1st Prize, University of Illinois at Chicago, 2011-2012. Graduate Student Paper Competition – 2nd Prize, Illinois Economics Association, 2011. C.Lowell Harriss Dissertation Fellowship, Lincoln Institute of Land Policy, 2010-2011. CBA Liautaud Fellowship, University of Illinois at Chicago, 2007-2010.
PROFESSIONAL MEMBERSHIPS:	American Economic Association, Midwest Economic Association, Illinois Economic Association, Mid-Continent Regional Science Association

The Cost of Delinquent Property Tax Collection

Three Essays in Local Public Finance

BY

Joshua J. Miller

B.B.A., University of New Mexico, 2000

M.B.A., College of Santa Fe, 2002

M.A., University of Illinois at Chicago, 2009

THESIS

Submitted as partial fulfillment of the requirements
for the degree of Doctor of Philosophy in Economics
in the Graduate College of the
University of Illinois at Chicago, 2012

Chicago, Illinois

Defense Committee:

Nathan Anderson, Chair and Advisor

Rebecca Hendrick, College of Urban Planning and Public Affairs, UIC

Robert Kaestner

David Merriman

Joseph Persky

This thesis is dedicated to JJ and Paetyn.

ACKNOWLEDGMENTS

I would like to thank my thesis committee—Nathan Anderson, Rebecca Hendrick, Robert Kaestner, David Merriman, Joseph Persky --for their unwavering support and assistance. I would also like to acknowledge Nathan Anderson, who oversaw the development of the proposal and made contributions important to the conduct of the study.

I am very grateful for the support provided by the Institute of Government & Public Affairs, Lincoln Institute of Land Policy, and the University of Illinois at Chicago Department of Economics.

TABLE OF CONTENTS

<u>CHAPTER</u>	<u>PAGE</u>
1. INTRODUCTION	8
1.1. Background and Motivation	8
2. CROSS STATE VARIATION IN DELINQUENT PROPERTY TAX COLLECTION POLICIES	
2.1. Introduction	10
2.2. The Delinquent Property Tax Collection System.....	10
2.3. Delinquent Property Tax Collection Policies – United States.....	11
2.3.1. Penalties.....	11
2.3.2. Interest Fees.....	12
2.3.3. Tax Lien Sales....	13
2.3.4. Tax Foreclosure.....	15
2.4. Equity, Efficiency, and Simplicity.....	16
2.5. Conclusion.....	19
2.6. Cited Literature.....	20
2.7. Appendix.....	21
3. THE RESPONSIVENESS OF PROPERTY TAXPAYERS TO DIFFERENCES IN PENALTIES AND INTEREST FEES: EVIDENCE FROM OREGON AND WASHINGTON STATE	
3.1. Introduction	51
3.1.1. Property Tax Delinquency Costs – Oregon.....	54
3.1.2. Property Tax Delinquency Costs – Washington State.....	55
3.1.3. Comparison of Property Tax Delinquency Costs.....	55
3.2. Literature Review	57
3.3. Property Tax Delinquency Decision.....	58
3.4. Data Sources and Variable Construction	60
3.5. Empirical Methods and Results	63
3.6. Conclusion	65
3.7. Cited Literature	66
3.8. Appendix	68
4. THE RESPONSIVENESS OF PROPERTY TAXPAYERS TO TAX LIEN SALES: EVIDENCE FROM OHIO	
4.1. Introduction	72
4.1.1. Ohio - Tax Lien Sales.....	74
4.1.2. Tax Lien Sale Adoption	75
4.1.3 Tax Lien Sale Costs – Delinquent Property Taxpayer.....	76
4.2. Literature Review	78
4.3. Data Sources and Variable Construction	80
4.4. Empirical Methods and Results	83
4.4.1. Identification Strategy	84
4.4.2. Fixed Effect and First Difference.....	88
4.5. Conclusion	91
4.6. Cited Literature	93
4.7. Appendix	94

TABLE OF CONTENTS (CONTINUED)

<u>CHAPTER</u>	<u>PAGE</u>
5. THE RESPONSIVENESS OF INVESTORS TO DIFFERENCES IN TAX LIEN SALE AUCTION DESIGN: EVIDENCE FROM ILLINOIS	
5.1. Introduction	100
5.1.1 Tax Lien Sale Auction Design	103
5.2. Literature Review	105
5.3. Theoretical Model	106
5.3.1. English Auctions	109
5.3.2. First Price Sealed Bid	113
5.4. Data Sources and Variable Construction	114
5.5 Empirical Methods	116
5.6. Results	119
5.7. Conclusion	122
5.8. Cited Literature	123
5.9. Appendix	125
VITA	135

LIST OF TABLES

<u>TABLE</u>		<u>PAGE</u>
I.	Table 2.3 – Delinquent Property Tax Collection Policies by State.....	21
II.	Table 2.3.3. – Tax Lien Sales by State.....	22
III.	Table 3.1.3.1. – Property Tax Delinquency Costs, Oregon & Washington State.....	69
IV.	Table 3.1.3.2. – Combined Penalties and Interest Fees, Oregon & Washington State.....	69
V.	Table 3.4 – County Descriptive Statistics, Oregon & Washington State.....	70
VI.	Table 3.5 – Empirical Results, OLS, Oregon & Washington State.....	71
VII.	Table 4.1.2 – Tax Lien Sale, Adoption, Ohio.....	94
VIII.	Table 4.1.3 – Property Tax Delinquency Costs, Ohio.....	95
IX.	Table 4.3.1 – County Descriptive Statistics, Ohio.....	96
X.	Table 4.3.2 – Municipality Descriptive Statistics, Ohio.....	97
XI.	Table 4.3.3 – Tax Lien Sale, Financial Effect, Ohio.....	98
XII.	Table 4.4.2 – Empirical Results, Fixed Effect and First Difference, Ohio.....	99
XIII.	Table 5.1.1 – Tax Lien Sale Auction Designs, Illinois.....	125
XIV.	Table 5.3 – Comparative Statistics.....	126
XV.	Table 5.4.1 – Descriptive Statistics I, Illinois.....	127
XVI.	Table 5.4.2 – Descriptive Statistics II, Illinois.....	128
XVII.	Table 5.4.3 – Descriptive Statistics III, Illinois.....	129
XVIII.	Table 5.6.1 – Empirical Results, Logit, Cook County.....	130
XIX.	Table 5.6.2 – Empirical Results, Logit, Collar Counties.....	131
XX.	Table 5.6.3 – Empirical Results, OLS, Cook County.....	132
XXI.	Table 5.6.4 – Empirical Results, OLS, Collar Counties	133
XXII.	Table 5.6.5 – Empirical Results, OLS, Censored.....	134

LIST OF FIGURES

<u>FIGURE</u>	<u>PAGE</u>
1. Figure 3 – Property Tax Delinquency Rates, Oregon & Washington State, 2000 to 2010...	68
2. Figure 5 – Cook and the Collar Counties.....	125

1. INTRODUCTION

1.1. Background and Motivation

Property tax delinquency can be costly for local governments and taxpayers. There are four important state government policies that affect the cost of property tax delinquency for taxpayers; penalties, interest fees, tax lien sales, and time to tax foreclosure.

Penalties are a one-time fee applied to a tax bill when not paid on time. Interest fees are recurring, applied to a tax bill the duration of delinquency. Tax lien sales introduce additional penalties, uncertain interest fees, and private tax foreclosure. Private tax foreclosure is more costly and faster than public tax foreclosure.

The first section of the dissertation documents state differences in penalties, interest fees, tax lien sales, and time to tax foreclosure. Higher penalties and interest increase the costs of property tax delinquency for delinquent taxpayers. The second section estimates the responsiveness of taxpayers to differences in penalties and interest fees. The third section estimates to what extent property tax delinquency is affected by tax lien sale induced changes in interest rates charged to delinquent taxpayers. The final section estimates the responsiveness of interest rates to differences in tax lien sale auction design.

The dissertation contributes to the literature because it is the first to describe cross-state variation in four important delinquent tax collection policies; penalties, interest fees, tax lien sales, and tax foreclosure. The dissertation is the first to estimate the responsiveness of taxpayers to differences in penalties, interest, and tax lien sales. The dissertation is the first to estimate the responsiveness of interest rate differences in tax lien sale auction design.

Property tax delinquency, the untimely payment of property taxes, is administratively and financially costly for local governments. Local governments cut services or raise taxes when property tax delinquency is high. Delinquent property tax bills require notification and monitoring. Penalties, interest fees, and tax lien sale policies set many decades in the past do not adequately cover costs for local governments. Estimating the responsiveness of taxpayers to penalties, interest fees, and tax lien sales is an important first step in designing policies which adequately cover property tax delinquency costs for local governments.

2. CROSS STATE VARIATION IN DELINQUENT PROPERTY TAX COLLECTION POLICIES

2.1. Introduction

The frequency and duration of property tax delinquency has increased significantly during the Great Recession. Many local governments struggle with excessive delinquent property tax balances. For example, the estimated total delinquent property tax balance in 2011 for the city of Philadelphia was \$472 million; approximately 19 percent of all properties in 2011 had a delinquent property tax balance (Kekstra, 2011).

The purpose of this paper is to document state variation in the application of four delinquent property tax collection policies. The four policies are penalties, interest fees, tax lien sales, and tax foreclosure. Documenting variation in these policies is important as local governments consider policy alternatives.

First, this paper describes how these four delinquent property tax collection policies function as a delinquent property tax collection system. Next, variation in the application of these policies by state is described. Finally, the benefits and costs of various delinquent property tax collection systems are considered. The paper provides policy makers with the first detailed examination of delinquent property tax collection policies.

2.2. The Delinquent Property Tax Collection System

Penalties, interest fees, tax lien sales, and tax foreclosure policies function as a system. When a taxpayer becomes delinquent a lien is placed on the property. A lien is an encumbrance placed on property to secure payment of delinquent taxes. The lien is either held by the local government or sold to private investors in a tax lien sale.

After the lien is placed on the property, penalties are added to the delinquent tax bill. Interest fees are applied monthly until the total delinquent balance paid in full. In the case of prolonged delinquency, property ownership rights are forcibly transferred to the lienholder through a process called a tax foreclosure.

2.3. Delinquent Property Tax Collection Policies – United States

Delinquent property tax collection systems vary in to the application of the four common policies penalties, interest fees, tax lien sales, and tax foreclosure. The application of policies are typically determined by state legislatures and uniformly applied by all local governments within a state. State legislatures choose penalties and interest fees, whether to conduct tax lien sales, and tax foreclosure procedures.

To draw a meaningful comparison of delinquent property tax policies by state are provided in table 2.3. The table lists policies applied to the typical taxpayer in each state in 2011. A typical delinquent property taxpayer is defined as an owner-occupier of residential property with the state median tax bill. Property tax delinquency is typically of duration less than one year. In cases where differences exist within state, features from the most populous taxing jurisdiction are presented. The table highlights variation in the application of policies by state.

2.3.1. Penalties

Penalties are a one-time fee applied to a tax bill when the tax bill is not paid on time. Penalties are typically applied as a percentage of the delinquent tax bill as reported in table 2.3. Penalties are charged in 29 states and the District of Colombia. For example in South Carolina delinquent property tax bills incur a penalty of three percent of the annual tax bill if paid one to

17 days delinquent, 10 percent of the annual tax bill 18 to 62 days delinquent, and 15 percent of the annual tax bill if paid any time after 63 days of delinquency. Penalties for South Carolina are reported as 15 percent. The typical taxpayer in South Carolina with a median delinquent property tax bill of \$756 incurred penalties of 15 percent or \$113.40 for one year of delinquency. In states that charge penalties, the most common, found in 11 states, is 10 percent.

2.3.2. Interest Fees

Interest fees also reduce the cost of delinquent property tax collection by discouraging short-term property tax delinquency and generating revenue from long-term property tax delinquency. Interest fees, unlike penalties, are charged in all states. With the exception of Alaska and Alabama, interest fees are based on a simple interest rate calculation. Alaska compounds interest monthly whereas Alabama compounds interest daily. Interest fees are reported in table 2.3 as a simple interest rate applied during the first year of delinquency.

A simple interest rate is applied to the annual property tax bill and not on interest accrued. For example, New Hampshire charges a simple interest rate of 1.5 percent per month or 18 percent per year. The interest fee charged on a delinquent median property tax bill of \$4,660 for one month of delinquency is 1.5 percent of the annual tax bill or \$69.90, two months is three percent or \$139.80, and three months is 4.5 percent or \$209.70. The most common interest fee, found in 18 states, is a 12 percent.

Six states set interest rates on a yearly basis. Alaska sets interest rates five percentage points above the federal funds rate. Colorado sets interest rates 9 percentage points above the federal funds rate. Kansas officials at the state level determine interest rate whereas in New

York City the interest rate is determined by the city council. Ohio sets interest fees three percentage points above the federal funds rate. Utah sets interest fees six percentage points above the federal funds rate with a minimum interest fee of 7 percent and a maximum of 10 percent.

2.3.3. Tax Lien Sales

Tax lien sales reduce the cost of delinquent property tax collection by discouraging short-term property tax delinquency and privatizing tax foreclosure. Tax foreclosure is the most costly part of the delinquent property tax collection system.

Local governments in all states place liens against property with delinquent tax bills. In 26 states¹ and the District of Columbia liens are sold by local governments to private investors in a tax lien sale. The tax lien sale column of table 2.3 indicates whether tax lien sales were conducted by the largest taxing jurisdiction within the state in 2011.

A tax lien sale is the sale delinquent property taxes by a local government to a private investor. When a property taxpayer becomes delinquent, a lien is placed against the property. The lien represents a collateralized receivable but not direct ownership. In a tax lien sale, investors pay the delinquent property tax bill to the government. In return, investors receive the property lien and the right to payment of the delinquent tax bill plus penalties and interest fees. In the case of prolonged property tax delinquency the investor obtains the property in tax foreclosure.

¹ In Massachusetts small municipalities conducted tax lien sales in 2011. However the majority of delinquent taxpayers are not subject to sales. Statute permits the use of tax lien sales in California and Nevada but no local governments within these states conducted tax lien sales in 2011. California, Massachusetts, and Nevada are not listed as a tax lien sale state in table 2.3 or table 2.3.3.

Tax lien sales are costly to delinquent taxpayers in two ways. The first is through additional penalties applied to delinquent property tax bills on property included in the sale. The second is through the privatization of the tax foreclosure process. Private initiated tax foreclosures are thought to occur more rapidly than public initiated tax foreclosures and are more costly to property owners (Rittenhouse, 2011).

Table 2.3.3 provides the basic features of tax lien sales in each state. Tax liens are sold to private investors in three ways; negotiated sales, lottery, and auctions. A majority of delinquent taxpayers in two states, New York and Texas, were subject to negotiated sales in 2011. In New York City officials negotiate with large firms to administer the entire portfolio of liens. Once the portfolio is transferred, the delinquent taxpayer owes delinquent taxes, penalties, and interest fees to the new lienholder, not to the city. In Texas, counties negotiate with local attorneys to administer the entire portfolio of liens. Once the portfolio is transferred, the delinquent taxpayer makes payment of the delinquent tax bill, penalties, and interest fees directly to the local attorney, not to the county government.

Kentucky and Wyoming sell annually, individual liens through a lottery. In both states investors are physically present the day of sale. In Wyoming, investors are assigned numbers which are drawn to determine whom has first right to purchase the lien. If the first investor drawn chooses not to purchase the lien, a second investor is drawn and given the right to purchase the lien. The process is repeated until the lien is sold. A slightly more involved lottery is conducted in Kentucky.

The method of tax lien sale in 22 states and the District of Columbia is auction. Auctions of individual liens are conducted in all instances with the exception of Maryland and Ohio. In

Maryland, investors are permitted to enter sealed bids on individual liens or multiple liens. In Ohio, county treasurers auction the entire portfolio of liens annually.

The most prevalent auction, used in 15 states and the District of Columbia, is the overbid method. Investors compete for the right to purchase liens by entering bids in whole dollars. Generally the minimum bid allowed is the delinquent property tax bill, penalties, and interest fees. The investor willing to pay the highest amount above the minimum bid wins the right to purchase the lien.

Arizona, Florida, Illinois, and New Jersey auction individual liens using the interest rate method. Investors compete for the right to purchase liens by entering bids corresponding to the interest rate charged to delinquent taxpayers. The investor willing to accept the lowest interest rate for paying the delinquent tax bill and penalties wins the right to purchase the lien.

Iowa, Nebraska, and Rhode Island auction individual liens using the percent ownership method. Investors compete for the right to purchase liens by entering a percentage bid between 100 and 0 representing the ownership stake of the property in the case of tax foreclosure. The investor willing to accept the lowest ownership stake in the property wins the right to purchase the lien.

2.3.4. Tax Foreclosure

Tax foreclosure is costly for local governments. Tax foreclosure is a legal proceeding where the payment of property taxes is enforced through the sale of property or transfer of ownership. The cost of delinquent property tax collection depends on the complexity of tax foreclosure and the duration of delinquency permitted prior to the completion of tax foreclosure.

Tax foreclosure is also costly for delinquent taxpayers because of court fee and court appearances. State laws dictate when local governments are allowed to begin the tax foreclosure process. Table 2.3 provides, by state, the maximum length of time, in years, of property tax delinquency permitted prior to the start of tax foreclosure.

For example, in the state of New Mexico property with three or more years of continuous property tax delinquency is seized by the New Mexico State Taxation & Revenue Department and sold at public auction. The length of delinquency allowed in New Mexico prior to tax foreclosure is three years. A slightly more involved example is a tax lien sale state such as Indiana. In Indiana liens are sold after six months of continuous property tax delinquency. When the lien is sold, property owners have one year to pay the delinquent tax bill, penalties, and interest fees. After an additional year of delinquency, lien holders are permitted to initiate tax foreclosure proceedings. The length of continuous property tax delinquency allowed in Indiana prior to tax foreclosure is 1.5 years.

2.4. Equity, Efficiency, and Simplicity

Using the criteria of equity, efficiency, and simplicity it is possible to compare delinquent property tax collection systems. The preferred set of policies is equitable in the distribution of tax burden, efficient as measured by economic growth and simple in taxpayer compliance and government administration. A delinquent property tax collection system includes penalties, interest fees, tax lien sales decision, and tax foreclosure.

Delinquent property tax collection system is equitable provided societal notions of fairness are achieved. For example a delinquent property tax collection system would be equitable provided an elderly residential property owner in County A with a delinquent tax bill

of \$2,000 faces the same penalties, interest fees, and tax foreclosure as an elderly residential property owner in County B with the same delinquent tax bill. Non-tax lien sale states promote equity when penalties, interest fees, and tax foreclosure policies are directed by state law and uniformly applied by all local governments. An example of such a state is Kansas whereby taxpayers face the same delinquent tax collection system regardless of county. An interest rate of 7 percent per year is applied to the delinquent tax bill and three years of delinquency are allowed prior to start of tax foreclosure proceedings. Additionally elderly, disabled, and disabled veterans are provided tax relief programs to alleviate the cost of property tax delinquency. Tax lien sales are not equitable as penalties, interest fees, and tax foreclosures often vary by local government and tax lien investor.

A delinquent property tax collection system is efficient provided a set of alternative policies does not raise the same revenue while increasing economic growth. An example of an efficient delinquent property tax collection system would be one that provides local governments with tax revenue sooner, delinquent taxpayers with interest fees equal to the borrowing costs, and promotes the most productive property use. Property tax revenue contributes to the economic growth of the community by allowing local governments to fund essential functions such as schools, fire, and police services. The more predictable and sooner property tax revenue is realized the better the local government is able to design and implement policies which promote economic growth.

The interest fees charged to delinquent taxpayers promotes economic growth by allowing taxpayers to use the property as collateral in borrowing against the delinquent tax bill. Property tax delinquency has been used by farmers and residential property owners as a form

of credit during economic recessions (Olson and Lachman 1976; Conrad and DeBoer 1988a). Delinquent tax bills are typically repaid during periods of economic expansion.

An efficient delinquent property tax collection system promotes the most productive property use by identifying and forcing the sale of under-utilized property. There exists a strong negative correlation between property tax delinquency and investments in property. Furthermore the decision to not pay all current and future property tax payments is a decision to abandon the property (White 1986). The forced transfer of property to owners willing to pay property taxes in a timely fashion and make investments in the property promotes economic growth.

Tax lien sale states using the interest rate auction method, such as Illinois, promote efficiency in terms of local government revenue, interest fees, and tax foreclosure when compared to non-tax lien sale states. Through the sale of liens to private investors, local governments realize delinquent property tax revenue sooner. In tax lien sales delinquent taxpayers pay weakly lower interest fees to private investors than local governments which are determined in a competitive market. Private investors are thought to force the sale of under-utilized property sooner through tax foreclosure than local governments.

Simplicity of the delinquent property tax collection policy is measured by the ability of taxpayers to comply and administrators to enforce. Non-tax lien sale states promote simplicity. Penalties, interest fees, and tax foreclosure requirements are known by administrators and taxpayers prior to the tax bill becoming delinquent. In tax lien sales penalties varies by investor. In tax lien sales using the interest rate auction method, interest fees often vary by property. In

addition in tax lien sale states local governments must conduct and administer these sales.

Administratively tax lien sale liens are costly.

In choosing delinquent tax collection policies, state and local government officials make a trade between the equity, efficiency, and simplicity. When analyzing qualitatively non-tax lien sale states offer equity and simplicity at the cost of efficiency. Tax lien sale states offer efficiency at the expense of equity and simplicity.

2.5. Conclusion

The first step in understanding the cost of delinquent property tax collection in the United States is to document variation the system of policies employed. This paper is the first to describe the four broad policies and the variation in the application of these policies by state. The policies are compared qualitatively using the criteria of equity, efficiency, and simplicity. Although no set of policies is superior in terms of equity, efficiency, and simplicity, the discussion is informative in understanding the trade-offs made by government officials in determining the appropriate set of delinquent property tax collection policies. The hope is that this paper will facilitate further study of the cost of delinquent property tax collection. The findings of such research would aid not only academics but also local government officials and property taxpayers alike.

2.6. Cited Literature

Kekstra, P. *Special Report: The Delinquency Crisis*. PlanPhilly. August 13, 2011.

O’Flaherty, B. “The Option Value of Tax Delinquency: Theory.” *Journal of Urban Economics* 28, 1990. 287-317.

Rittenhouse, C. D. “The True Cost of Not Paying Your Property Taxes in Ohio.” *University of Dayton Law Review* 36 (2), 2011. 221-247.

White, M. J. 1986. “Property Taxes and Urban Housing Abandonment.” *Journal of Urban Economics* 20, 1986. 312-330.

2.7. Appendix – Property Tax Delinquency Costs by State

Table 2.3
Delinquent Property Tax Collection Policies by State - 2011

State	Penalties	Interest Fees	Tax Foreclosure	Tax Lien Sale	Median Property Tax *
Alabama	-	12%	3.5 years	Yes	\$512
Alaska**	10%	5.25%	2 years	No	\$2,982
Arizona	-	16%	4 years	Yes	\$1,427
Arkansas	10%	10%	3 years	No	\$610
California	10%	18%	5 years	No	\$2,881
Colorado	-	10%	3.25 years	Yes	\$1,446
Connecticut	-	18%	1 year	No	\$4,903
Delaware**	6%	12%	2 years	No	\$1,198
District of Columbia	10%	18%	1.5 years	Yes	\$2,316
Florida	3%	18%	2 years	Yes	\$1,791
Georgia	10%	12%	1 years	No	\$1,447
Hawaii	10%	12%	6 years	No	\$1,396
Idaho	2%	12%	3 years	No	\$1,222
Illinois	-	18%	2.5 years	Yes	\$3,711
Indiana	10%	10%	1.5 years	Yes	\$1,041
Iowa	-	18%	2.25 years	Yes	\$1,652
Kansas	-	7%	3 years	No	\$1,716
Kentucky	-	12%	1.5 years	Yes	\$947
Louisiana	10%	12%	3.5 years	Yes	\$595
Maine**	-	7%	2.5 years	No	\$2,087
Maryland	8%	12%	1.25 years	Yes	\$2,956
Massachusetts**	-	14%	3 years	No	\$3,595
Michigan	4%	12%	3 years	No	\$2,244
Minnesota	10%	10%	3 years	No	\$2,140
Mississippi	-	12%	2.5 years	Yes	\$726
Missouri	7%	18%	4 Years	Yes	\$1,302
Montana	2%	10%	3.5 years	Yes	\$1,549
Nebraska	-	14%	3.5 years	Yes	\$2,319
Nevada	7%	10%	3 years	No	\$1,720
New Hampshire	-	18%	2.5 years	No	\$4,660
New Jersey	-	16%	2.25 years	Yes	\$6,828
New Mexico	5%	12%	3 years	No	\$1,068
New York**	-	18%	2 years	Yes	\$4,090
North Carolina	2%	9%	0.5 year	No	\$1,256
North Dakota	9%	12%	2 years	No	\$1,676
Ohio**	10%	3%	2 Years	Yes	\$1,932
Oklahoma	-	18%	3 years	No	\$894
Oregon	-	16%	3 years	No	\$2,390
Pennsylvania**	2%	18%	4 years	Yes	\$2,316
Rhode Island	-	12%	2 years	Yes	\$3,734
South Carolina	15%	12%	2 years	Yes	\$756
South Dakota	-	10%	3 years	Yes	\$1,713
Tennessee	6%	12%	1.5 years	Yes	\$972
Texas	12%	12%	2.5 years	Yes	\$2,433
Utah	2.5%	7%	5 years	No	\$1,407
Vermont	8%	12%	1.5 years	Yes	\$3,494
Virginia	10%	10%	2 years	No	\$1,919
Washington	11%	12%	3 years	No	\$2,658
West Virginia	-	9%	2 years	Yes	\$548
Wisconsin**	-	18%	1 year	No	\$3,128
Wyoming	3%	15%	4.5 years	Yes	\$1,119

* U.S. Census Bureau - American Community Survey - 2010 Median Real Estate Taxes Owner-occupied housing with a mortgage.

** Data was collected from the largest taxing jurisdiction due to within state variation (New Castle County, DE; Boston, MA; Portland, ME; New York City, NY; Cuyahoga County, OH; Philadelphia, PA; Milwaukee, WI)

Table 2.3.3
Tax Lien Sales by State - 2011

State	Type	Max Interest	Redemption Period
Alabama	Overbid	12%	2.5 years
Arizona	Interest Rate	16%	3 years
Colorado	Overbid	10%	3 years
District of Colombia	Overbid	18%	0.5 year
Florida	Interest Rate	18%	2 years
Illinois	Interest Rate	18%	2.5 years
Indiana	Overbid	10%	1 year
Iowa	Percent Ownership	24%	1.75 years
Kentucky	Lottery	12%	1 year
Louisiana	Overbid	12%	3 years
Maryland	Overbid	20%	0.5 year
Mississippi	Overbid	18%	2 years
Missouri	Overbid	10%	1 year
Montana	Overbid	10%	3 years
Nebraska	Percent Ownership	14%	3 years
New Jersey	Interest Rate	18%	2 years
New York**	Negotiated	18%	1 year
Ohio**	Overbid	18%	1 year
Pennsylvania**	Overbid	18%	3 years
Rhode Island	Percent Ownership	16%	1 year
South Carolina	Overbid	12%	1 year
South Dakota	Overbid	10%	3 years
Tennessee	Overbid	10%	1 year
Texas	Negotiated	-	2 years
Vermont	Overbid	12%	1 year
West Virginia	Overbid	12%	1.5 years
Wyoming	Lottery	15%	4 years

** Data was collected from the largest taxing jurisdiction due to within state variation
(New York City, NY; Cuyahoga County, OH; Philadelphia, PA)

Alabama - Property taxes are payable annually in one installment. A \$5.00 penalty is added to the unpaid tax bill the day after the due date. An interest fee of one percent per month or 12 percent per year is applied to the delinquent tax bill.

County governments conduct tax lien sales six months after the tax bill becomes delinquent. Liens are auctioned individually using the overbid method. Investors compete for the right to purchase liens by entering bids in whole dollars. The minimum bid allowed is the delinquent tax bill and penalties. The investor willing to pay the highest amount above the minimum bid of the delinquent tax bill and penalties wins the right to purchase the lien.

During a three year period of redemption investors earn an interest fee of one percent per month or 12 percent per year. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fee accrued during the three year redemption period the property deed is awarded to the lienholder.

Source: The Code of Alabama – Section 40-5-9/40-10

Alaska – Property taxes are payable annually in two equal installments. A 10 percent penalty is added to each installment if unpaid by the due date. An interest fee of two percent above the prime rate as of April 15 of each year is applied to the unpaid tax bill. The delinquent real property interest rate was 5.25 percent in 2011. Interest is compounded monthly.

Tax lien sales are not conducted in Alaska. If the delinquent taxpayer has not paid the unpaid tax bill, penalties, and interest accrued during a two year period the property deed is awarded to the municipality.

Source: Alaska Statute Title 29 - Chapter 45; Anchorage Municipal Code Title 12 - Chapter 12

Arkansas – Property taxes are payable annually in one installment. A 10 percent penalty is added to the delinquent tax bill the day after the due date. An interest fee of 0.83 percent per month or 10 percent per year is applied to the delinquent tax bill.

Tax lien sales are not conducted in Arkansas. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during a three year period the property deed is awarded to the state.

Source: The Arkansas Code of 1987 Section 23-36-201/23-36-202/23-37-101

Arizona – Property taxes are payable annually in two equal installments. An interest fee of 1.33 percent per month or 16 percent per year is applied to the delinquent tax bill.

County governments conduct tax lien sales 13 months after the tax bill becomes delinquent. Delinquent property included in the sale are assessed a five percent penalty. Liens are auctioned individually using the interest rate method. Investors compete for the right to purchase liens by entering one percentage point bids between 16 and zero percent. The investor willing to accept the lowest interest fee for paying the delinquent tax bill and penalties wins the right to purchase the lien.

During a three year period of redemption investors earn an interest fee agreed to during the auction. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during the three year redemption period the property deed is awarded to the lienholder.

Source: Arizona Revised Statute – Title 42 – Chapter 18

California – Property taxes are payable annually in two equal installments. A 10 percent penalty is added to each installment if unpaid by the due date. An interest fee of 1.5 percent per month or 18 percent per year is applied to the delinquent tax bill.

Tax lien sales are not conducted in California but are permitted by statute. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during a five year period the property deed is awarded to the county.

Source: California Revenue and Taxation Code – Section 2700-2708/3351-3353

Colorado – Property taxes are payable annually in one or two installments. An interest fee, set annually, of nine points above the federal discount rate is applied to the delinquent tax bill. The delinquent real property interest fee was 10 percent in 2011. Interest is compounded monthly.

County governments conduct tax lien sales a few months after the second installment. Liens are auctioned individually using the overbid method. Investors compete for the right to purchase liens by entering bids in whole dollars. The minimum bid allowed is the delinquent tax bill and penalties. The investor willing to pay the highest amount above the minimum bid of delinquent tax bill and penalties wins the right to purchase the lien.

During a three year period of redemption investors earn an interest fee of 10 percent per year. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during the three year redemption period the property deed is awarded to the lienholder.

Source: Colorado Revised Statute 39-10-104.5/39-11

Connecticut – Property taxes are payable annually with the number of installments varying by municipality. An interest fee of 1.5 percent per month or 18 percent per year is applied to the delinquent tax bill.

Tax lien sales are not conducted in Connecticut. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during a one year period the property deed may be awarded to the municipality.

Source: General Statutes of Connecticut – Title 12 – Chapter 204 – Section 12-146/12-157

Delaware – Property taxes are payable annually in one installment. Penalties, interest fees, and tax foreclosure policy vary by municipality. The policies of the largest municipality, New Castle, Delaware, are discussed. A six percent penalty is added to the delinquent tax bill the day after the due date. An interest fee of one percent per month or 12 percent per year is applied to the delinquent tax bill.

Tax lien sales are not conducted in Delaware. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during a two year period the property deed is awarded to the municipality.

Source: The Delaware Code – Title 9 – Chapter 86 to 87

District of Columbia – Property taxes are payable annually in two installments. A 10 percent penalty is added to each installment if unpaid by the due date. An interest fee of 1.5 percent per month or 18 percent per year is applied to the delinquent tax bill.

The District conducts tax lien sales annually for taxes with one year of delinquency. Liens are auctioned individually using the overbid method. Investors compete for the right to purchase liens by entering bids in whole dollars. The minimum bid allowed is the delinquent tax bill and penalties. The investor willing to pay the highest amount above the minimum bid of delinquent tax bill and penalties wins the right to purchase the lien.

During a six month period of redemption investors earn an interest fee of 18 percent per year. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during the six month year redemption period the property deed is awarded to the lienholder.

Source: District of Columbia Official Code 2001 – Division VII. – Title 47 – Chapter 13/13A/42

Florida – Property taxes are payable annually in one installment. A three percent penalty is added to the delinquent tax bill the day after the due date. An interest fee of 1.5 percent per month or 18 percent per year is applied to the delinquent tax bill.

County governments conduct tax lien sales two months after the tax bill becomes delinquent. Liens are auctioned individually using the interest rate method. Investors compete for the right to purchase liens by entering quarter percentage point bids between 18 and zero percent. The investor willing to accept the lowest interest fee for paying the delinquent tax bill and penalties wins the right to purchase the lien.

During a twenty two month period of redemption investors earn an interest fee agreed to during the auction. If the delinquent taxpayer has not paid the delinquent tax bill, penalties,

and interest fees accrued during the twenty two month redemption period the property deed is awarded to the lienholder.

Source: The 2011 Florida Statutes – Title XIV – Chapter 197 – Section 172/432

Georgia – Property taxes are payable annually in installment plans that vary by county. A 10 percent penalty is added to each installment 90 days after the due date. An interest fee of one percent per month or 12 percent per year is applied to the delinquent tax bill.

Tax lien sales are not conducted in Georgia but instead tax deed sales. Tax deeds may be conducted at any time after delinquency occurs. Deeds are auctioned individually using the overbid method. Investors compete for the right to purchase deeds by entering bids in whole dollars. The investor willing to pay the highest amount above the minimum bid of unpaid taxed and penalties wins the right to purchase the deed.

During a one year period of redemption investors earn an interest fee of 20 percent per year. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during the one year period of redemption period the property deed is awarded to the lienholder.

Source: Official Code of Georgia – Title 48 – Chapter 2 – Article 2; Official Code of Georgia – Title 48 – Chapter 4 – Article 5;

Hawaii – Property taxes are payable annually with the number of installments varying by municipality. A 10 percent penalty is added to each installment upon delinquency. An interest fee of one percent per month or 12 percent per year is applied to the delinquent tax bill.

Tax lien sales are not conducted in Hawaii. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during a six year period the property deed may be awarded to the municipality.

Source: Hawaii Revised Statute – Volume 1 – Division 1 - Title 14 – Chapter 246

Idaho – Property taxes are payable annually in one installment or two equal installments. A two percent penalty is added to each installment unpaid after the due date. An interest fee of one percent per month or 12 percent per year is applied to the delinquent tax bill.

Tax lien sales are not conducted in Idaho. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during a three year period the property deed may be awarded to the county.

Source: Idaho Statutes - Title 63 – Chapter 10

Illinois – Property taxes are payable annually in two installments. An interest fee of 1.5 percent per month or 18 percent per year is applied to the delinquent tax bill.

County governments conduct tax lien sales a few months after the tax bill becomes delinquent. Liens are auctioned individually using the interest rate method. Investors compete for the right to purchase liens by entering one percentage point bids between 18 and zero percent. The investor willing to accept the lowest interest fee for paying the delinquent tax bill and penalties wins the right to purchase the lien.

During a 2.5 year period of redemption investors earn an interest fee agreed to during the auction. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and

interest fees accrued during the 2.5 year redemption period the property deed is awarded to the lienholder.

Source: Illinois Compiled Statute – Chapter 35-200 – Title 7 – Article 21

Indiana – Property taxes are payable annually in two equal installments. A 10 percent penalty is added to each installment unpaid after the due date. An interest fee of 0.83 percent per month or 10 percent per year is applied to the delinquent tax bill.

County governments conduct tax lien sales a few months after the second installment. Liens are auctioned individually using the overbid method. Investors compete for the right to purchase liens by entering bids in whole dollars. The minimum bid allowed is the delinquent tax bill and penalties. The investor willing to pay the highest amount above the minimum bid of delinquent tax bill and penalties wins the right to purchase the lien.

During a one year period of redemption investors earn an interest fee of 10 percent per year. In addition if the lien is redeemed no more than six months after the sale a 10 percent penalty must be paid. If the lien is redeemed more than six months after the sale the penalty increases to 15 percent. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during the one year redemption period the property deed is awarded to the lienholder.

Source: Indiana Code – Title 6 – Article 1.1 – Chapter 22 to 24

Iowa – Property taxes are payable annually in two installments. An interest fee of 1.5 percent per month or 18 percent per year is applied to the delinquent tax bill.

County governments conduct tax lien sales a few months after the second installment becomes delinquent. Liens are auctioned individually using the percent ownership method. Investors compete for the right to purchase liens by entering a percentage between 100 and 0 representing the ownership stake of the property in the case of tax foreclosure. The investor willing to accept the lowest ownership stake in the property wins the right to purchase the lien.

During a 1.75 years period of redemption investors earn an interest fee of two percent per month or 24 percent per year. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during the 1.75 years redemption period the property deed is sold at auction.

Source: Iowa Code – Title X – Subtitle 2 – Chapter 445 to 448

Kansas – Property taxes are payable annually in two equal installments. An interest fee of 7 percent per year is applied to the delinquent tax bill. The interest fee is determined each year by the state.

Tax lien sales are not conducted in Kansas. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during a three year period the property deed may be awarded to the county.

Source: Kansas Statute Annotated – Chapter 79 – Article 20/23

Kentucky - Property taxes are payable annually in one installment. If the full tax bill is two months early a two percent discount is applied to the tax bill. A penalty of five percent is

applied to the delinquent tax bill after delinquency. The penalty is increased to 21 percent after 2.5 months of delinquency.

Liens are sold individually using a lottery method following six months of delinquency. At tax sale, numbers are drawn to determine the order in which bills are sold and investors rank. The first investor drawn is permitted to purchase the first lien on their list. The second investor drawn is then permitted to purchase the first lien on their list provided the lien has not already been purchased by the first investor drawn. The process is repeated until all liens are sold.

During a one year period of redemption investors earn an interest fee of 12 percent per year. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during the one year redemption period the property deed is awarded to the lienholder.

Source: Kentucky Revised Statute – Title XI – Chapter 134

Louisiana – Property taxes are payable annually in one installment. A 10 percent penalty is added to the delinquent tax bill after the due date. An interest fee of one percent per month or 12 percent per year is applied to the delinquent tax bill.

County governments conduct tax lien sales a few months after the second installment. Liens are auctioned individually using the overbid method. Investors compete for the right to purchase liens by entering bids in whole dollars. The minimum bid allowed is the delinquent tax bill and penalties. The investor willing to pay the highest amount above the delinquent tax bill and penalties wins the right to purchase the lien.

During a three year period of redemption investors earn an interest fee of 12 percent per year. In addition if the lien is redeemed a five percent penalty must be paid by the delinquent taxpayer. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during the three year redemption period the property deed is awarded to the lienholder.

Source: Louisiana Revised Statute – Title 47

Maine – Property taxes are payable annually. Penalties, interest fees, and tax foreclosure policy vary by municipality. The policies of the largest municipality, Portland, Maine, are discussed. An interest fee of 7 percent per year is applied to the delinquent tax bill.

Tax lien sales are not conducted in Maine. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during a 2.5 year period the property deed is awarded to the municipality.

Source: Maine Revised Statute – Title 36 – Chapter 105 – Subchapter 9

Maryland – Property taxes are payable annually in one installment or two equal installments. A one percent per month penalty is added to each delinquent installment after the due date. An interest fee of 0.67 percent per month or 8 percent per year is applied to the delinquent tax bill.

County governments conduct tax lien sales a few months after the second installment. Liens are auctioned in bulk using the overbid method. Investors compete for the right to

purchase multiple liens by entering sealed bids expressed as a multiple of the full cash value of properties. The investor with the highest multiple wins the right to purchase the lien.

During a one year period of redemption investors earn a 0.67 per month interest fee and one percent per month penalty fee. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during the six month redemption period the property deed is awarded to the lienholder.

Source: Maryland Code – Title 14 – Subtitle 8

Massachusetts – Property taxes are payable annually with the number of installments varying by municipality. Penalties, interest fees, and tax foreclosure policy vary by municipality. The policy of the largest municipality, Boston, Massachusetts, is discussed. An interest fee of 14 percent per year is applied to the delinquent tax bill.

Tax lien sales are not conducted in Boston, Massachusetts. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during a three year period the property deed is awarded to the county.

Source: Massachusetts General Law – Part I – Title IX – Chapter 60

Michigan – Property taxes are payable annually. A four percent penalty is added to the delinquent tax bill after the due date. An interest fee of one percent per month or 12 percent per year is applied to the delinquent tax bill. After two consecutive years of delinquency the interest fee increases to 1.5 per month or 18 percent per year.

Michigan discontinued the use of tax lien sales in 2006. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during a three year period the property deed is awarded to the municipality.

Source: Michigan Legislature – Act 206 of 1893

Minnesota - Property taxes are payable annually in two installments. A two percent penalty is added to the delinquent tax bill after the due date which increases to a maximum of 10 percent at the first year of delinquency. An interest fee of 10 percent per year is applied to the delinquent tax bill. The interest fee is set by statute each year.

Tax lien sales are not conducted in Minnesota. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during a three year period the property deed is awarded to the county. The length of redemption varies by property and homeowner characteristics.

Source: Minnesota Statutes – Chapters 279 to 281

Mississippi – Property taxes are payable annually in one installment. An interest fee of one percent per month or 12 percent per year is applied to the delinquent tax bill.

County governments conduct tax lien sales six months after the taxes become delinquent. Liens are auctioned individually using the overbid method. Investors compete for the right to purchase liens by entering bids in whole dollars. The minimum bid allowed is the delinquent tax bill and penalties. The investor willing to pay the highest amount above the minimum bid of delinquent tax bill and penalties wins the right to purchase the lien.

During a two year period of redemption investors earn an interest fee of 18 percent per year. In addition if the lien is redeemed a five percent penalty must be paid by the delinquent taxpayer. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during the two year redemption period the property deed is awarded to the lienholder.

Source: Mississippi Code of 1972 – Title 27 – Chapters 41/43/45/47

Missouri – Property taxes are payable annually in one installment. A 7 percent penalty is added to the delinquent tax bill after the due date. An interest fee of 1.5 percent per month or 18 percent per year is applied to the delinquent tax bill.

County governments conduct tax lien sales 8 months after the taxes become delinquent. Liens are auctioned individually using the overbid method. Investors compete for the right to purchase liens by entering bids in whole dollars. The minimum bid allowed is the delinquent tax bill and penalties. The investor willing to pay the highest amount above the minimum bid of delinquent tax bill and penalties wins the right to purchase the lien.

During a one year period of redemption investors earn an interest fee of 10 percent per year. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during the one year redemption period the property deed is awarded to the lienholder.

Source: Missouri Revised Statute – Title X – Chapter 139 to 141

Montana – Property taxes are payable annually in two equal installments. A two percent penalty is added to the delinquent tax bill after the due date. An interest fee of 0.83 percent per month or 10 percent per year is applied to the delinquent tax bill.

County governments conduct tax lien sales a few months after the second installment becomes delinquent. Liens are auctioned individually using the overbid method. Investors compete for the right to purchase liens by entering bids in whole dollars. The minimum bid allowed is the balance of the unpaid tax bill and penalties. The investor willing to pay the highest amount above the minimum bid of delinquent tax bill and penalties wins the right to purchase the lien.

During a three year period of redemption investors earn an interest fee of 10 percent per year. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during the three year redemption period the property deed is awarded to the lienholder.

Source: Montana Code Annotated – Title 15 – Chapter 16/17

Nebraska – Property taxes are payable annually in two equal installments. An interest fee of 0.039 percent per day or 14 percent per year is applied to the delinquent tax bill.

County governments conduct tax lien sales six months after the second installment becomes delinquent. Liens are auctioned individually using the percent ownership method. Investors compete for the right to purchase liens by entering a percentage between 100 and 0 representing the ownership stake of the property in the case of tax foreclosure. The investor willing to accept the lowest ownership stake in the property wins the right to purchase the lien

During a three year period of redemption investors earn an interest fee of 14 percent per year. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during the three year redemption period the property deed is awarded to the lienholder.

Source: Nebraska Revised Statute – Chapter 45 – Section 104.1; Nebraska Revised Statute – Chapter 77

Nevada – Property taxes are payable annually in four equal installments. A penalty of four percent is added to the tax bill if the first installment is not paid. The penalty is increased to five percent if the second installment is not paid, six percent if the third installment is not paid, and seven percent if the fourth installment is not paid. An interest fee of 0.83 percent per month or 10 percent per year is applied to the delinquent tax bill.

Tax lien sales are not conducted in Nevada but are permitted by statute. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during a three year period the property deed is awarded to the county.

Source: Nevada Revised Statute – Title 32 – Chapter 361

New Hampshire – Property taxes are payable annually with the number of installments varying by municipality. An interest fee of 1.5 percent per month or 18 percent per year is applied to the delinquent tax bill.

Tax lien sales are not conducted in New Hampshire. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during a 2.5 year period the property deed is awarded to the municipality.

Source: New Hampshire Statute – Title V – Chapter 80

New Jersey – Property taxes are payable annually in four equal installments. An interest fee of 8 percent per year is applied to the first \$1,500 of unpaid tax bill with 18 percent on the remaining balance.

Municipalities conduct tax lien sales a few months after the fourth installment becomes delinquent. Liens are auctioned individually using the interest rate method. Investors compete for the right to purchase liens by entering one percentage point bids between 18 and zero percent. The investor willing to accept the lowest interest fee for paying the delinquent tax bill and penalties wins the right to purchase the lien.

During a two year period of redemption investors earn an interest fee agreed to during the auction. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during the two year redemption period the property deed is awarded to the lienholder.

Source: New Jersey Permanent Statute – Title 54

New Mexico – Property taxes are payable annually in two equal installments. A one percent per month penalty, five percent maximum, is added to the delinquent tax bill after the due date.

An interest fee of one percent per month or 12 percent per year is applied to the delinquent tax bill.

Tax lien sales are not conducted in New Mexico. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during a three year period the property deed is awarded to the state.

Source: New Mexico Statute – Chapter 7 - Article 38

New York – Property taxes are payable annually. Penalties, interest fees, and tax foreclosure policy vary by municipality. The policies of the largest municipality, New York City, New York, are discussed. The interest fee is set annually by the city council. An interest fee of 9 percent per year is applied to the delinquent tax bill on property with an assessed value less than \$250,000. An interest fee of 18 percent per year is applied to the delinquent tax bill on vacant property and property with an assessed value greater than \$250,000.

The City of New York does not offer liens for sale to individual investors or to the general public. Instead the City negotiates with large firms to administer the entire delinquency portfolio with one year or more of delinquency. Once the portfolio is transferred, the delinquent taxpayer then owes the taxes, penalties, and accrued interest to the new lienholder, not to the City. The amount the property owner owes automatically increases once the lien is sold, because the lienholder is entitled to receive a 5 percent penalty on the entire lien amount, plus 18 percent interest, compounded daily and payable semi-annually. Foreclosure can begin within one year after the lien sale date if the delinquent tax bill is not paid the lien in full or entered into an installment agreement with the new lienholder.

Source: New York Real Property Tax Law – Article 11

North Carolina – Property taxes are payable annually in one installment. A two percent penalty is added to the delinquent tax bill after the due date. An interest fee of 0.75 percent per month or 9 percent per year is applied to the delinquent tax bill.

North Carolina discontinued the use of tax lien sales in 1983. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during a six month period the property deed is may be awarded to the county.

Source: North Carolina General Statute – Chapter 105 – Article 26

North Dakota – Property taxes are payable annually in two equal installments. If the full tax bill is paid early a five percent discount is applied to the tax bill. A nine percent penalty is added to the delinquent tax bill after second installment is not paid. An interest fee of one percent per month or 12 percent per year is charged against the delinquent tax bill.

Tax lien sales are not conducted in North Dakota. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during a two year period the property deed is may be awarded to the county.

Source: North Dakota Century Code – Title 57

Ohio – Property taxes are payable annually in two equal installments. A penalty of 10 percent is added to the delinquent tax bill 10 days after the due date. An interest fee of three percent

above the Federal Reserve short-term interest rate is applied to the delinquent tax bill. The delinquent real property interest fee was four percent in 2011.

Counties choose whether to conduct tax lien sales and the type of tax lien sales to conduct. Liens with one year of delinquency are auctioned in bulk using either the interest rate or overbid method. In the interest rate auction investors compete for the right to purchase all liens by entering one percentage point bids between 18 and zero percent. The investor willing to accept the lowest interest fee for paying the delinquent tax bill and penalties wins the right to purchase all liens.

In the overbid auction Investors compete for the right to purchase liens by entering bids in whole dollars. The minimum bid allowed is the balance of the delinquent tax bill and penalties. The investor willing to pay the highest amount above the minimum bid of delinquent tax bill and penalties wins the right to purchase all liens. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during the one year redemption period the property is sold at auction.

Source: Ohio Revised Code – Chapter 5721; Ohio House Bill 371/562

Oklahoma – Property taxes are payable annually in one or two installments. An interest fee of 1.5 percent per month or 18 percent per year is applied to the delinquent tax bill.

Oklahoma discontinued the use of tax lien sales in 2008. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during a three year period the property deed is awarded to the county.

Source: Oklahoma Statutes – Title 68

Oregon – Property taxes are payable annually in one, two, or three installments. A three percent discount is applied to the tax bill for early payment using one installment. An interest fee of 1.33 percent per month or 16 percent per year is applied to the delinquent tax bill.

Tax Lien sales are not conducted in Oregon. If the delinquent taxpayer has not paid the delinquent tax bill and interest fees accrued during a three year period the property deed is awarded to the county.

Source: Oregon Revised Statute – Volume 8 – Title 29 – Chapter 311/312

Pennsylvania – Property taxes are payable annually. Penalties, interest fees, and tax foreclosure policy vary by municipality. The policies of the largest municipality, Philadelphia, Pennsylvania, are discussed. An interest fee of 1.5 percent per month or 18 percent per year is charged.

The Sheriff's Office conducts tax lien sales about one year after taxes become delinquent. Liens are auctioned individually using the overbid method. Investors compete for the right to purchase liens by entering bids in whole dollars. The minimum bid allowed is the delinquent tax bill and penalties. The investor willing to pay the highest amount above the minimum bid of the delinquent tax bill and penalties wins the right to purchase the lien.

During a three year period of redemption investors earn an annual interest fee of 18 percent. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fee accrued during the three year redemption period the property deed is awarded to the lienholder.

Source: The Pennsylvania Code – Title 61; The Philadelphia Code – Chapter 19

Rhode Island – Property taxes are payable annually in four equal installment. Penalties, interest fees, and tax foreclosure policy vary by municipality. The policies of the largest municipality, Providence, Rhode Island, are discussed. An interest fee of one percent per month or 12 percent per year is charged against the delinquent tax bill.

County governments conduct tax lien sales about one year after taxes become delinquent. Liens are auctioned individually using the percent ownership method. Investors compete for the right to purchase liens by entering a percentage between 100 and 0 representing the ownership stake of the property in the case of tax foreclosure. The investor willing to accept the lowest ownership stake in the property wins the right to purchase the lien.

During a one year period of redemption investors earn an interest fee of 10 percent if delinquent taxes are paid in the first six months and one percent per month thereafter. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during the one year redemption period the property deed is awarded to the lienholder.

Source: State of Rhode Island General Laws – Title 44

South Carolina – Property taxes are payable annually in one installment. A penalty of three percent is applied to the unpaid tax bill after delinquency. The penalty is increased to 10 percent after 15 days of delinquency and to 15 percent after two months of delinquency. An interest fee of one percent per month or 12 percent per year is applied to the delinquent tax bill.

County governments conduct tax lien sales about one year after taxes become delinquent. Liens are auctioned individually using the overbid method. Investors compete for the right to purchase liens by entering bids in whole dollars. The minimum bid allowed is the delinquent tax bill and penalties. The investor willing to pay the highest amount above the minimum bid of delinquent tax bill and penalties wins the right to purchase the lien.

During a one year period of redemption investors earn an interest fee of three percent if delinquent taxes are paid in the first three months, six percent is paid from three to six months, 9 percent if paid six to 9 months, and 12 percent is paid thereafter. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during the one year redemption period the property deed is awarded to the lienholder.

Source: South Carolina Code of Laws – Title 12 – Chapter 45/49

South Dakota – Property taxes are payable annually in two equal installments. An interest fee of 0.83 percent per month or 10 percent per year is applied to the delinquent tax bill.

County governments conduct tax lien sales a few months after the second installment becomes delinquent. Liens are auctioned individually using the overbid method. Investors compete for the right to purchase liens by entering bids in whole dollars. The minimum bid allowed is the delinquent tax bill and penalties. The investor willing to pay the highest amount above the minimum bid of delinquent tax bill and penalties wins the right to purchase the lien.

During a three year period of redemption investors earn an interest fee of 10 percent per year. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest

fees accrued during the three year redemption period the property deed is awarded to the lienholder.

Source: South Dakota Codified Laws – Title 10 – Chapter 21 to 26

Tennessee – Property taxes are payable annually in one installment. A penalty of 0.5 percent fee per month or six percent per year is applied to the unpaid tax bill. An interest fee of one percent per month or 12 percent per year is applied to the delinquent tax bill.

County governments conduct tax lien sales a five months after the tax bill becomes delinquent. Liens are auctioned individually using the overbid method. Investors compete for the right to purchase liens by entering bids in whole dollars. The minimum bid allowed is the delinquent tax bill and penalties. The investor willing to pay the highest amount above the minimum bid of the delinquent tax bill and penalties wins the right to purchase the lien.

During a one year period of redemption investors earn an interest fee of 10 percent per year. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during the one year redemption period the property deed is awarded to the lienholder.

Source: Tennessee Code – Title 67 – Chapter 5

Texas - Property taxes are payable annually in one installment. A penalty of six percent is added to the tax bill after delinquency. The penalty increases by one percent each month for a maximum of 12 percent penalty. An interest fee of one percent per month or 12 percent per year is applied to the unpaid tax bill.

Texas counties do not offer liens for sale to individual investors or to the general public. Instead the county negotiates with local attorneys large firms to administer the entire delinquency portfolio of liens with six months or more of delinquency. Once the entire portfolio is transferred, the property owner then owes the delinquent tax bill, charges, and accrued interest fees to the new attorneys, not to the county. The amount the property owner owes automatically increases once the lien is sold, because the lienholder is entitled to receive a 15 to 20 percent penalty of the accumulate delinquency. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during the two year redemption period the property deed is awarded to the lienholder.

Source: Texas Tax Code – Title 1 – Subtitle E

Utah – Property taxes are payable annually in one installment. A penalty of 2.5 percent is added to the delinquent tax bill after two months of delinquency. An interest fee of six percent above the target federal funds rate as of January 1 is applied to the unpaid tax bill. The interest fee must fall within the minimum of 7 percent and a maximum of 10 percent. The delinquent real property interest fee was 7 percent in 2011.

Tax Lien sales are not conducted in Utah. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fee accrued during a five year period the property deed is awarded to the county.

Source: Utah Code – Title 59 – Chapter 2

Vermont – Property taxes are payable annually with the number of installments varying by municipality. An 8 percent penalty is added to the unpaid tax bill 30 days after the due date. An interest fee of one percent per month or 12 percent per year is applied to the delinquent tax bill.

Municipalities conduct tax lien sales a few months after the tax bill becomes delinquent. Liens are auctioned individually using the overbid method. Investors compete for the right to purchase liens by entering bids in whole dollars. The minimum bid allowed is the delinquent tax bill and penalties. The investor willing to pay the highest amount above the minimum bid of delinquent tax bill and penalties wins the right to purchase the lien.

During a one year period of redemption investors earn an interest fee of 12 percent per year. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during the one year redemption period the property deed is awarded to the lienholder.

Source: Vermont Statutes – Title 32 – Chapter 133

Virginia – Property taxes are payable annually with the number of installments varying by municipality. A 10 percent penalty is added to the delinquent tax bill after the due date. An interest fee of 0.83 percent per month or 10 percent per year is applied to the delinquent tax bill.

Tax Lien sales are not conducted in Virginia. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during a two year period the property deed is awarded to the county.

Source: Code of Virginia – Title 58.1 – Chapter 32

Washington – Property taxes are payable annually in two equal installments. A penalty of three percent is added to the tax bill if the first installment is not paid. The penalty is increased to 11 percent if the second installment is not paid. An interest fee of one percent per month or 12 percent per year is applied to the delinquent tax bill.

Tax lien sales are not conducted in Washington. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during a three year period the property deed is awarded to the county.

Source: Revised Code of Washington – Title 84

West Virginia – Property taxes are payable annually in two equal installments. An interest fee of 0.75 percent per month or 9 percent per year is applied to the delinquent tax bill.

Counties conduct tax lien sales a six months after the tax bill becomes delinquent. Liens are auctioned individually using the overbid method. Investors compete for the right to purchase liens by entering bids in whole dollars. The minimum bid allowed is the delinquent tax bill and penalties. The investor willing to pay the highest amount above the minimum bid of delinquent tax bill and penalties wins the right to purchase the lien.

During a one year period of redemption investors earn an interest fee of 12 percent per year. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during the 1.5 year redemption period the property deed is awarded to the lienholder.

Source: West Virginia Code – Chapter 11A

Wisconsin – Property taxes are payable annually in two or three equal installments. An interest fee of 1.5 percent per month or 18 percent per year is applied to the delinquent tax bill.

Tax lien sales are not conducted in Wisconsin. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during a one year period in Milwaukee County and a two year period in all other counties the property deed is awarded to the county.

Source: Wisconsin Statute – Chapter 74

Wyoming – Property taxes are payable annually in one installment or two equal installments. Counties conduct tax lien sales a shortly after the second installment is not paid. A penalty of three percent is added to the delinquent tax bill for liens included in the sale.

Liens are sold individually using a lottery method. The treasurer announces each delinquent property by owner name and amount due. After each announcement, a number is drawn. The participant's number which matches the number drawn has the option to purchase the lien or pass. In the case of a pass, another number is drawn until the lien is purchased. This process is repeated until all liens are sold.

During a four year period of redemption investors earn an interest fee of 15 percent per year. If the delinquent taxpayer has not paid the delinquent tax bill, penalties, and interest fees accrued during the four year redemption period the property deed is awarded to the lienholder.

Source: Wisconsin Statute – Title 39

3. THE RESPONSIVENES OF PROPERTY TAXPAYERS TO DIFFERENCES IN PENALTIES AND INTEREST FEES: EVIDENCE FROM OREGON AND WASHINGTON STATE

3.1. Introduction

Property tax delinquency, the untimely payment of property taxes, is administratively and financially costly for local governments. Local governments cut services or raise taxes when property tax delinquency is high. Delinquent property tax bills require notification and monitoring.

Penalties and interest fees are applied to tax bills in the United States when property taxes are paid late. Penalties and interest fees serve two main functions. The first is to discourage late payment, property tax delinquency. The second is to reduce the cost of unavoidable property tax delinquency, delinquency of taxpayers unwilling or unable to pay. Although penalties and interest fees are found in all 50 states and the District of Colombia, little is known about the responsiveness of property taxpayers to differences in penalties and interest fees. The purpose of this paper is to estimate the responsiveness of property taxpayers to differences in penalties and interest fees.

Estimating the responsiveness of taxpayers to differences in penalties and interest fees is important because property tax delinquency has increased significantly during the Great Recession. Penalties and interest fees policies set many decades in the past do not adequately meet the needs of local governments. For example, Ohio sets interest fees three percentage points above the federal funds rate. The three percent interest fee does not capture the “true” cost of borrowing for the local government or taxpayers. This paper provides policy makers with an estimate of the responsiveness of taxpayers to differences in penalties and interest fees; an essential step in weighing the benefits and costs of alternative policies.

In the United States, penalties and interest fees are set by state governments and applied to delinquent property tax bills by local governments within each state. Variation in penalties and interest fees are observed by state. Ideally, estimating taxpayer responsiveness is accomplished by comparing aggregate measures of property tax delinquency in each state controlling for differences in penalties and interest fees.

There are two possible reasons why a comparison of property tax delinquency by state would not produce an unbiased estimate. The first is the result of non-random selection of penalties and interest fees. It is possible that state legislatures select penalties and interest fees based on unobserved characteristics correlated with property tax delinquency. If states with high levels of property tax delinquency choose high penalties and interest fees, then across-state variation in penalties and interest fees is positively associated with property tax delinquency. Inattentive estimation would imply that higher penalties and interest fees cause higher rates of delinquency.

The second potential bias is the result of differences in the way states measure property tax delinquency. California, for example, measures property tax delinquency of less than one year for real property. Ohio measures property tax delinquency for real and personal property. Comparing different measures of property tax delinquency presents a potential bias of unknown direction and magnitude.

Oregon and Washington State provide the best opportunity to generate an unbiased estimate of the responsiveness of taxpayers to differences in penalties and interest fees. Oregon and Washington State offer comparable measures of property tax delinquency for all counties. Counties do not choose penalties and interest fees. Instead, state legislatures in

Oregon set penalties and interest fees in 1989 which are uniformly applied in all counties. Legislatures in Washington State set penalties and interest fees in 1981 which are uniformly applied in all counties. The comparable county measures of property tax delinquency and uniform application of penalties and interest fees in all counties mitigate potential biases.

The responsiveness of property taxpayers to differences in penalties and interest fees is estimated using county property tax delinquency data in Oregon and Washington State. I estimate property tax delinquency rates in Oregon counties to be 17 percent higher than similar counties in Washington State from 2000 to 2010. The observed variation in county property tax delinquency rates between Oregon and Washington State is explained by time invariant differences in state mandated penalties and interest fees. The results imply that had the largest county in Oregon, Multnomah County, utilized Washington State penalties and interest fees in 2010, the county would have reduced the property tax delinquency by approximately \$11 million.

To understand the magnitude of taxpayer responsiveness to variation in property tax delinquency costs it is worth noting that property tax delinquency is typical of duration less than one year. The largest county in Washington State, King County, estimates of the 2009 property tax delinquency nearly 70 percent was paid within one year. The largest county in Oregon, Multnomah County, estimates of the 2009 property tax delinquency nearly 60 percent was paid within one year. Therefore, focusing on first year property tax delinquency costs the combined penalties and interest fees in Washington State are 44 percent higher than the combined penalties and interest fees in Oregon.

The results suggest that a 44 percent increase in combined penalties and interest fees lead to a decrease in the amount of property tax delinquency by 17 percent. The estimated price elasticity of demand for property tax delinquency is 0.36. It appears the demand for property tax delinquency is rather inelastic. The findings suggest taxpayers choosing property tax delinquency are largely individuals with high personal borrowing rates.

3.1.1. Property Tax Delinquency Costs - Oregon

In Oregon, the annual property tax bill is payable each year on November 15. Taxpayers may elect to pay the tax bill in three equal installments with the first installment due November 15, the second installment due on February 15, and the final installment due on May 15. A discount of three percent is applied if the tax bill is paid in full by November 15; a two percent discount is applied if two-thirds of the tax bill is paid by November 15.

If the taxpayer is unable to pay the tax bill by the due date, interest accrues at a rate of 1.33 percent per month (16 percent per year). Interest fees are applied to the total annual tax bill but not to interest accrued from prior delinquency. For example if a taxpayer is unable to pay any portion of a \$1,000 total annual property tax bill by November 15 an interest fee of 1.33 percent is applied on November 16 resulting in new balance due of \$1,013.33. If the tax bill remains delinquent an additional interest fee of 1.33 percent is applied to the \$1,000 tax bill on December 16 and the total amount due becomes \$1,026.67. Interest fees accrue at a monthly rate of 1.33 percent until tax foreclosure.

If taxes remain unpaid for three years counties initiate tax foreclosure proceedings. Tax foreclosure is the legal process by which a county acquires title to a property for the non-payment of taxes. Once title is acquired by the county, the property is sold.

3.1.2. Property Tax Delinquency Costs - Washington State

In Washington State property taxes are collected in two equal installments. The first installment is due April 30 and the second installment is due October 30. No discount is given for full payment of the tax bill on April 30.

If the taxpayer is unable to make timely payment, interest accrues at a rate of one percent per month (12 percent per year). Interest fees are applied to the total annual tax bill but not to interest accrued from prior delinquency. For example if a taxpayer is unable to pay one half of a \$1,000 property tax bill by April 30 an interest fee of one percent is applied to the total annual tax on May 1 resulting in new balance due of \$1,010. If the tax bill remains delinquent an additional interest fee of one percent is applied to the \$1,000 tax bill on June 1. Interest fees accrue at a monthly rate of one percent until tax foreclosure.

In addition to interest fees Washington State applies penalties for property tax delinquency. A three percent penalty is applied to the total annual tax bill if unpaid one month after the first installment is due on June 1. An additional 8 percent penalty is applied to the total annual tax bill if unpaid 7 months after the first installment is due on December 1. The penalties are only applied during the first year of delinquency and not on interest accrued.

If taxes remain unpaid for three years the counties initiate tax foreclosure proceedings. Tax foreclosure is the legal process by which a county acquires title to a property for the non-payment of taxes. Once title is acquired by the county, the property is sold.

3.1.3. Comparison of Property Tax Delinquency Costs

Delinquent property tax collection policies commonly used in the United States include penalties, interest fees, tax lien sales, and tax foreclosure. These policies effect property tax

delinquency costs. Oregon and Washington State policies are summarized in table 3.1.3.1. The two states do not allow tax lien sales and follow similar tax foreclosure policy, three years of delinquency prior to the start of tax foreclosure proceedings. Oregon and Washington State differ in penalties and interest fees.

Penalties and interest fees are direct substitutes for lenders. Empirical evidence (Massoud, et al. 2011) suggests that credit card companies use penalties and interest fees interchangeably. The study finds an increase in credit card interest rates by one standard deviation reduces late fees by between 7 percent and 20 percent.

Theoretically, penalties and interest fees are direct substitutes for borrowers. Penalties increase the cost of borrowing immediately. Interest fees are penalties applied at a future date. A borrower's discount rate determines the relative price of penalties and interest fees. Table 3.1.3.2 provides combined penalties and interest at each month of delinquency. Penalties and interest fees are higher for Washington State taxpayers from the second month of delinquency to the 32nd month of delinquency.

The relationship between discounts for early payment and property tax delinquency is unknown. Oregon offers a three percent discount for full payment of the annual tax bill at the first installment, whereas Washington State offers no discount for full payment of the annual tax bill at the first installment. It is possible that discounts for early payment are equivalent to interest fees for late payment. However, it is more likely that just taxpayers view discounts for early payment and combined penalties and interest fees for property tax delinquency as separate goods. In which case, taxpayers switch from timely payment to early payment when discounts for early payment are offered and not from delinquency to early payment.

3.2. Literature Review

Previous literature does not provide estimates of the responsive of property taxpayers to differences in penalties and interest fees. Larry DeBoer and James Conrad (DeBoer and Conrad, 1989a) examine the relationship between interest fees, the yield on three month U.S. securities, and property tax delinquency rates. The study finds that in 12 urban Indiana counties from 1969 to 1986 a five percent increase in the interest-penalty spread, the difference between the yield on three month U.S. securities and interest fees, increases the property tax delinquency rate by just over one percentage point. The results suggest taxpayers are responsive to interest fees.

Property tax delinquency fluctuates with economic conditions. Economic indicators found to be correlated with property tax delinquency rates in prior literature include unemployment, income, and property value (DeBoer, 1990). Using selected Indiana counties from 1970 to 1984 it is estimated that that a five percentage point increase in the unemployment rate increases the property tax delinquency rate by 0.5 percentage points (DeBoer and Conrad, 1988a). A related study estimated that a one percent increase in farm income decreases the property tax delinquency rate by 0.5 percentage points. The same study found a five percentage point increase in the value of farm land decreased property tax delinquency by 0.5 percentage points (DeBoer and Conrad, 1988b).

Empirical results estimating the effect of the property tax rates on property tax delinquency rates are less conclusive. Susan Olson and M. Leanne Lachman find property tax rates to be uncorrelated with property tax delinquency rates in Cleveland, Ohio (Olson and Lachman, 1976). The authors argue that properties are abandoned by delinquent taxpayers

prior to tax rates increases making higher or lower tax rates irrelevant. However, in a study of New York City it is estimated that a one percent increase in the property tax rate leads to a two to three percent increase in the share of property tax delinquent buildings (White, 1980).

While prior literature examines determinants of property tax delinquency, no study to date provides an empirical assessment of the responsiveness of property taxpayers to differences in penalties and interest fees. In this paper I control for determinants of property tax delinquency identified in previous literature when estimating the responsive of taxpayers to differences in penalties and interest fees.

3.3. Property Tax Delinquency Decision

Prior literature (Conrad and DeBoer, 1988b; Lake, 1979) finds the most common reasons cited by taxpayers for property tax delinquency is lack of money or declining property value. In this section, I define property tax delinquency as either short-term (lack of money) or long-term (declining property value). I examine the decision of taxpayers to choose short-term delinquency and long-term delinquency. I then explore the relationship between short-term delinquency, long-term delinquency, penalties and interest fees.

Short-term delinquents view the net benefits of property ownership to be positive, but strategically choose delinquency or are unable to pay the tax bill on time due to liquidity constraints. More explicitly, a property taxpayer chooses short-term delinquency when the personal rate of borrowing is greater than property tax delinquency costs. The personal rate, r_i , is the lowest opportunity cost of borrowing unique to individual property taxpayers. Short-term delinquent taxpayers unable to pay the tax bill, due to liquidity constraints, possess an infinite personal borrowing rate. Property tax delinquency costs are common to all taxpayers and

include penalties, p , and interest fees, $(m\pi)$. Penalties are a one-time charge applied as a percentage of the original tax bill. Interest fees increases with time; applied as a simple interest rate. The variable, π , represents the monthly interest rate and the variable, m , represents the number of months a taxpayer chooses to be delinquent.

Short-Term Delinquency Decision:
$$r_i > m\pi + p \quad (1)$$

Equation (1) implies that short-term delinquency decreases with decreases to the personal rate of borrowing. Short-term delinquency decreases with increases to property tax delinquency costs; higher penalties and interest fees.

Take for example a property taxpayer initially able to borrow funds at an annual rate of 17 percent to pay a property tax bill on time. Penalties and interest fees for one year of delinquency are 18 percent. The property taxpayer would be better off borrowing at a 17 percent to pay the property tax bill on time. If the rate of borrowing were to increase to 19 percent, keeping the property tax delinquency cost constant, the taxpayer would be better off strategically choosing short-term delinquency.

Long-term property tax delinquency is a symptom of property abandonment. A property taxpayer chooses to financially abandon property, and therefore long-term property tax delinquency, when benefits of property ownership and the expected equity position at sale are less than the costs of property ownership (Bhutta et al., 2010). The decision by an owner to financially abandon property is a decision to stop all remaining mortgage payments as well as a decision to cease payment on maintenance, insurance, and property taxes. Benefits of property ownership include the stream of rental payments a homeowner foregoes or the stream of rental payments received on investment property. Transaction and stigma costs associated with

financial abandonment may also be considered benefits to property ownership or more explicitly benefits of maintaining ownership. The cost of property ownership includes mortgage payments, maintenance, and property tax payments. The property taxpayer's abandonment decision is presented in equation (2) below.

A taxpayer will choose abandonment, and therefore long-term delinquency, when the net benefits from property ownership and the expected equity position at sale are less than zero. Net benefits are benefits of property ownership less costs of property ownership.

Long-Term Delinquency Decision:
$$NetBenefits + Equity < 0 \quad (2)$$

Equation (2) implies that long-term property tax delinquency will increase due to abandonment with decreases to the net benefit of property ownership or decreases to the expected equity at sale. Long-term delinquency is unaffected by property tax delinquency costs, including changes to penalties and interest fees.

The taxpayer's delinquency decision is important in understanding the responsiveness of taxpayers to differences in penalties and interest fees. Equation (1) suggests that the short-term delinquency decision is effected by penalties and interest fees. Equation (2) suggests the long-term delinquency decision is unaffected by penalties and interest fees. The implication is that not all taxpayers are responsive to difference in penalties and interest fees.

3.4. Data Sources and Variable Construction

To estimate the responsive of taxpayers to differences in penalties and interest fees empirically, data is collected from the Oregon Department of Revenue, Washington State Department of Revenue, Federal Housing Finance Agency, Bureau of Labor Statistics, and U.S. Census Bureau. Data is collected from 2000 to 2010 for Oregon and Washington State.

The Oregon Department of Revenue reports property tax statistics annually. In Oregon, taxes are applied to real property (land, buildings, and improvements) and personal property (farm equipment & machinery, industrial equipment & machinery, material & supplies not for resale). The property tax delinquency rate, the dependent variable, for each of the 36 counties in Oregon is computed by dividing property taxes uncollected by the current year tax levy. Property taxes uncollected include uncollected taxes from prior and current year levies, but do not include interest accrued during delinquency. The current year tax levy excludes credits applied to the tax bill for various tax relief programs and the early payment program available to Oregon property taxpayers.

The Washington State Department of Revenue reports property tax statistics annually. In Washington State taxes are applied to real property (land, buildings, and improvements) and personal business property (equipment, furniture, and machinery). Property taxes uncollected divided by the current year tax levy provides the delinquency rate for each of the 39 counties; the dependent variable. Property taxes uncollected include uncollected taxes from prior and current year levies, but do not include interest or penalties accrued during delinquency. The current year tax levy excludes credits applied to the tax bill for various tax relief programs.

Net benefits of property ownership influence the taxpayer's long-term property tax delinquency decision. Net benefits are a function of rental prices and the costs of property ownership which include property taxes. County level measures of current year property taxes are available through the Washington State Department of Revenue and Oregon Department of Revenue.

The expected equity position when the property is sold influences the individual taxpayer's long-term property tax delinquency decision. Expected equity positions are not easily measured. However, current and prior property values may provide a reasonable proxy for expected equity positions at the county level. The Finance Housing Finance Agency (FHFA) publishes annually a home price index by metropolitan statistical area. The FHFA home price index is estimated using sales price and appraisal data. The FHFA home price index and FHFA one year change in the home price index are used as proxies for the expected equity position. Metropolitan statistical areas are mapped to counties. Counties not included in a metropolitan statistical area are assigned the state non-metropolitan area home price index.

The personal borrowing rate affects the individual taxpayer's short-term property tax delinquency decision. The yield on three month U.S. securities (DeBoer and Conrad, 1989a) is not a valid proxy for the personal borrowing rate during the period of observation, 2000 to 2010. Instead unemployment rate, poverty rate, and median household income statistics provide a proxy for the county level average personal borrowing rate.

The Bureau of Labor Statistics publishes annual labor force estimates. The estimates include unemployment rates for all counties within the United States. Unemployed taxpayers borrow at higher rates than employed taxpayers. Similarly personal rates of borrowing are negatively correlated with household income and poverty rates. Ceteris paribus higher unemployment, higher poverty rates, and lower median household income will lead to more short-term delinquency. Data on poverty and income estimates are drawn from the U.S. Census Bureau. The estimates include the percent of the total population in poverty and median household income.

Table 3.4 provides state level economic and housing descriptive statistics in Oregon and Washington State from 2000 to 2010 including the unemployment rate, median household income, and Federal Housing Finance Agency home price index (HPI). The table shows state level economic and housing descriptive statistics in Oregon and Washington State to be highly correlated.

3.5. Empirical Methods and Results

The aim of the research design is to estimate the responsiveness of taxpayers to differences in penalties and interest fees. Oregon and Washington State provide the best opportunity to generate an unbiased estimate using county level aggregate property tax delinquency data.

The empirical model estimating the effect is provided below;

$$DelinquencyRate_{ct} = \beta_1 W_c + \beta_2 X'_{ct} + \lambda_t + \varepsilon \quad (3)$$

The outcome variable, $DelinquencyRate_{ct}$, is the property tax delinquency rate in county, c , at year, t . The state dummy variable, W_c , is equal to one if the county is located in Washington State and zero if the county is located in Oregon. The state dummy estimates the effect of time invariant differences between states; penalties and interest fees.

X'_t is a vector of economic characteristics for each county year which affect long-term and short-term property tax delinquency. Economic characteristics are necessary controls in estimating the effect of property tax delinquency costs on county property tax delinquency rates. The set of variables controlling for short-term property tax delinquency include the

average annual unemployment rate, average annual poverty rate, and median annual household income. The set of variables controlling for long-term property tax delinquency include the current year property taxes, FHFA home price index, and the one year change in the FHFA home price index. λ_t is the year fixed effect which addresses trends in property tax delinquency common to both states.

Estimation results are provided in table 3.5. The results are presented using three measures of property tax delinquency at the county level; property tax delinquency rates, the natural log of property tax delinquency, and per capita property tax delinquency. Per capita property tax delinquency is computed by dividing property tax delinquency by the population of each county.

The first column estimates that counties located in Washington State experienced a property tax delinquency rate approximately 1.3 percentage points or 17 percent lower than the mean property tax delinquency rate of 7.7 percent for counties in Oregon. The second column, regressing the natural log of property tax delinquency on the full set of control variables, estimates the property tax delinquency to be approximately 16 percent lower in Washington State counties when compared to counties in Oregon. The third column, regressing per capita property tax delinquency on the full set of controls, estimates per capita property tax delinquency to be approximately \$28 lower in Washington counties when compared to Oregon counties. The mean per capita property tax delinquency in Oregon during the period of observation is \$94.

3.6. Conclusion

This study is the first to estimate the responsiveness of taxpayers to differences in penalties and interest fees. I exploit Oregon and Washington State differences in penalties and interest fees and comparable measures of county property tax delinquency. I find property tax delinquency rates of counties in Washington State to be lower than similar counties in Oregon from 2000 to 2010. The findings are robust when using alternative measures of delinquency.

The observed variation in county property tax delinquency rates is explained by time invariant differences in property tax delinquency costs. Time invariant differences include penalties and interest fees. Although it is not possible to examine the component time invariant differences, penalty fees and interest fees move delinquency in the same direction. Here I estimate the joint effect of the two policy components. Oregon counties offer property taxpayers lower property tax delinquency cost, by way no penalties and lower interest fees, and therefore experience more short-term delinquency than similar counties in Washington State.

To understand the magnitude of taxpayer responsiveness to variation in property tax delinquency costs it is worth noting that property tax delinquency is typically of duration less than one year. The results suggest that a 44 percent increase in property tax delinquency costs decreases the amount of property tax delinquency by 17 percent. The estimated price elasticity of demand for property tax delinquency is 0.36. It appears the demand for property tax delinquency is rather inelastic. The findings suggest taxpayers choosing property tax delinquency are largely individuals with high personal borrowing rates.

3.7. Cited Literature

- Alexander, F. S. "Tax Liens, Tax Sales, and Due Process." *Indiana Law Journal* 75, 2000. 747-807.
- Accordino, J. and G. T. Johnson. "Addressing the Vacant and Abandoned Property Problem." *Journal of Urban Affairs* 22 (3), 2000. 301-315.
- Bright, E.M. Taking without compensation in low income areas: Turning tragedy in opportunity. Arlington, Texas: The Center for Economic Research and Service. 1995.
- Bhutta N., J. Dokko, and H. Shan. "The Depth of Negative Equity and Mortgage Default Decisions." Financial and Economic Discussion Series. Divisions of Research & Statistics and Monetary Affairs. Federal Reserve Board, Washington, D.C. 2010-35.
- Carlson, T. L. The Illinois Military Tract: A Study of Land Occupation, Utilization and Tenure. *Illinois Studies in the Social Sciences* 32 (2), 1951. 1-218.
- Conrad, J. and L. DeBoer. "Do High Interest Rates Encourage Property Tax Delinquency?" *National Tax Journal* 41 (4), 1988a. 555-560
- _____. "Rural Property Tax Delinquency and Recession in Agriculture." *American Journal of Agricultural Economics* 70 (3), 1988b. 553-559.
- Conrad, J, L. DeBoer and K. T. McNamara. "Property Tax Auction Sales." *Land Economics* 68 (1), 1992. 72-82.
- DeBoer, L. "Property Tax Delinquency and Tax Sales: A Review of the Literature." *Public Budgeting & Financial Management* 2 (2), 1990. 311-349.
- Foote, C. L., K. Gerardi, and P. S. Willen. "Negative Equity and Foreclosure: Theory and Evidence." *Journal of Urban Economics* 64, 2008. 234-245.
- Lake, R. W. *Real Estate Tax Delinquency: Private Disinvestment & Public Response*. The Center for Urban Policy Research. Rutgers – The State University of New Jersey. 1979.
- Massoud, N., A. Saunders, and B. Scholnick. "The Cost of Being Late? The Case of Credit Card Penalty Fees." *Journal of Financial Stability* 7, 2011. 49-59.
- Mier, C. and A. Kibler. "Delinquent Property Tax Revenue Collection." *Municipal Finance Journal* 32 (2), Summer 2011. 53-61.
- O'Flaherty, B. "The Option Value of Tax Delinquency: Theory." *Journal of Urban Economics* 28, 1990. 287-317.

- Olson, S. and M. L. Lachman. *Tax Delinquency in the Inner City: the problem and its solutions*. Lexington Books. 1976.
- Pointdexter, G. C. *Selling Municipal Property Tax Receivables: Economics, Privatization, and Public Policy in an Era of Urban Distress*. Real Estate Center, Wharton School of the University of Pennsylvania. 1997.
- Swierenga, R. P. "Acres for Cents: Delinquent Tax Auctions in Frontier Iowa." *Agricultural History* 48 (2), 1974. 247-266.
- White, M. J. 1986. "Property Taxes and Urban Housing Abandonment." *Journal of Urban Economics* 20, 1986. 312-330.
- Woodworth, L. D. *Collection of Property Taxes with Special Reference to Real Estate*. 1933.
- Youngman, Joan M. *Alternative Perspectives on Property Taxation*. Lincoln Institute of Land Policy.

3.7.1. Appendix

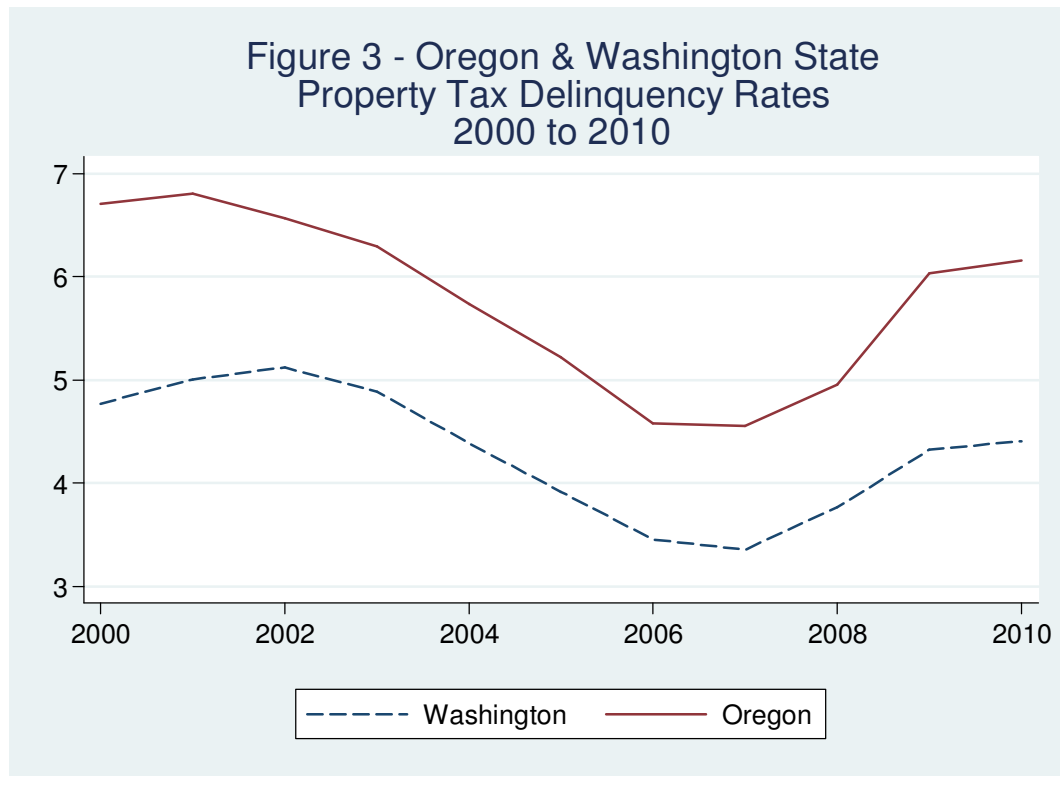


Table 3.1.3.1
Property Tax Delinquency Costs

	<u>Oregon</u>	<u>Washington State</u>
Penalties	None	11.0%
Annual Interest Fee	16.0%	12.0%
Tax Lien Sales	No	No
Tax Foreclosure	3 Years	3 Years

Table 3.1.3.2 - Property Tax Delinquency
Combined Penalties & Interest Fees

<u>Month</u>	<u>Washington State</u>	<u>Oregon</u>	<u>Month</u>	<u>Washington State</u>	<u>Oregon</u>	<u>Month</u>	<u>Washington State</u>	<u>Oregon</u>
1	1%	1.33%	13	24%	17.33%	25	36%	33.33%
2	5%	2.67%	14	25%	18.67%	26	37%	34.67%
3	6%	4%	15	26%	20%	27	38%	36%
4	7%	5.33%	16	27%	21.33%	28	39%	37.33%
5	8%	6.67%	17	28%	22.67%	29	40%	38.67%
6	9%	8%	18	29%	24%	30	41%	40%
7	10%	9.33%	19	30%	25.33%	31	42%	41.33%
8	19%	10.67%	20	31%	26.67%	32	43%	42.67%
9	20%	12%	21	32%	28%	33	44%	44%
10	21%	13.33%	22	33%	29.33%	34	45%	45.33%
11	22%	14.67%	23	34%	30.67%	35	46%	46.67%
1 Year	23%	16%	2 Years	35%	32%	3 Years	47%	48%

Table 3.4
County Descriptive Statistics
Oregon & Washington State - 2000 to 2010

		<u>Oregon</u>		<u>Washington State</u>
Property Tax Delinquency Rate (0 to 100)	Mean	7.7	Mean	5.7
	Standard Deviation	3.1	Standard Deviation	2.6
Unemployment Rate (0 to 100)	Mean	7.9	Mean	7.3
	Standard Deviation	3.1	Standard Deviation	2.2
Median Household Income (Thousand 2010 \$)	Mean	\$44.6	Mean	\$47.7
	Standard Deviation	\$7.4	Standard Deviation	\$7.9
Poverty Rate (0 to 100)	Mean	14.2	Mean	13.9
	Standard Deviation	3.2	Standard Deviation	3.7
HPI FHFA - Home Price Index	Mean	181.7	Mean	166.0
	Standard Deviation	38.3	Standard Deviation	35.4
Property Tax Levy (Millions 2010 \$)	Mean	\$125.3	Mean	\$201.8
	Standard Deviation	\$222.7	Standard Deviation	\$511.8

Sources: Oregon Department of Revenue, Washington State Department of Revenue, Federal Housing Finance Agency, Bureau of Labor Statistics, and U.S. Census Bureau

Table 3.5 - Empirical Results - OLS
Oregon & Washington State

	Property Tax Delinquency Rates	ln(Property Tax Delinquency)	Per Capita Property Tax Delinquency
	(1)	(2)	(3)
Washington State (0 or 1)	-1.3323 *** (0.4814)	-0.1579 ** (0.0758)	-28.3045 ** (13.8311)
Unemployment Rate (0 to 100)	0.7605 *** (0.1203)	0.1219 *** (0.0208)	5.3079 ** (2.5620)
Median Household Income (Thousands \$ 2010)	0.0135 (0.0518)	0.0009 (0.0071)	0.8475 (2.0046)
Poverty Rate (0 to 100)	0.1473 (0.0929)	0.0274 * (0.0145)	0.2919 (2.4331)
HPI FHFA	0.0098 (0.0085)	0.0017 (0.0015)	0.1857 (0.1467)
HPI FHFA - 1 Yr. Change	0.0745 ** (0.0359)	0.0033 *** (0.0044)	0.6571 (1.1075)
ln(Current Year Property Taxes)	-0.3625 * (0.2045)	0.9685 *** (0.0294)	-8.9210 (8.2385)
Year Fixed Effect	Yes	Yes	Yes
N	823	823	823
R-Squared	0.4909	0.9548	0.1599

Notes: Robust standard errors reported. Clustered at County.

-Significant at least 10 percent Level *, 5 percent level **, and 1percent level ***

4. THE RESPONSIVENESS OF PROPERTY TAXPAYERS TO TAX LIEN SALES: EVIDENCE FROM OHIO

4.1. Introduction

In 2011 tax lien sales were conducted in a majority of states and the District of Colombia. A tax lien sale is the sale of delinquent property taxes by a local government to private investors. When a property taxpayer becomes delinquent, a lien is placed against the property. The lien represents a collateralized receivable but not direct ownership of the property. In a tax lien sale, investors pay the delinquent property tax bill to the government. In return, investors receive the lien and the right to repayment of the delinquent taxes plus interest fees.

Although tax lien sale have been used in the United States since 1819 (Carlson, 1951; Swierenga, 1974) and tax lien sales are used in a majority of states, little is known about the responsiveness of taxpayers to tax lien sales. The purpose of this paper is to estimate the responsiveness of taxpayers to tax lien sales.

Estimating the responsiveness of taxpayers to tax lien sales is important because property tax delinquency has increased significantly during the Great Recession. Tax lien sales provide a viable policy alternative to states not conducting tax lien sales in search of immediate property tax revenue. This paper provides policy makers with an estimate of the responsiveness of taxpayers to tax lien sales; an essential step in weighing the benefits and costs of tax lien sales.

In the United States, tax lien sales policy is typically set by state governments and uniformly applied by all local governments within each state. Ideally, estimating taxpayer

responsiveness is accomplished by comparing property tax delinquency in each tax lien sale states to property tax delinquency in non-tax lien sale states.

There are two possible reasons why a comparison of property tax delinquency by state would not produce an unbiased estimate. The first is the result of non-random selection of tax lien sales. It is possible that state legislatures choose tax lien sales based on unobserved characteristics correlated with property tax delinquency. The second potential bias is the result of differences in the way states measure property tax delinquency. California, for example, measures property tax delinquency of less than one year for real property. Oregon measures property tax delinquency for real and personal property.

A recent policy innovation in Ohio provides the best opportunity to generate an unbiased estimate of the responsiveness of taxpayers to tax lien sales. The policy is innovative for introducing the local option, allowing county treasurers the choice of tax lien sales. From 1997 to 2010, nine of Ohio 88 counties conducted at least one tax lien sale. Exploiting the plausibly random timing of adoption and consistent measurement of property tax delinquency by Ohio municipalities potential biases are mitigated.

The responsiveness of property taxpayers to tax lien sales is estimated by comparing annual measures of property tax delinquency across Ohio municipalities. I estimate property tax delinquency to be approximately two percent lower in tax lien sale year when compared to non-tax lien sale years. A two percent reduction evaluated at the mean suggests that municipalities experience \$54,000 reduction in property tax delinquency with the adoption of tax lien sales due to taxpayers paying early to avoid the tax lien sale.

4.1.1. Ohio - Tax Lien Sales

In 1998, Ohio House Bill 371 (HB371) allowed for the first time counties with populations of at least 200,000 to choose tax lien sales. The bill was innovative for introducing the local option, allowing County Treasurers the choice of tax lien sales. In late 2008 House Bill 562 (HB 562) extended the option of conducting tax lien sales to all 88 counties in Ohio. In 2010 Lawrence County became the first county in Ohio with a population of less than 200,000 residents to conduct a tax lien sale.

Ohio tax lien sales are conducted via auction using either an interest rate auction or overbid auction. Tax liens are sold, regardless of auction type, in bundles. A bundle is comprised of all liens eligible for sale. Property tax liens with one year of continuous delinquency are eligible for sale. Property tax liens of elderly, low income, disabled, active duty military, and veterans are ineligible for sale.

In an interest rate auction, investors compete for the right to purchase the bundle of liens by entering quarter percentage point bids between 18 and zero percent. The investor willing to accept the lowest interest rate for paying the total delinquent property tax bill of all liens wins the right to purchase the bundle. For example, in 2010, Franklin County offered a bundle of 1,203 tax liens with a total delinquent tax bill \$6,169,882 using an interest rate auction. The winning investor placed an interest rate bid of 17.25 percent and paid Franklin County \$6,169,882. Delinquent property taxpayers with liens included in the sale pay an interest rate of 17.25 percent during the following year of delinquency. The majority of tax lien sales in Ohio from 1998 to 2010 were conducted using the interest rate auction method.

In the overbid auction investors compete for the right to purchase the bundle by entering bids in dollars. The investor willing to pay the highest dollar value for the bundle wins the auction. Delinquent property taxpayers with liens included in the overbid auctions pay an interest fee of 18 percent during the following year of delinquency. Bids below the delinquent property taxes bill of all liens are accepted. In 2010 Cuyahoga County offered a bundle of 400 tax liens using an overbid auction. The winning investor entered a bid of \$3,665,940 for the bundle of liens. During the period of observation, 1998 to 2010, overbid auctions were conducted by Cuyahoga County, Mahoning County, and Summit County.

4.1.2. Tax Lien Sale Adoption

Selection into tax lien sales is not random. The decision to adopt tax lien sales belong to the County Treasurer; a government official elected once every four years. County Treasurers that perceive positive net benefits from tax lien sales are likely to adopt. Tax lien sale costs include set-up of the first tax lien sale and annual administration. Tax lien sale benefits include the receipt of delinquent property tax revenue sooner and the privatization of tax foreclosure. Tax foreclosure, the forced sale of property for the purposes collecting delinquent property taxes, is costly.

Table 4.1.2 provides descriptive statistics, delinquent property taxes and population, of counties conducting tax lien sales at any point during the period of observation and the mean statistics of all counties not conducted tax lien sales during that time period. Although table 4.1.2 implies county treasurers with higher delinquent property tax balances and higher populations are more likely to ever-adopt tax lien sales, no characteristic observed at the county level predicts timing of adoption including geographic proximity. For example, observed

county characteristics from 1997 to 2010 do not explain well the decision of the Hamilton County Treasurer to adopt tax lien sales in 2008 and Franklin County Treasurer to adopt tax lien sales in 2003 despite the many shared county similarities.

The decision to ever-adopt appears to be explained by the potential benefits from the sale of delinquent property taxes and privatizing tax foreclosure, whereas the timing of tax lien sale adoption appears to be driven by political decisions made by the county treasurers. A County Treasurer is unlikely to adopt tax lien sales when the policy is not supported by voters. This explains the decision at the start of the Great Recession by the treasurers in Lucas County, Montgomery County, and Stark County to suspend tax lien sales. Treasurers in these counties were unwilling to conduct tax lien sales with many property taxpayers and potential voters in financial distress. Understanding the timing of adoption is critical to the identification strategy.

4.1.3. Tax Lien Sale Costs – Delinquent Property Taxpayer

In Ohio, property taxes are payable annually in two equal installments. A penalty of 10 percent is applied to delinquent tax bill 10 days after the installment is due. An interest fee, set annually, of three percent above the Federal Reserve short-term interest rate is applied to the delinquent tax bill. The interest fee was four percent in 2010. If property taxes are delinquent for one or more year, the county government may choose to begin tax foreclosure proceedings.

Table 4.1.3 compares the cost of delinquency for delinquent property taxpayers included in a tax lien sale to delinquent property taxpayers not included in a tax lien sale. Tax lien sales increase the cost of property tax delinquency in four ways; increased notification, penalties, uncertain interest fees, and privatized tax foreclosure.

Prior to a tax lien sale delinquent property taxpayers receives more frequent notifications via mail, publication in the local newspaper, or postings on the county webpage. Notifications are costly to delinquent taxpayers. Franklin County publishes the name and address of the delinquent property taxpayer in the local newspaper a minimum of four times prior to the tax lien sale. Delinquent taxpayers in counties that do not conduct tax lien sales face less frequent notification.

Delinquent property taxpayers included in a tax lien sale are charged penalties between \$100 and \$400 once the lien is sold. Penalties vary by county and year. Delinquent taxpayers in counties that do not conduct tax lien sales are not charged penalties after the first year of delinquency.

Interest fees charged to delinquent taxpayers are higher in the tax lien sale environment. Delinquent taxpayers with liens sold using the overbid auction method are charged an interest fee of 18 percent which is consistently higher than the interest fee charged by the county government. Delinquent taxpayers with liens sold using the interest rate auction method incur an uncertain interest fee between zero percent and 18 percent. The interest fee has consistently been higher than the interest fee charged by the county government. The winning investor in Franklin County in 2010 charged an interest fee of 17.25 percent. The county government interest fee for liens not included in the sale was four percent in 2010.

Delinquent property taxpayers face private initiated tax foreclosure proceedings rather than public initiated tax foreclosure proceedings in the tax lien sale environment. Private lien holders reserve the right to use private attorneys and are permitted to pass “reasonable” fees onto delinquent property taxpayers. Without court approval attorney fees may be as high as

\$2,500 (Rittenhouse, 2011). Private initiated tax foreclosures are thought to occur more rapidly than public initiated tax foreclosures and are more costly to property owners. Prior to the utilization of tax lien sales a typical delinquent property in Cuyahoga County faced tax foreclosure after nine years of continuous delinquency (Olson and Lachman, 1976). Once tax lien sales were adopted private investors pursued tax foreclosure much more rapidly (Rittenhouse 2011).

Tax lien sales increase the cost of property tax delinquency for delinquent taxpayers. The increased cost of property tax delinquency decreases property tax delinquency as taxpayers choose to pay delinquent tax bills sooner. Estimating the responsiveness of taxpayers, the decision of delinquent taxpayers to pay delinquent tax bills sooner, is the focus of this study.

4.2. Literature Review

Previous literature does not estimate the responsiveness of taxpayers to tax lien sales. Although Larry DeBoer and James Conrad (DeBoer and Conrad, 1989a) do much to further the understanding of tax lien sales, the studies examine determinants of property tax delinquency (DeBoer and Conrad, 1989a) and determinants of winning bids at tax lien sale auctions (DeBoer and Conrad, 1989b). Therefore previous literature is helpful in identifying variables other than tax lien sales which are thought to effect property tax delinquency.

Larry DeBoer and James Conrad examine the relationship between interest fees, the yield on three month U.S. securities, and property tax delinquency rates (DeBoer and Conrad, 1989a). The study finds that in 12 urban Indiana counties from 1969 to 1986 a five percent increase in the interest-penalty spread, the difference between the yield on three month U.S.

securities and interest fees, increases the property tax delinquency rate by just over one percentage point. The results suggest taxpayers are responsive to changes in interest fees.

Property tax delinquency fluctuates with economic conditions. Economic indicators correlated with property tax delinquency identified in previous literature include unemployment, income, and property value (DeBoer, 1990). Using selected Indiana counties from 1970 to 1984 it is estimated that that a five percentage increase in the unemployment rate increases the property tax delinquency rate by 0.5 percentage points (DeBoer and Conrad, 1988a). A related study estimates that a one percent increase in farm income decreases the property tax delinquency rate by 0.5 percentage points. The same study finds a five percentage point increase in the value of farm land decreased property tax delinquency by 0.5 percentage points (DeBoer and Conrad, 1988b).

Empirical results estimating the effect of the property tax rates on property tax delinquency rates are less conclusive. Susan Olson and M. Leanne Lachman find property tax rates to be uncorrelated with property tax delinquency rates in Cleveland, Ohio (Olson and Lachman, 1976). The authors argue that properties are already abandoned by delinquent taxpayers when tax rates increase making higher or lower tax rates irrelevant. However, in a study of New York City it is estimated that a one percent increase in the property tax rate lead to two to three percent increase in the share of property tax delinquent buildings (White, 1980).

While prior literature identifies determinants of property tax delinquency, no study to date provides an estimate of the responsiveness of taxpayers to tax lien sales. In this paper I

control for determinants of property tax delinquency in order to estimate the responsiveness of taxpayers to tax lien sales.

4.3. Data Sources and Variable Construction

To empirically test the responsiveness of taxpayers to tax lien sales data is collected from the Ohio Department of Taxation, Bureau of Labor Statistics, U.S. Census Bureau, Ohio Department of Job and Family Services, and local county officials. Data is available at county and municipality from 1997 to 2010. Table 4.3.1 provides descriptive statistics of all 88 counties in Ohio and table 4.3.2 provides descriptive statistics of the 219 municipalities included in the analysis from 1997 to 2010. The table separates descriptive statistics by tax lien sale years and non-tax lien sale years.

The Ohio Department of Taxation reports delinquent property tax balances for real property and public utility personal property as of December 31 of each year as a combined, and inseparable. Delinquent property taxes include delinquent taxes from the current year tax bill, unpaid taxes from all prior year tax bills, penalties, and interest fees accrued during delinquency. Local government officials in tax lien sale counties were contacted to determine the amount of delinquent property taxes paid by private investors in each municipality and in each year; the financial effect of tax lien sales on property tax delinquency. The dependent variable for municipalities in non-tax lien sale county years is the Ohio Department of Taxation measure of property tax delinquency. The dependent variable is constructed for municipalities in tax lien sale years by adding the Ohio Department of Taxation measure of property tax delinquency to delinquent property taxes paid by private investors in each municipality and in each year; the financial effect of tax lien sales on property tax delinquency. Delinquent property

taxes and the financial effect of tax lien sales have been adjusted for inflation using the 2010 consumer price index as the base year.

A tax lien sale reduces property tax delinquency through two effects. The first effect I refer to as the financial effect; the sale of property tax delinquency to private investors. The second effect I refer to as the behavioral effect. When a tax lien sale is announced some taxpayers choose to pay delinquent property taxes early. The purpose of the paper is to estimate the responsiveness of taxpayers to tax lien sales or more precisely behavioral effect of tax lien sales.

The financial effect of tax lien sales includes property tax delinquency sold in tax lien sales and subsequent sales. A subsequent sale is the sale of delinquent taxes on liens sold the previous year. For example, a lien is sold on a delinquent property in 2005 from an unpaid 2004 tax bill. In 2006, if the taxpayer is unable to pay the lienholder and is unable to pay the 2005 tax bill a subsequent sale is held. In a subsequent sale a lien on the 2005 delinquency is offered to the lienholder of the 2004 lien. A lienholder choosing to purchase subsequent liens earn an interest fee of 18 percent.

The Ohio Department of Taxation publishes net property taxes charged for real property and public utility personal property as of December 31 of each year. Net property taxes charged at the municipality is a necessary control as property taxes are thought to determinants of long-term property tax delinquency. Real property includes land, buildings, and improvements for residential, agricultural, commercial, industrial, and mineral property. Public utility personal property includes tangible personal property of electric, rural electric, natural gas, pipeline, water works, water transportation, heating, and telegraph companies. Net property taxes

charged are property taxes due for the current year minus all approved reduction such as the homestead exemption. Net property taxes charges have been adjusted for inflation using the 2010 consumer price index as the base year.

The expected equity position when the property is sold influences the individual taxpayer's long-term property tax delinquency decision. Expected equity positions are not easily measured. However, current and prior property values may provide a reasonable proxy for expected equity positions at the county level. The Ohio Department of Taxation publishes the median sales price of residential property as of December 31 of each year. The measure has been adjusted for inflation using the 2010 consumer price index as the base year. The median sales price of residential property is used as a proxy for the expected equity position. The county median sales price of residential property is used in municipalities where no median residential sale prices are collected.

The personal borrowing rate affects the short-term property tax delinquency decision. The yield on three month U.S. securities (DeBoer and Conrad, 1989a) is not a valid proxy for the personal borrowing rate during the period of observation, 1997 to 2010. Instead unemployment rate, poverty rate, and median household income statistics provide a proxy for the county level average personal borrowing rate.

The Ohio Department of Job and Family Services publish annual labor force estimates for selected municipalities. The estimates include unemployment rates. Unemployed taxpayers borrow at higher rates than employed taxpayers. For municipalities where no data is collected, county unemployment rates obtained from the Bureau of Labor Statistics are utilized. Similarly personal rates of borrowing are negatively correlated with household income and poverty

rates. Ceteris paribus higher unemployment, higher poverty rates, and lower median household income will lead to more borrowing from the local government. Data on poverty and income estimates are obtained from the U.S. Census Bureau. The estimates include the percent of the total population in poverty and median household income.

Local government officials were contacted to determine the years tax lien sales were conducted and the financial effect of each sale. The information was validated through local newspapers where available. Summit County and Stark County were unable to provide the financial effect by municipality but rather provided the county level measures. The tax lien sale financial effect for adopting Ohio counties from 1998 to 2010 are presented in table 4.3.3. Property tax delinquency in Ohio was reduced by approximately \$331 million through the sale of tax liens to private investors, the financial effect of tax lien sales.

4.4. Empirical Methods and Results

The responsiveness of taxpayers to tax lien sales is estimated by regressing annual municipality measures of property tax delinquency. One weaknesses of the Ohio data set is the inclusion of ineligible property tax delinquency. Property tax delinquency of less than one year and property tax delinquency belonging to senior taxpayers is not subject to tax lien sales. The inclusion of ineligible property tax delinquency introduces measurement error which potentially biases the estimation result. It is likely that changes in property tax delinquency between tax lien sale regimes are also influenced by changes in ineligible property tax delinquency. Provided the model specification correctly controls for changes in ineligible delinquency the potential is mitigated.

Another potential bias of the Ohio data set is that property tax delinquency is measured several months after the tax lien sale has been conducted. Property tax delinquency for municipalities conducting tax lien sales does not include property tax delinquency sold to investors. Not including property tax delinquency sold to investors overestimates the responsiveness of delinquent taxpayers to tax lien sales. Property taxpayers allowing property tax delinquency to be sold to investors by definition are not responsive to tax lien sales. To correct this potential bias, property tax delinquency sold to investors has been added to the measure of property tax delinquency for municipalities conducting tax lien sales.

4.4.1. Identification Strategy

In this section, I define the property tax delinquency published in the state of Ohio. I describe how this data is used to identify the responsiveness of taxpayers to tax lien sales, the behavioral effect.

In Ohio, local government faces two possible environments. In the first environment, where $T=0$, the local government does not conduct a tax lien sale. In the second environment, where $T=1$, the local government conducts a tax lien sale.

The following notation is used to describe total property tax delinquency:

- D : Total property tax delinquency
- $D_{E,S}$: Eligible delinquency, short-term
- $D_{E,L}$: Eligible delinquency, long-term
- D_I : Ineligible delinquency

Total property tax delinquency in either tax lien sale environment is a function of ineligible delinquency not legally permitted to be sold at the tax lien sale and eligible delinquency. Further, eligible delinquency is either short-term property tax delinquency or long-term property tax delinquency.

By assumption, total property tax delinquency in the non-tax lien sale environment is equal to the total property tax delinquency in the tax lien sale as given in equation (1) below.

$$E[D | T = 1] = E[D | T = 0] \quad (1)$$

Tax lien sales increase the cost of long-term property tax delinquency and have no effect on the cost of short-term delinquency or ineligible delinquency. Thus, tax lien sales cause a shift from long-term delinquency to short-term delinquency leaving total property tax delinquency unchanged. Therefore, by assumption, ineligible delinquency in the non-tax lien sale environment, where $T=0$, is equal to ineligible delinquency in the tax lien sale environment, where $T=1$, as given in equation (2).

$$E[D_I | T = 1] = E[D_I | T = 0] \quad (2)$$

Total property tax delinquency in the non-tax lien sale environment, where $T=0$, is given by equation (3) below.

$$E[D | T = 0] = E[D_{E,S} | T = 0] + E[D_{E,L} | T = 0] + E[D_I | T = 0] \quad (3)$$

Total property tax delinquency in the tax lien sale environment where $T=1$ is given by equation (4) below.

$$E[D | T = 1] = E[D_{E,S} | T = 1] + E[D_{E,L} | T = 1] + E[D_I | T = 1] \quad (4)$$

Provide equation (1) and equation (2) hold, the difference in total property tax delinquency between the two environments is a function of the difference in short-term eligible delinquency and the difference in long-term eligible delinquency. The identity describing the difference in total property tax delinquency is given by equation (5).

$$\begin{aligned} E[D | T = 1] - E[D | T = 0] = \\ E[D_{E,S} | T = 1] - E[D_{E,S} | T = 0] + E[D_{E,L} | T = 1] - E[D_{E,L} | T = 0] \end{aligned} \quad (5)$$

Hence equation (5) is simplified to reveal the behavioral effect of tax lien sales.

$$E[D_{E,0} | T = 1] - E[D_{E,0} | T = 0] = E[D_{E,1} | T = 1] - E[D_{E,1} | T = 0] \quad (6)$$

The left hand side of equation (6) shows the behavioral effect of tax lien sales to be equal to the difference in short-term eligible delinquency between the two environments. The right hand side of equation (5) shows the behavioral effect of tax lien sales to also be equal to the difference in long-term eligible delinquency.

In Ohio, it is possible to identify the behavioral effect of tax lien sales by observing differences in long-term eligible delinquency, the right hand side of equation (6). In municipalities not conducting tax lien sales, where $T=0$, ineligible delinquency and long-term eligible delinquency are observed as combined and inseparable through the Ohio Department of Taxation. In municipalities conducting tax lien sales, where $T=1$, ineligible delinquency is observed and provided by the Ohio Department of Taxation. In municipalities conducting tax lien sales, where $T=1$, long-term eligible delinquency is observed and provided by local government officials. Long-term eligible delinquency in municipalities conducting tax lien sales, where $T=1$, is sold to private investors and is referred to in this study as the financial effect of tax lien sales.

The empirical strategy used to estimate the behavioral effect, BE, of tax lien sales is given by equation (7). The empirical strategy employed examines the difference in ineligible delinquency and long-term eligible delinquency in non-tax lien sale municipalities to the ineligible delinquency and long-term eligible delinquency in tax lien sale municipalities.

$$[D_{E,L} | T = 1] + E[D_I | T = 1] - E[D_{E,L} | T = 0] - E[D_I | T = 0] = BE \quad (7)$$

Provided the appropriate treatment and control groups are identified, and ineligible delinquency is unaffected by tax lien sales as assumed in equation (3), the accounting identity is further reduced to equation (8).

$$[D_{E,L} | T = 1] - E[D_{E,L} | T = 0] = BE \quad (8)$$

4.4.2. Fixed Effects and First Difference

The goal of the research design is to estimate the responsiveness of taxpayers to tax lien sales. Ohio provides the best opportunity to generate an unbiased estimate. Identification of the effect of tax lien sales is reliable provided the timing of adoption is random. Exploiting the plausibly random timing of adoption at the municipality allows for an identification strategy that compares delinquent property taxes in tax lien sale municipalities, the treatment against the specified control group, delinquent property taxes in non-tax lien sale municipalities.

The fixed effect regression model is shown in equation (9). The purpose of the model is to isolate the effect of tax lien sales on delinquent property taxes.

$$\ln(y_{mt}) = \beta_0 + \beta_1 TS_{mt} + \beta_2 X_{ct/mt} + \lambda_t + e_{mt} \quad (9)$$

The outcome variable, y_{mt} , is the natural log of delinquent property taxes in municipality (m) at year (t). The policy variable of interest TS_{mt} is equal to 1 if the municipality is subject to a tax lien sale at year t and 0 otherwise. TS_{mt} is used to identify the control and treatment groups. The variable $X_{ct/mt}$ includes a set of control variables at the municipality and county identified in as important determinants of delinquent property taxes. λ_t is the year fixed effect which addresses yearly trends in property tax delinquency common to all municipalities. For example, in 2007 the homestead exemption was extended to elderly property owners regardless of income. The expansion of the homestead exemption reduced the number of delinquent taxpayers eligible for tax lien sale in all municipalities.

Control variables included in equation (9) measured at the municipality are unemployment rate, median sales price of residential property and natural log of property taxes. Control variables included in equation (9) measured at the county level include percent

of the population living in poverty and median household income. The median sales price of residential property, property taxes, and median household income are adjusted for inflation and are presented in 2010 dollars.

The data set provides a balanced panel at the municipality-year unit of observation. The 3,066 total observations represent 219 cities in Ohio over a 14 year time period, 1997 to 2010. Municipality-year observations are split into two groups. The first group is municipalities during years in which tax lien sales are held. The first group represents the treatment group. The second group is municipalities during years in which no tax lien sales are held. The second group represents the control.

The decision to include municipalities from ineligible counties in the control group is appropriate given the expansion of tax lien sale eligibility to all Ohio counties in late 2008. Including county ineligible municipalities allows the implications of the policy expansion to be examined.

Table 4.4.2 provides regression results from the fixed effect model specification, equation (9), and first difference model specification, equation (10). The models address concerns that tax lien sale adoption is restricted to population eligible counties prior to 2008 and more likely to be adopted by municipalities with higher levels of property tax delinquency. The benefit of using first difference over a fixed effect model is to account for positive correlation in the error term. It is likely that errors from unobserved municipality characteristics influence errors in subsequent periods.

The tax lien sale policy variable in the fixed effect model specification is large and significant. The results imply delinquent taxpayers are highly responsive to tax lien sales.

Property tax delinquency is estimated to be nearly 11 percent lower in counties conducting tax lien sales. Tests of serial correlation suggest the fixed effect model provides a biased estimate. The Durbin-Watson statistic is 0.744, which is well below the critical value for the lower bound.

To correct for serial correlation in the error term over time, an alternative specification requires that one differences out the correlation. The first difference model specification estimates property tax delinquency to be two percent lower in counties conducting tax lien sales.

Equation (10) provides the first-difference model specification.

$$\Delta \ln(y_{mt}) = \beta_0 + \beta_1 \Delta TLS_{mt} + \beta_2 \Delta X_{ct/mt} + \beta_3 d99_t + \dots + \beta_{14} d10_t + \Delta e_{mt} \quad (10)$$

The outcome variable in equation (10) now measures the change in log property tax delinquency in municipality (m) from period (t-1) to period (t) or $\Delta \ln(y_{mt})$. The policy variable of interest ΔTLS_{mt} is equal to 1 if the municipality conducts a tax lien sale during year t and 0 otherwise. The variable $\Delta X_{ct/mt}$ includes the controls from equation (9) presented as changes in log from period (t-1) to period t.

Equation (10) regression results are provided in column (2) of table 4.4.2. The findings suggest that tax lien sales reduce property tax delinquency by two percent through the behavioral effect. The coefficient on the tax lien sale dummy is significant at the one percent level. The mean level of property tax delinquency for all municipality-year observations from 1997 to 2010 was nearly \$2.7 million. A two percent reduction evaluated at the mean suggests that municipalities experience \$54,000 reduction in property tax delinquency with the adoption of tax lien sales as delinquent taxpayers pay early (behavioral effect).

4.5. Conclusion

This paper is the first to explain the two effects of tax lien sales on property tax delinquency. The paper is also the first to document the financial effect and estimate the behavioral effect of tax lien sales on Ohio municipalities from 1997 to 2010. Exploiting the random timing of tax lien sale adoption by Ohio counties the behavioral effect of tax lien sales on property tax delinquency in Ohio Municipalities is estimated. The findings estimate the behavioral effect of tax lien sales to be two percent off of the mean level of property tax delinquency measured at the municipality.

A two percent decrease in property tax delinquency is not large. The size of the effect is obscured by the inclusion of ineligible delinquency. Instead a more appropriate comparison is to size of the behavioral effect in relation to the financial effect. For example, it is estimated that in 2009 delinquent taxpayers in Franklin County paid \$3,373,000 in delinquent property taxes to avoid the tax lien sale. The county sold \$7,768,000 in delinquent property taxes to a private investor. The estimated delinquent property tax balance eligible for sale in Franklin County in 2009 is \$11,141,000 ($\$3,373,000 + \$7,768,000$), suggesting approximately 30 percent of tax lien sale eligible delinquent property taxes were paid early to avoid the tax lien sale.

The median delinquent tax bill of liens sold at the 2009 Franklin County tax lien sale was \$3,163. Delinquent taxpayers included in the tax lien sale incurred a penalty of \$400 and a 13.75 percent annual interest fee. Delinquent taxpayers not included in the sale incurred no penalty and four percent annual interest fee. Assuming \$3,163 is representative delinquent tax bill for eligible and ineligible liens, it is estimated that combined penalties and interest fees are nearly 660 percent higher for tax lien sale eligible property.

The results suggest that a 660 percent increase in combined penalties and interest fees lead to a decrease in the amount of property tax delinquency by 30 percent. The estimated price elasticity of demand for property tax delinquency is 0.045. It appears the demand for property tax delinquency is rather inelastic. The findings suggest taxpayers choosing property tax delinquency are largely individuals with high personal borrowing rates.

The implications of the study extend beyond Ohio. As of late 2010, 23 states did not widely use or allow tax lien sales. In these states the cost of property tax delinquency for local governments would be reduced with the use of tax lien sales. This study provides government officials a clearer estimate of the tax lien sale benefits. These benefits could be weighed against the political costs of tax lien sales to determine the appropriate policy.

4.6. Cited Literature

- Alexander, F. S. "Tax Liens, Tax Sales, and Due Process." *Indiana Law Journal* 75, 2000. 747-807.
- Allen, H. K. "Collection of Delinquent Taxes by Recourse to the Taxed Property." *Law and Contemporary Problems* 3 (3), 1936. 397-405.
- Carlson, T. L. The Illinois Military Tract: A Study of Land Occupation, Utilization and Tenure. *Illinois Studies in the Social Sciences* 32 (2), 1951. 1-218.
- Conrad, J. and L. DeBoer. "Do High Interest Rates Encourage Property Tax Delinquency?" *National Tax Journal* 41 (4), 1988a. 555-560
- _____. "Rural Property Tax Delinquency and Recession in Agriculture." *American Journal of Agricultural Economics* 70 (3), 1988b. 553-559.
- Conrad, J, L. DeBoer and K. T. McNamara. "Property Tax Auction Sales." *Land Economics* 68 (1), 1992. 72-82.
- DeBoer, L. "Property Tax Delinquency and Tax Sales: A Review of the Literature." *Public Budgeting & Financial Management* 2 (2), 1990. 311-349.
- Lake, R. W. *Real Estate Tax Delinquency: Private Disinvestment & Public Response*. The Center for Urban Policy Research. Rutgers – The State University of New Jersey. 1979.
- Olson, S. and M. L. Lachman. *Tax Delinquency in the Inner City: the problem and its solutions*. Lexington Books. 1976.
- Pointdexter, G. C. *Selling Municipal Property Tax Receivables: Economics, Privatization, and Public Policy in an Era of Urban Distress*. Real Estate Center, Wharton School of the University of Pennsylvania. 1997.
- Swierenga, R. P. "Acres for Cents: Delinquent Tax Auctions in Frontier Iowa." *Agricultural History* 48 (2), 1974. 247-266.
- Rittenhouse, C. D. "The True Cost of Not Paying Your Property Taxes in Ohio." *University of Dayton Law Review* 36 (2), 2011. 221-247.

4.7. Appendix

Table 4.1.2 - Tax Lien Sale - Adoption

Ohio

County	Population (1997)	Delinquent Property Taxes (Thousands 1997 \$)	Tax Lien Sales -Years
Cuyahoga	1,364,453	\$115,567	1999-2001, 2004-2010
Franklin	992,239	\$39,858	2003-2010
Hamilton	831,578	\$38,824	2008-2010
Montgomery	561,228	\$28,948	2005-2008*
Summit	529,158	\$25,275	1998-2010
Lucas	442,299	\$25,388	2006-2008
Stark	365,501	\$14,619	2000-2002, 2004-2007
Mahoning	252,333	\$35,553	2000, 2002-2010
Lawrence	63,684	\$3,222	2010
	Mean Population (1997)	Mean Delinquent Property Taxes (Thousands 1997 \$)	
Non-Adopting Counties	70,102	\$2,257	

Source: Census Bureau; Ohio Department of Taxation

* In 2008 a Tax Lien Sale was held in Montgomery County, however no liens were sold.

Table 4.1.3 - Property Tax Delinquency Costs - Ohio

	<u>County - Tax Lien Sale</u>	<u>County - No Tax Lien Sale</u>
Notification	More frequent notification of the consequences of property tax delinquency through certified mail, news publications, and on-line.	Less frequent notification
Penalty Fee	\$100 to \$400 per lien sold	No Penalty Fee Charged
Interest Fee	0% to 18% in Interest Rate Auction; 18% in Overbid Auction	The interest fee is set annually three percentage points above the Federal short-term interest rate. The interest fee in 2010 was 4%.
Tax Foreclosure	Private Initiated	County Initiated

Table 4.3.1 - County Descriptive Statistics - Ohio

County-Year	# of Obs.		Property Tax Delinquency (Million 2010 \$)	Unemployment Rate	Poverty Rate
No Tax Lien Sale	1,174	Mean	\$7.5	6.6	11.7
		Standard Deviation	\$16.2	2.6	4.4
Tax Lien Sale	58	Mean	\$89.2	6.5	14.1
		Standard Deviation	\$88.5	1.8	2.7
County- Year	# of Obs.		Median Household Income (Thousand 2010 \$)	Residential Median Sales Price (Thousand 2010 \$)	Property Tax Levy (Million 2010 \$)
No Tax Lien Sale	1,174	Mean	\$48.4	\$104.4	\$94.2
		Standard Deviation	\$9.3	\$34.2	\$188.5
Tax Lien Sale	58	Mean	\$47.2	\$128.4	\$947.2
		Standard Deviation	\$4.0	\$18.9	\$711.6

Table 4.3.2 - Municipality Descriptive Statistics - Ohio

Muni-Year	# of Obs.		Property Tax Delinquency (Million 2010 \$)	Unemployment Rate	Poverty Rate
No Tax Lien Sale	2,447	Mean	\$1.8	6.0	11.3
		Standard Deviation	\$5.9	2.4	3.8
Tax Lien Sale	633	Mean	\$6.3	6.3	15.4
		Standard Deviation	\$18.8	2.1	2.1
Muni-Year	# of Obs.		Median Household Income (Thousand 2010 \$)	Residential Median Sales Price (Thousand 2010 \$)	Property Tax Levy (Million 2010 \$)
No Tax Lien Sale	2,447	Mean	\$50.6	\$125.5	\$22.0
		Standard Deviation	\$8.0	\$63.0	\$47.6
Tax Lien Sale	633	Mean	\$46.5	\$167.6	\$58.7
		Standard Deviation	\$3.4	\$79.8	\$115.0

**Table 4.3.3 - Tax Lien Sale - Financial Effect
Ohio**

County	Tax Lien Sales			Millions \$ 2010
	Interest Rate Auction	Overbid Auction	Subsequent Sales	
Cuyahoga	-	1999-2001, 2004-2010	2000-2010	\$101.6
Franklin	2003-2010	-	2004-2010	\$55.2
Hamilton	2008-2010	-	2009-2010	\$13.2
Lawrence	2010	-	-	\$0.5
Lucas	2006-2008	-	2007-2009	\$12.4
Mahoning	2000, 2002-2003	2004-2010	2001, 2003, 2005	\$23.6
Montgomery	2005-2008*	-	2007-2010	\$24.5
Stark	2000-2002, 2004-2007	-	2001-2008	\$15.3
Summit	1998-2009	2010	1999-2010	\$84.4
				<u>\$330.6</u>

Source: Ohio County Treasurers

* In 2008 a Tax Lien Sale was held in Montgomery County. The sale was cancelled when no investors registered.

**Table 4.4.2 - Empirical Results - Fixed Effects and First Difference
Ohio Municipalities**

	Fixed Effect		First Difference	
	(1)		(2)	
	<u>Log (Delinquent Property Taxes)</u>		<u>Δ Log (Delinquent Property Taxes)</u>	
Tax Lien Sale	-0.1085 *** (0.0338)		Δ Tax Lien Sale -0.0226 ** (0.0101)	
Unemployment Rate 0 to 100	0.0213 * (0.0113)		Δ Unemployment Rate 0 to 100 0.0088 * (0.0048)	
Poverty Rate 0 to 100	0.0060 (0.0062)		Δ Poverty Rate 0 to 100 -0.0001 (0.0030)	
Median Household Income (Thousands 2010 \$)	-0.0008 (0.0035)		Δ Median Household Income (Thousands 2010 \$) -0.0011 (0.0021)	
Median Residential Sales Price (Thousands 2010 \$)	-0.0022 *** (0.0007)		Δ Median Residential Sales Price (Thousands 2010 \$) -0.0005 (0.0004)	
Log (Property Tax Levy)	0.8786 *** (0.1095)		Δ Log (Property Tax Levy) 0.3530 *** (0.1098)	
Year Fixed Effects	Yes		Year Fixed Effects	Yes
Municipality Fixed Effects	Yes			
Adj-R	0.9492		Adj-R	0.0513
Obs	3,066		Obs	2,847

++Standard errors clustered at municipality; * p< 0.1.; ** p <0.05; *** p<0.001

5. THE RESPONSIVENESS OF INVESTORS TO DIFFERENCES IN TAX LIEN SALE AUCTION DESIGN: EVIDENCE FROM ILLINOIS

5.1. Introduction

In 2011 the majority of delinquent property taxpayers in 26 states and the District of Colombia were subject to tax lien sales. A tax lien sale is the sale of delinquent property taxes by a local government to private investors. When a property taxpayer becomes delinquent, a lien is placed against the property. The lien represents a collateralized receivable but not direct ownership of the property. In a tax lien sale, investors pay the delinquent property tax bill to the government. In return, investors receive the lien and the right to repayment of the delinquent taxes plus interest fees.

Although tax lien sale have been used in the United States since 1819 (Carlson, 1951; Swierenga, 1974) and tax lien sales are used in a majority of states, little is known about the responsiveness of investors to differences in auction design. The purpose of this paper is to estimate the responsiveness of investors to differences in tax lien sale auction designs. Investors may respond to tax lien sale auction design by changing the decision to bid or changing the bid.

Estimating the responsiveness of investors to differences in auction design is important because property tax delinquency has increased significantly during the Great Recession. Property tax delinquency is costly for local governments and taxpayers. Tax lien sales provide a viable policy alternative to states not conducting tax lien sales in search of immediate property tax revenue. Certain tax lien sale auction designs provide delinquent taxpayers immediate relief in lower interest rates.

In the United States tax lien sales policy is typically set by state governments and uniformly applied by all local governments within each state. Ideally, estimating investor responsiveness is accomplished by comparing property tax delinquency in states using alternative auction designs.

There are two possible reasons why a comparison of property tax delinquency by state would not produce an unbiased estimate. The first is the result of non-random selection of tax lien sale auction design. The second potential bias is the result of differences in the way states measure property tax delinquency. California, for example, measures property tax delinquency of less than one year for real property. Oregon measures property tax delinquency for real and personal property.

A recent policy innovation in Illinois provides the best opportunity to generate an unbiased estimate of the responsiveness of investors to differences in auction design. The policy is innovative for introducing the local option, allowing county treasurers the choice of tax lien sales auction design.

In this paper, I am the first to investigate the effects of tax lien sale auction design on auction revenues and interest fees. To estimate the effect of auction design on these outcomes I compare changes in auction outcomes in counties that switch auction design to changes in auction outcomes in counties that did not switch auction design. Counties switched auction designs during this time period to reduce the number of days needed to sell the increased number of liens. Using administrative data and this difference-in-difference strategy, I find that auction design has large effects on local government revenue and interest fees. Specifically, I

find that a switch in auction design can reduce the average interest rate by as much as 30 percent or nearly \$200 in interest fees for the average delinquent taxpayer.

I examine three auction designs. I refer to these three designs as the English matching, English non-matching, and First Price Sealed Bid designs. The findings suggest that the English non-matching design provides local governments with the greatest amount of revenue and delinquent taxpayers with the lowest interest fees. These results provide local government officials valuable information on the effects of auction design on tax lien sale auction design. Although the results are derived from unique variation in tax lien sale auctions, this paper contributes to the broad empirical literature on the effects of auction design.

While English non-matching design reduces the burden of delinquency for both local governments and delinquent taxpayers, a First Price Sealed Bid produces the opposite result. Consider the example of Cook County which switched from the English matching auction design to the First Price Sealed Bid auction design in 2008, the results indicate switching auction design resulted in seven million dollars in liens being returned to the county for collection from 2008 to 2010 that would have been sold to private investors under the alternative designs. The findings also suggest that the mean delinquent taxpayer in Cook County, with \$3,452 in delinquent property taxes, paid \$69 more in interest fees with the switch to the First Price Sealed Bid auction design during the first year of delinquency.

In the Collar counties, the counties bordering Cook County, there was no observed difference in auction revenue between the English matching and English non-matching designs. However, it was estimated that the mean taxpayer in the English matching auction with an

outstanding delinquency of \$4,947 paid nearly \$200 more in interest fees when compared to similar liens offered in the English non-matching design.

In sum, of the three auction designs considered, the findings suggest that the English non-matching auction is the auction design that both maximizes government revenue and minimizes interest fees charged to delinquent taxpayers. The result is consistent with auction theory suggesting sequential English common value auctions produce higher prices (lower winning interest rate bids) when compared to sequential First Price Sealed Bid common value auctions.

5.1.1. Tax Lien Sale Auction Design

Although the state allows counties to determine their own tax lien sale auction design, in Illinois statute dictates some rules common to all tax lien sale auctions. In all counties, investors bid on individual liens by declaring an interest rate between 18 and zero percent. Bids are entered in whole percentage point increments (i.e. 18, 17, 16, and 15). The investor with the lowest interest rate bid wins the right to pay the delinquent property taxes in exchange for repayment plus interest fees and the property lien as collateral. Interest rate bids of 18 percent represent a low price for investors in which case the investor will earn an 18 percent return on investment during the first year of delinquency. Interest rate bids of zero percent represent a high price in which the investor will earn no return on investment during the first year of delinquency. Liens are offered in sequential order one parcel at a time by municipality and property identification number (PIN). Liens not receiving a bid at auction are returned to the county for collection with the delinquent taxpayer charged an interest fee of 18 percent during the first year of delinquency.

In this paper, auction design varies because of differences in auction type, English or First Price Sealed Bid, and differences in bidding rules, matching or non-matching. Investors face unique auction types and bidding rules depending on which county the auction is conducted. Three auction designs compared in this analysis include English matching, English non-matching, and First Price Sealed Bid. Table 5.1.1 provides a brief description of the three auction designs observed.

In the English matching auction, investors submit a bid by raising a paddle. The auction concludes when only one investor remains or multiple investors with matching bids are unwilling to bid at a lower interest rate. In cases where more than one investor offers the same low bid, a winner is chosen at random by the county treasurer. The overwhelming majority of liens sold to private investors receive more than one bid at the same low rate; often ten or more investors bid the same interest rate.

In the English non-matching auction, investors submit a bid by selecting the desired interest rate on a computer screen. The first investor to select the lowest interest rate bid wins the right to purchase the lien. It is not possible in the English non-matching auction design for more than one investor to register the same interest rate bid.

In the First Price Sealed Bid auction, investors submit bids on-line. If more than one investor bids zero percent the winner is chosen at random. Liens receiving multiple low bids between one percent and 18 percent are reoffered in a second round. A second round low bid by two or more investors between one percent and 18 percent results in the lien being returned the county for collection.

5.2. Literature Review

Although the breadth of auction literature is extensive, no studies examine the responsiveness of investors to differences in tax lien sale auction design. Previous theoretical and empirical literature suggests that auction design affects auction results when investors do not possess strictly private values (Menezes and Monteiro, 2005). This paper expands the literature by examining the responsiveness of investors to differences in tax lien sale auction design. The novelty of this research is the use of administrative data and a difference-in-difference specification to estimate the impact of auction design on auction results.

Two previous studies (DeBoer et al., 1992; Allen et al., 2004) have identified determinants of tax lien sale auction results. Using data from the 1987 tax lien sale held in Marion County, Indiana and parcel characteristics of 1,073 liens offered at auction the authors (DeBoer et al., 1992) examine the probability of a lien selling and winning price; Indiana auctions are conducted in terms of dollars value rather than interest rates. In a separate study (Allen et al., 2004) auction results for 166,316 delinquent parcels in Palm Beach County, Florida from 1982 to 2000 were used to examine potential factors of winning interest rates.

The two studies find delinquent tax bill, assessed value, property use, and property location to be important determinants of the probability of sale and winning bids. Investors use these characteristics to estimate the expected payoff of each lien. The determinants identified in previous studies (DeBoer et al., 1992; and Allen et al., 2004) of delinquent tax bill, assessed value, property use, and property location are necessary controls in this analysis for the identification of the effect of auction design on auction results in this study.

5.3. Theoretical Model

In this section, I argue that tax lien sales are common value auctions and show that the three auction designs affect local government revenue and winning interest rates. The investor bidding strategy is described under each of the three designs. The implications to local government revenue and winning interest rates are discussed.

Tax lien sales are common value auctions because the monetary benefit of lien ownership, which is unknown at the time of bidding, does not vary across investors (Menezes and Monteiro, 2005). My description of the monetary payoff from lien ownership and optimal bidding strategy of investors assumes that there are no non-pecuniary benefits to lien ownership. An example of a non-pecuniary benefit would be additional benefit derived from purchasing a lien on a property close to a relative or in the ideal school district. Liens are almost exclusively purchased as an investment vehicle for large buyers purchasing multiple liens rather than individuals purchasing single liens in the hope of personally occupying the property. In Collar counties, for example, from 2005 to 2010, 97 percent of liens were sold to large investors purchasing 100 or more liens at any one auction.

Deriving the optimal bidding strategy for a sequential common value auction requires a model of the investor's expected payoff. The investor faces two possible outcomes when purchasing a lien: redemption or tax foreclosure. When a lien is purchased the investor pays the delinquent tax bill at time (t). The payoff from redemption occurs at time period ($t+1$) whereby the investor receives the delinquent tax bill plus interest fees accrued. In tax foreclosure the investor obtains ownership of the property at time period ($t+2$). The payoff in tax foreclosure is the property market value at tax foreclosure minus the delinquent tax bill. In

both redemption and tax foreclosure the net payoff is the monetary payoff minus the investor's opportunity cost.

The following notation is used to describe the expected payoff function:

D : Delinquent tax bill

r_{it} : Investor opportunity cost; unique to each investor i

V_{it} : Property market value; estimated with error by each investor i

π_i : Probability of redemption; estimated with error by each investor i

l_i : Lien interest rate bid; unique to each investor i

Equation (1) below provides the probability of redemption which is estimated with error by each investor at the beginning of the auction. Equation (2) provides the payoff with redemption at time period (t+1).

$$\text{Probability of redemption} = \pi_i \quad (1)$$

$$\text{Payoff with redemption} = D(1 + l_i) - D(1 + r_{i(t+1)}) \quad (2)$$

Equation (3) below provides the probability of tax foreclosure which is estimated with error by each investor at the beginning of the auction. Equation (2) provides the payoff with tax foreclosure at time period (t+2).

$$\text{Probability of tax foreclosure} = 1 - \pi_i \quad (3)$$

$$\text{Payoff with tax foreclosure} = V_{i(t+2)} - D(1 + r_{i(t+2)}) \quad (4)$$

The investors' expected payoff at the start of the auction is shown in equation (5). The expected payoff discounted to the beginning of the auction, d , is equal to the probability of redemption multiplied by the payoff in redemption plus the probability of tax foreclosure multiplied by the payoff in tax foreclosure.

$$E^I_{(t)} = \pi_i \frac{D(l_i - r_{i(t+1)})}{(1+d)^{(t+1)}} + (1 - \pi_i) \frac{V_{i(t+2)} - D(1 + r_{i(t+2)})}{(1+d)^{(t+2)}} \quad (5)$$

An investor's interest rate bid is a function of the expected payoff function. Equation (5) demonstrates that the expected payoff of lien ownership is a function of the probability of redemption, the delinquent tax bill, estimated property value at tax foreclosure, and investor's opportunity cost.

In practice, the probability of redemption is unobservable to the investor. An investor's estimate of the probability of redemption varies across properties according to observable property characteristics. The estimated probability of redemption is a function of whether the delinquent taxpayer finds total outstanding liabilities, including the delinquent tax bill and interest fees accrued, to be greater than property value at tax foreclosure. The estimated probability of redemption is affected by the delinquent tax bill, estimated property value at tax foreclosure, and lien interest rate bid.

Table 5.3 of the appendix provides comparative statistics for the probability of redemption with respect to changes in the delinquent tax bill, estimated property market value, and lien interest rate bid. The table also provides comparative statistics for expected payoff with respect to changes in the delinquent tax bill, opportunity cost of investor, estimated property market value, estimated probability of redemption, and lien interest rate bid.

From equation (5) it is possible to solve for the minimum lien interest rate, $\bar{l}_i$, beyond which no investor will bid. This is the lien interest rate which sets the expected payoff to zero.

$$\bar{l}_i = r_{i(t+1)} - \frac{(1 - \pi_i) [V_{i(t+2)} - D(1 + r_{i(t+2)})]}{\pi_i D(1 + d)} \quad (6)$$

Equation (6) shows that as the probability of redemption approaches one, $\pi_i = 1$, the minimum lien interest rate bid approaches $r_{i(t+1)}$, the one period opportunity cost of the investor. An investor will not bid a lien interest rate below the next best investment alternative when redemption is certain.

Equation (6) also shows as the probability of redemption approaches zero, $\pi_i = 0$, the minimum lien interest rate bid approaches zero provided a positive payoff at tax foreclosure. The payoff with a lien interest rate bid of 18 percent is identical to a lien interest rate bid of zero percent when tax foreclosure is certain. An investor will bid the lien interest rate of zero percent when the probability of tax foreclosure is certain and the expected payoff is positive. A zero percent interest rate bid is thought to provide investors with the greatest probability of winning the right to purchase the lien.

The minimum lien interest rate bid represents the lower bound for investors. In a competitive market such as a common value auction the expected payoff will approach zero and the lien interest rate bid will approach the minimum lien interest rate bid.

5.3.1. English Auction

At English auctions, once the sale begins, investors use the bids of other investors to update estimates of the probability of redemption and estimates of property market value at tax foreclosure. After the market based estimates are established, the only difference in expected payoffs across investors is idiosyncratic opportunity costs.

From figure (5), the expected payoff derived from the market, $E^m_{(t)}$, is provided as follows:

$$E^m_{(t)} = \pi_m \frac{D(l_m - r_{i(t+1)})}{(1+d)^{(t+1)}} + (1 - \pi_m) \frac{V_{m(t+2)} - D(1 + r_{i(t+2)})}{(1+d)^{(t+2)}} \quad (7)$$

The market expected payoff function is used to solve for the minimum lien interest rate bid, $\bar{l}_m$, beyond which no investor will bid when bids are revealed.

$$\bar{l}_m = r_{i(t+1)} - \frac{(1 - \pi_m)}{\pi_m} \frac{[V_{m(t+2)} - D(1 + r_{i(t+2)})]}{D(1 + d)} \quad (8)$$

Theoretically (Milgrom and Weber, 1982; Engelbrecht-Wiggans and Weber, 1983) it has been demonstrated that the English sequential common value auction follow a martingale – the law of one price holds. Empirically the law of one price is not settled (Mezzitti, 2011) as prices of similar goods have been shown to both increase and decrease as the sequential auction proceeds. Regardless, the optimal bidding strategy for all investors in the English sequential common value auction is to bid the market lien interest rate bid. The market lien interest rate is the symmetric Bayesian Nash Equilibrium for all investors.

The two auction designs using the English auction type differ with respect to rules on matching. The English matching design has not been formally modeled in the previous literature, however in observing the 1996 Cook County tax lien sale auction Paul Milgrom (Milgrom, 2004) noted that 80 percent of all liens sold at the maximum interest rate of 18 percent. The poor result of the auction design was attributed to problematic rules on matching.

In the English non-matching auction design the market lien interest rate is the symmetric Bayesian Nash Equilibrium for all investors. An investor lien interest rate bid below the market lien interest rate bid, $\bar{l}_m > \bar{l}_i$, would result in continual overpayment. This phenomenon is referred to as the “winners curse” in auction literature. Rational actors would not be willing to pay more than the market value of any good of common value. An investor lien interest rate bids above the market lien interest rate bid, $\bar{l}_m < \bar{l}_i$, would not win the right to purchase the lien. Therefore investors in the English non-matching auction design would bid the market lien interest rate.

In the English matching design the market lien interest rate bid represents the lower bound as multiple investors are permitted to enter a bid at the market lien interest rate. The pareto optimal solution may be to enter a bid above the market lien interest rate. As an example, imagine three investors with an opportunity cost of three percent. Each investor is willing to purchase the lien for at most three percent when the probability of redemption is high. In the English non-matching design the first investor to three percent wins the right to purchase the lien with one hundred percent certainty. In the English matching design all three investors are able to enter the same bid of three percent and face a one-third probability of winning the right to purchase the lien. The same investors, however, could instead choose to enter a bid of 18 percent and face the same one-third probability of winning the right to purchase the lien. In this scenario the market lien interest rate is not the Pareto optimal bidding strategy.

Collusion is not necessary for the pareto optimal bidding strategy to persist but rather an understanding by investors of auction rules. Reducing lien interest rate bids in English

matching design does not necessarily increase the probability of winning. The bidding strategy in the English matching design is for the investor to equate the marginal cost of reducing the lien interest rate bid with the marginal benefit of reducing the lien interest rate bid. The cost of reducing the lien interest rate bid is a reduction in interest earned. The benefit of reducing the lien interest rate bid is the potential increase in the probability of winning the right to purchase the lien.

Therefore the result is that the bidding strategy in the English non-matching design is the market lien interest rate bid. The bidding strategy in the English matching design is greater than or equal to the market lien interest rate bid.

Hypothesis one: *The interest fee charged to the delinquent taxpayers will be higher in the English matching auction design as the bidding strategy in the English matching auction is to submit a lien interest rate bid greater than or equal to the optimal English non-matching lien interest rate bid.*

Theory provides little insight into the probability of sale in the English non-matching auction and the probability of sale in the English matching auction. One plausible hypothesis is that because the cost of participation (entry fees and research expense) is the same across English auction designs the probability of sale would be unchanged with change in auction design. In other words the same liens will be sold regardless of auction design; English matching or English non-matching.

Hypothesis two: *The probability of sale and therefore local government revenue will be the same in the English matching design and English non-matching design.*

5.3.2. First Price Sealed Bid

In the First Price Sealed Bid auction investors are unable to observe signals. The investors expected payoff function provided in equation (5) does not change during the auction. The minimum lien interest rate bid provided in equation (6) is the bid entered by investors in the First Price Sealed Bid auction. Comparing the minimum lien interest rate bid entered in the First Price Sealed bid auction to the minimum lien interest rate bid entered in the English auction suggests when no matching is allowed the First Price Sealed Bid winning interest rate is lower. When matching is allowed the result is ambiguous.

First Price Sealed Bid to English non-matching: $\bar{l}_i < \bar{l}_m$

First Price Sealed Bid to English matching: $\bar{l}_i \approx \bar{l}_m$

Changing auction type, English to First Price Sealed Bid, in a sequential common value auction would not effect the probability of sale and therefore local government revenue. However, the First Price Sealed Bid design observed introduces a rule which does affect local government revenue. Because a second round low bid by two or more investors between one percent and 18 percent results in the lien being returned the county for collection, local government auction revenue will be lower in the First Price Sealed Bid auction than in auctions using either English design provided tie bids in the second rounds occur. In the English matching

design tie low bids between one percent and 18 percent are awarded to investors based a random assignment. In the English non-matching design tie bids between one percent and 18 percent are not permitted.

Hypothesis three: *The probability of sale in the First-Price Sealed -Bid is lower than the probability of sale in either English auction design.*

5.4. Data Sources and Variable Construction

Data for this study was obtained from government officials in six Illinois counties. Results provided for 30 auctions include liens offered, liens sold, and winning interest rate bids. Delinquent tax bill, estimated market value, property classification, buyer name, and auction order were collected for each lien offered. Descriptive statistics are provided in table 5.4.1, table 5.4.2, and table 5.4.3.

Counties in the dataset are located in the northeast corner of Illinois. The data includes the city of Chicago and suburban communities. The counties are commonly referred to as Cook and the Collar counties. The Collar counties are similar when compared in terms of economic and demographic characteristics. Cook County is the second largest county in the nation and more diverse in terms of economic and demographic characteristics. From 2005 to 2010, 14 auctions were observed using the English matching design, 13 using the English non-matching design, and three using the First Price Sealed Bid design.

In the Collar counties approximately 98 percent of the dollars of property tax delinquency offered at auction were sold. In Cook County 82 percent of the dollars of property

tax delinquency offered at auction were sold. Table 5.4.1 shows that most unsold property was vacant and of little market value. Across all designs and all counties winning interest rates ranged from zero to 18 with a median of zero and mean of six percent.

Because a lien is placed against property, property characteristics have been shown to affect auction results (DeBoer et al., 1992; Allen et al., 2004). Delinquent tax bill, estimated property market value, and property use for each lien offered were collected. In the tax lien sale auction, investors must pay the delinquent tax bill for each lien won. The estimated property market value was computed by multiplying assessed value by three, the inverse of the assessment ratio. Delinquent tax bill and estimated property market value used in the analysis are provided in thousands of inflation adjusted 2010 dollars.

Estimated property market value is also thought to be affected by property location and property use. Property location is controlled for by using the township in which each property resides. In Illinois counties are separated into townships which are smaller geographic units responsible for the assessment of property value for tax purposes. Property use in this dataset is separated into three mutually exclusive categories. The first is residential improved which represents two-thirds of all observation. Residential improved property includes one-family dwelling, multi-family dwelling, condo-units, and apartment buildings. The second is vacant property representing approximately one-quarter of all observations. The third is all other improved property which includes commercial improved and industrial improved.

Tax lien sale investors vary in the number of liens purchased, types of liens purchased, experience, and access to capital (DeBoer and Conrad, 1990). Previous research (Allen et al.,

2004) finds that large volume investors, those purchasing 100 or more liens at any one auction, purchase at lower rates.

To account for investor characteristics which affect winning interest rates buyer names were normalized across auctions. For example, Joseph Johnson of 123 Main Street in St. Charles, IL purchasing liens in the 2007 Kane County tax lien sale was treated as the same investor Joe Johnson of 123 Main Street St. Charles, IL purchasing liens in the 2008 Lake County tax lien sale. Normalizing buyer names was necessary in establishing buyer fixed effects for each lien purchased. There were a total of 831 unique buyer names observed in the dataset. In cases where the lien was returned to the county for collection the county was treated as the buyer with an interest rate of 18 percent.

The price-decline anomaly as observed in the literature (Ashenfelter, 1989; Ashenfelter and Genesove, 1992; Mezzitti, 2011) suggests that auction order effects winning bids. In the case of tax lien sale auctions it is possible that similar liens sold at the beginning of the auction receive different winning interest rate than similar liens sold at the end. To account for this possibility the order in which the lien offered was collected.

5.5. Empirical Methods

Identification of the causal effect of auction design on the probability of sale and interest rate is possible due to variation of auction design across counties and within counties over time. An unbiased estimate of the effect of auction design on auction results is only possible provided the appropriate reference group is identified. Differences in demographic, economic, housing characteristics and tax lien sale administration between Cook and the Collar

counties suggests empirical analysis is best conducted by separating Cook from the Collar counties.

For Cook County the empirical analysis compares auction results from two auctions conducted using the English matching design to auction results from three auctions conducted using the First Price Sealed Bid design. Cook County switched from the English matching auction design to the First Price Sealed Bid in 2008. For the Collar counties the empirical analysis compares auctions results from the English matching design to auction results from the English non-matching design. From 2005 to 2010 two counties used the English matching design during the entire period (Kane & McHenry Counties), two counties used the English non-matching design during the entire period (Will & DuPage Counties), and one county switched from the English matching design to the English non-matching design. Lake County switched from the English matching auction design to the English non-matching in 2007.

The first research question to be addressed is the effect of auction design on the probability of a lien selling at auction to private investors. To estimate the effect a logit model is utilized.² The basic model is provided below;

$$\text{Cook County:} \quad \text{Sold}_i = \beta_1 F_i + \beta_2 X_i' + T_i + \varepsilon \quad (9)$$

$$\text{Collar counties:} \quad \text{Sold}_i = \beta_1 E_i + \beta_2 X_i' + T_i + \varepsilon \quad (10)$$

$$\text{If } \text{Sold}_i > 0$$

$$\text{Sold}_i = 0 \quad \text{Otherwise.}$$

² The Probit regression produces nearly identical results. Logit is reported as tests of Akaike's Information Criterion (AIC) and Schwarz's Bayesian Information Criterion (BIC) indicate Logit to be slightly superior to Probit.

The outcome variable, $Sold_l$, is a dummy variable indicating whether lien l is sold at auction to a private investor. The value of one indicates the lien is sold to an investor and zero when the lien is returned to the county for collection. The variable, E_l , is equal to one if the lien was offered at the English non-matching design and zero otherwise. The variable, F_l , is equal to one if the lien was offered at the First Price Sealed Bid design and zero otherwise. The comparison group for the analysis in both Cook and the Collar counties is liens offered using the English matching design.

X_l' is a vector of property characteristics for lien l . Property characteristics are necessary controls in isolating the effect of auction design on the probability of a lien selling at auction. The variables include the delinquent tax bill, estimated market value, and property use.³ Property use is designated with a dummy variable indicating whether the property is residential improved or vacant. The comparison group is all other property uses including industrial vacant and commercial vacant. A dummy variable equal to one was also included if the lien received a tie bid in the First Price Sealed Bid auction and was reoffered in a second round.

The second research question considers the effect of auction design on the interest rate charged to delinquent taxpayers after the auction. A standard OLS model is used.

I estimate the following regressions;

³ Equalized Value and delinquent tax bill have been adjusted for inflation using the 2010 consumer price index as the base year.

$$\text{Cook County:} \quad \text{Interest}_{it} = \alpha_0 + \beta_1 F_l + \beta_2 X_l + I_l + T_l + \varepsilon \quad (11)$$

$$\text{Collar counties:} \quad \text{Interest}_{it} = \alpha_0 + \beta_1 E_l + \beta_2 X_l + I_l + T_l + \varepsilon \quad (12)$$

The outcome variable, Interest_{it} , is the interest rate of lien l at year t . The remaining variables are consistent with those included in the logit model including auction design, property characteristics, auction order, reoffer, year fixed-effect, and township fixed-effect. The addition to the model is investor fixed-effects, I_l , for each unique buyer name. Liens not purchased at auction by private investors are purchased by the county at 18 percent.

5.6. Results

Results from the empirical model testing the probability of sale on auction design are presented in table 5.6.1 and table 5.6.2. Table 5.6.1 provides the empirical analysis for Cook County comparing auction results from the English matching auction design to the First Price Sealed Bid auction design. The results suggest that liens offered under the First Price Sealed Bid auction design are approximately two percent less likely to sell to private investors than liens offered under the English matching design. The empirical estimate matches the results obtained from analysis of the administrative data. From 2008 to 2010 approximately seven million dollars in liens received a tie bid in the first round but after being reoffered in a second round were returned to the county for collection. Seven million dollars represents roughly two percent of the value of all liens offered during that time period. Table 5.6.2 provides the empirical analysis for the Collar counties comparing auction results from the English matching auction design to the English non-matching auction design. The results suggest the probability

of sale does not change across the English auction designs. The findings provided in table 5.6.1 and table 5.6.2 confirm hypothesis two and three.

The second empirical model, testing interest rates on auction design, is presented in table 5.6.3 for Cook County and table 5.6.4 for the Collar counties. Liens not sold to private investors are sold to the county at 18 percent. This treatment avoids issues with selection of liens and appears to be appropriate given the sale of unsold liens in a secondary market after auction. The Heckman selection model described in most auction literature is not appropriate in this case as all liens are treated sold. In addition utilization of the Heckman selection model for liens sold to private investors does not fully answer the question of the effect of auction design on the delinquent taxpayer experience in regard to interest fees.

The model is presented in each case using three specifications. The first model specification regresses the lien interest rate against a set of control variables including specified fixed effects for all property use categories. The second model specification regresses lien interest rate against a set of control variables including specified fixed effects for residential improved property. The third model specification regresses lien interest rate against a set of control variables including specified fixed effects for vacant and other property. The three model specifications allow the reader to examine variations in the effect of auction design by property use category.

The results in table 5.6.3 estimates that delinquent taxpayers in Cook County pay interest rates one percent higher as a result of the switch to the First Price Sealed Bid auction design when all property is included. This represents an increase in interest fees of 59 percent during the first year of delinquency. The mean taxpayer with an outstanding delinquency of

\$3,452 paid \$69 more in interest fees the first year of delinquency by the county switching to the First Price Sealed Bid auction design.

The results in table 5.6.4 estimates that delinquent taxpayers in the Collar counties pay interest rates two percentage points lower as a result of the switch to the English non-matching auction design when all property is included. This represents a decrease in interest fees of 30 percent. The mean taxpayer with an outstanding delinquency of \$4,947 paid nearly \$200 less in interest fees during the first year of delinquency by the county switching to the English non-matching auction design.

In Cook County under the English matching auction design 68 percent of liens were sold at 0 percent. In Cook County under the First Price Sealed Bid auction design 43 percent of liens were sold at 0 percent. It is possible that auction design affects the number of liens sold at 0 percent.

To estimate the effect of auction design on the probability of a lien receiving a winning interest rate bid of 0 outcome variable is a dummy variable indicating whether the winning interest rate bid is 0. The value of one indicates winning interest rate is 0 percent and zero when the winning interest rate is not 0 percent.

Table 5.6.5 provides the estimate results for both Cook and the Collar counties. It is estimated that 20 percent less likely to receive a 0 percent winning interest rate bid under the First Price Sealed Bid auction design in Cook County. It is estimated that there is no material difference in the likelihood of a 0 percent winning interest rate bid under the English – no matching design in the collar counties.

5.7. Conclusion

Poor economic and housing market conditions throughout the United States suggest analysis of tax collection policy is important. Local governments facing declining revenue from other sources would benefit from an auction design providing the highest revenue in the current period. Delinquent property taxpayers facing high rates of unemployment and declining home values would benefit from an auction design providing the lowest interest rate fee for delinquency. This paper allows policy-makers to calculate the trade-off between designs and make more informed decisions in future changes to design. The results suggest the English non-matching design is superior in producing the highest tax lien sale auction and lowest interest fees of the three designs analyzed.

5.8. Cited Literature

- Allen, M. T., S. Faircloth and A. Nejadmalayeri. "Factors Influencing Interest Rates on Delinquent Property Tax Certificates." *Journal of Real Estate Finance and Economics* 28 (1), 2004. 19-36.
- Ashenfelter, O. "How Auctions Work for Wine and Art." *Journal of Economic Perspectives*. 3 (3), 1989. 23-36.
- Ashenfelter, O. and D. Genesove. "Testing for Price Anomalies in Real-Estate Auction." *American Economic Review* 82 (2), 1992. 501-505.
- Conrad, J. and L. DeBoer. "Do High Interest Rates Encourage Property Tax Delinquency?" *National Tax Journal* 41 (4), 1988a. 555-560
- _____. "Rural Property Tax Delinquency and Recession in Agriculture." *American Journal of Agricultural Economics* 70 (3), 1988b. 553-559.
- _____. "The 1989 Property Tax Sale in Marion County: Results of a Survey of Bidders." Purdue University Department of Agricultural Economics Staff Paper #90-11, 1990.
- Conrad, J, L. DeBoer and K. T. McNamara. "Property Tax Auction Sales." *Land Economics* 68 (1), 1992. 72-82.
- DeBoer, L. "Property Tax Delinquency and Tax Sales: A Review of the Literature." *Public Budgeting & Financial Management* 2 (2), 1990. 311-349.
- Engelbrecht-Wiggans, R. and R. J. "A Sequential Auction Involving Asymmetrically-Informed Bidders." *International Journal of Game Theory* 12 (2), 1983. 123-127.
- Klemperer, P. "Auction Theory: A Guide to the Literature." *Journal of Economic Surveys* 13 (3), 1999. 227-286.
- Klemperer, P. "What Really Matters in Auction Design." *Journal of Economic Perspective*. 16 (1), 2002. 169-189.
- Lusht, K. M. "Order and Price of in a Sequential Auction." *Journal of Real Estate Finance and Economics* 8, 1994. 259-266.
- Milgrom, Paul. *Putting Auction Theory to Work*. Cambridge University Press. 2004.
- Menezes, F. M. and P. K. Monteiro. *An Introduction to Auction Theory*. Oxford University Press. 2005.

Mezzitti, Cluadio. "Sequential Auctions with Informational Externalities and Aversion to Price Risk: Decreasing and Increasing Price Sequences." *The Economic Journal* 121, 2011. 990-1016.

Milgrom, P. R. and R. J. Weber. "A Theory of Auctions and Competitive Bidding." *Econometrica* 50 (5), 1982. 1089-1122.

Milgrom, Paul. *Putting Auction Theory to Work*. Cambridge University Press. 2004.

5.9. Appendix

Figure 5 - Cook and the Collar counties

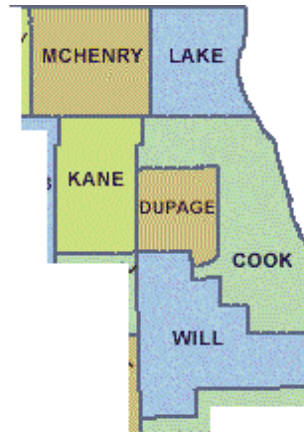


TABLE 5.1.1 - Tax Lien Sale Auction Design

Illinois			
Design	Type	Bid Rules	County-Years
Reference Group	English	Matching allowed.	Cook (2006-2007) Kane (2005-2010) Lake (2005-2006) McHenry (2007-2010)
Treatment Group One	English	Matching not allowed.	DuPage (2007-2010) Lake (2007-2010) Will (2006-2010)
Treatment Group Two	First-Price Sealed-Bid	Winner chosen at random at tie bids of 0 percent. Tie bids between 1 and 18 after second round returned to the county for collection.	Cook (2008-2010)

TABLE 5.3 - Comparative Statistics

This table provides the comparative statistics for the probability of redemption and expected payoff with respect to changes in the variables of interest; where $0 < \pi < 1$, $0.0 \leq l \leq 0.18$, and $0 < \phi < 1$.

Increase in Variable		Probability of Redemption, π	Expected Payoff
D	Delinquent Tax Bill	-	$\sim$
r_{it}	Opportunity Cost of Investor		-
V_{it}	Property Market Value	+	+
π_i	Probability of Redemption		$\sim$
l_i	Lien Interest Rate Bid	-	+

TABLE 5.4.1 - Auction Descriptive Statistics I

Illinois

	Cook County					
	Sold			Unsold		
Initial Offer	No. Liens	Mean Delinquent Tax Bill (\$)^~	Percent Residential Improved	No. Liens	Mean Delinquent Tax Bill (\$)^~	Percent Residential Improved
English - Matching	26,982	\$2,897	76.7%	6,902	\$2,543	12.7%
First Price Sealed Bid	66,631	\$3,453	80.1%	18,644	\$2,389	26.1%
Reoffer	No. Liens	Mean Delinquent Tax Bill (\$)^~	Percent Residential Improved	No. Liens	Mean Delinquent Tax Bill (\$)^~	Percent Residential Improved
First Price Sealed Bid	3,440	\$4,789	82.3%	1,250	\$5,592	89.7%
C						
	Collar Counties					
	Sold			Unsold		
	No. Liens	Mean Delinquent Tax Bill (\$)^~	Percent Residential Improved	No. Liens	Mean Delinquent Tax Bill (\$)^~	Percent Residential Improved
English - Matching	39,398	\$4,315	69.2%	3,591	\$813	2.5%
English - Non-Matching	59,985	\$4,947	73.6%	6,380	\$983	3.7%

~ Adjusted for inflation and presented in 2010 \$

TABLE 5.4.2 - Auction Descriptive Statistics II

Illinois

	Cook County					
	No. Liens		Tax Delinquency ~		Winning Interest Rate*	
	Percent		Percent		Mean	Median
	Offered	Sold	Offered	Sold		
English - Matching	33,884	79.6%	\$95,730.9	81.7%	4.2	0.0
First Price Sealed Bid	89,965	77.9%	\$296,896.1	82.6%	5.1	0.0
	Collar Counties					
	No. Liens		Tax Delinquency ~		Winning Interest Rate*	
	Percent		Percent		Mean	Median
	Offered	Sold	Offered	Sold		
English - Matching	42,989	91.6%	\$172,918.4	98.3%	5.1	3.0
English - Non-Matching	66,365	90.4%	\$303,070.2	97.9%	3.9	3.0

~ Adjusted for inflation and presented in thousands of 2010 \$; * Weighted by inflation adjusted dollars of property tax delinquency.

TABLE 5.4.3 - Auction Descriptive Statistics III

Illinois

	Cook County					
	No. Liens		Tax Delinquency ~		Mean	
	Purchased	Percent	Purchased	Percent	Winning Interest Rate	Delinquent Tax Bill
English - Matching						
Large Buyers (100 or more liens)	25,930	96.1%	\$76,709.5	98.1%	1.7	\$2,958
Meduim Buyers (10 to 99 liens)	816	3.0%	\$1,030.6	1.3%	0.7	\$1,263
Small Buyers (1 to 9 liens)	236	0.9%	\$440.2	0.6%	1.1	\$1,865
First Price Sealed Bid						
Large Buyers (100 or more liens)	68,621	97.9%	\$237,216.5	96.7%	3.1	\$3,457
Meduim Buyers (10 to 99 liens)	1,171	1.7%	\$7,137.0	2.9%	2.4	\$6,095
Small Buyers (1 to 9 liens)	279	0.4%	\$1,003.7	0.4%	2.6	\$3,598
	Collar Counties					
	No. Liens		Tax Delinquency ~		Mean	
	Purchased	Percent	Purchased	Percent	Winning Interest Rate	Delinquent Tax Bill
English - Matching						
Large Buyers (100 or more liens)	26,351	66.9%	\$116,939.6	68.8%	6.3	\$4,438
Meduim Buyers (10 to 99 liens)	12,341	31.3%	\$50,787.9	29.9%	7.0	\$4,115
Small Buyers (1 to 9 liens)	706	1.8%	\$2,271.2	1.3%	7.7	\$3,217
English - Non-Matching						
Large Buyers (100 or more liens)	48,409	80.7%	\$246,262.5	83.0%	4.1	\$5,086
Meduim Buyers (10 to 99 liens)	10,516	17.5%	\$46,729.9	15.7%	4.8	\$4,444
Small Buyers (1 to 9 liens)	1,060	1.8%	\$3,804.7	1.3%	5.4	\$3,589

* Buyer volume was measured at each auction. For example a large buyer in the 2010 Cook County annual tax sale purchased 100 or more liens during that auction not including previous activity.

~ Adjstued for inflation and presented in thousands of 2010 \$

TABLE 5.6.1 - Empirical Results - Logit
Cook County

Y: One if lien was Sold	Coefficient	Δ in Probability	Standard Deviation (S.D.)	Δ in Probability in Δ of One S.D.
First Price Sealed Bid ~	-0.2156** (0.0864)	-0.0166		
Delinquent Tax Bill (\$ Thousands)	-0.0115*** (0.0031)	-0.0009	10.9	-0.3055
Est. Market Value (\$ Thousands)	0.0004*** 0.0001	<0.0000	563.8	0.5477
Residential Improved ~	1.4542*** (0.0610)	0.1290		
Vacant ~	-1.9184*** (0.0903)	-0.2785		
Late Offer ~	-0.3424* (0.1203)	-0.0297		
Reoffered ~	-2.1578* (0.12504)	-0.3451		
Township Fixed Effect	Yes			
N	123,849			
Iterations	5			
Log-Likelihood Function	-122,232.6			
R-Squared	0.3308			

- Robust standard errors reported; ~ dy/dx is for discrete change of dummy from 0 to 1 Tax delinquency weighted.

*** Significant at 1percent Level; ** Significant at 5 percent level; * Significant at 10 percent level

TABLE 5.6.2 - Empirical Results - Logit
Collar Counties

Y: One if lien was Sold	Coefficient	Δ in Probability	Standard Deviation (S.D.)	Δ in Probability in Δ of One S.D.
English - No Matching ~	-0.1492 (0.1391)	-0.0003		
Delinquent Tax Bill (\$ Thousands)	-0.0005 (0.0011)	<-0.0000	8.3	-0.0144
Est. Market Value (\$ Thousands)	0.0014** (0.0007)	<0.0000	382.3	1.8593
Residential Improved ~	3.2527* (0.2400)	0.0199		
Vacant ~	-1.5954* (0.2658)	-0.0066		
Late Offer ~	-0.6231 (0.1951)	-0.0014		
Township Fixed Effects	Yes			
N	109,354			
Iterations	7			
Log-Likelihood Function	-28,109.6			
R-Squared	0.3798			

- Robust standard errors reported; ~ dy/dx is for discrete change of dummy from 0 to 1 Tax delinquency weighted.

*** Significant at 1percent Level; ** Significant at 5 percent level; * Significant at 10 percent level

TABLE 5.6.3 - Empirical Results - OLS

Cook County

	All Property	Residential	Vacant &
	Coefficient	Improved	Other
Y: Interest Rate	OLS	OLS	OLS
First Price Sealed Bid	0.9661*** (0.0821)	1.2464*** (0.0319)	0.4217** (0.1729)
Delinquent Tax Bill (\$ Thousands)	0.0014 (0.0018)	0.0082 (0.0054)	0.0002 (0.0013)
Est. Market Value (\$ Thousands)	<-0.0000 (<0.0000)	<-0.0000 (0.0001)	<-0.0000 (<0.0000)
Residential Improved	-1.3487*** (0.0594)	- -	- -
Vacant	1.4780*** (0.1094)	- -	- -
Late Offer	0.2991** (0.1328)	0.4856*** (0.0418)	-0.0516 (0.3466)
Reoffered	-0.0970 (0.0809)	-0.0156 (0.0419)	-1.1502*** (0.2345)
Buyer Fixed Effect	Yes	Yes	Yes
Township Fixed Effect	Yes	Yes	Yes
N	123,849	83,767	40,082
R-Squared	0.8543	0.8390	0.8328

Notes: Robust standard errors reported. Tax delinquency weighted.

*** Significant at 1percent Level; ** Significant at 5 percent level; * Significant at 10 percent level

TABLE 5.6.4 - Empirical Results - OLS

Collar Counties

	<u>All Property</u>	<u>Residential</u>	<u>Vacant &</u>
	<u>Coefficient</u>	<u>Improved</u>	<u>Other</u>
Y: Interest Rate	OLS	OLS	OLS
English - No Matching	-1.9892*** (0.0601)	-1.9636*** (0.0539)	-1.8601*** (0.1567)
Tax Delinquency (\$ Thousands)~	-0.0014*** (0.0005)	0.0005 (0.0019)	0.0001 (0.0007)
Est. Market Value (\$ Thousands)	<-0.0000 (<0.0000)	0.0002 (0.0002)	-0.0001*** (<0.0000)
Residential Improved	-0.5689*** (0.0795)	-	-
Vacant	2.3782*** (0.1126)	-	-
Late Offer	-0.3146*** (0.0550)	-0.4400*** (0.0625)	-0.0120 (0.1223)
Buyer Fixed Effect	Yes	Yes	Yes
Township Fixed Effect	Yes	Yes	Yes
N	109,354	71,718	37,636
R-Squared	0.5546	0.4921	0.6134

Notes: Robust standard errors reported. Tax delinquency weighted.

*** Significant at 1 percent Level; ** Significant at 5 percent level; * Significant at 10 percent level

Table 5.6.5 - Empirical Results - OLS
Cook & Collar Counties -Censored Regressions

Y: Interest Rate	Winning Interest Rate = 0		Winning Interest Rate = 0
	Coefficient OLS		Coefficient OLS
English - No Matching	-0.0050*** (0.0010)	First Price Sealed Bid	-0.2022*** (0.0101)
Tax Delinquency (\$ Thousands)~	0.0001 (0.0001)	Tax Delinquency (\$ Thousands)~	-0.0002 (0.0003)
Est. Market Value (\$ Thousands)	<0.0000 (<0.0000)	Est. Market Value (\$ Thousands)	<0.0000 (<0.0000)
Residential Improved	-0.0020 (0.0022)	Residential Improved	0.1914*** (0.0098)
Vacant	0.0034 (0.0026)	Vacant	-0.0783*** (0.0113)
Late Offer	-0.0203*** (0.0018)	Late Offer	-0.0153 (0.0107)
Reoffer	- -	Reoffer	0.0606*** (0.0173)
Buyer Fixed Effect	Yes		Yes
Tax District Fixed	Yes		Yes
N	109,354		123,849
R-Squared	0.6641		0.3653

Notes: Robust standard errors reported. Tax delinquency weighted.

*** Significant at 1percent Level; ** Significant at 5 percent level; * Significant at 10 percent level

VITA

NAME: Joshua J. Miller

EDUCATION: B.B.A., Finance, University of New Mexico, December 2000

M.B.A, Management Information Systems, College of Santa Fe, May 2002

M.A., Economics, University of Illinois at Chicago, May 2009

FIELDS OF INTEREST: Public Economics, Labor and Demographic Economics

EXPERIENCE: Instructor, ECON 370, Department of Economics, University of Illinois at Chicago, Spring 2012

Instructor, ECON 218, Department of Economics, University of Illinois at Chicago, Fall 2011

Instructor, ECON 121, Department of Economics, University of Illinois at Chicago, Spring 2011

Research Assistant to Professor Nathan Anderson, Institute of Government & Public Affairs, University of Illinois at Chicago, 2008 -2010

Instructor, ECON 121, Department of Economics, University of Illinois at Chicago, Summer 2010

Instructor, ECON 120, Department of Economics, University of Illinois at Chicago, Summer 2009

Senior Budget Analyst/Team Leader, Los Alamos National Laboratory – University of California, 2001-2007

Finance Intern, Pulakos & Alongi, Ltd., 1999-2000

PUBLICATIONS: Anderson, Nathan, and Joshua J. Miller. *The Illinois Economy: Taxing Business*. The Illinois Report 2009. Institute of Government & Public Affairs.

VITA (CONTINUED)

HONORS AND AWARDS:	Graduate Student Paper Competition – 1st Prize, University of Illinois at Chicago, 2011-2012. Graduate Student Paper Competition – 2nd Prize, Illinois Economics Association, 2011. C.Lowell Harriss Dissertation Fellowship, Lincoln Institute of Land Policy, 2010-2011. CBA Liautaud Fellowship, University of Illinois at Chicago, 2007-2010.
PROFESSIONAL MEMBERSHIPS:	American Economic Association, Midwest Economic Association, Illinois Economic Association, Mid-Continent Regional Science Association