The Effect of Increasing the Number of Property Tax Payment Installments
on the Rate of Property Tax Delinquency

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Abstract

At a time when property tax revenues are falling across the country, it is important to consider the impact property tax administration has on reducing delinquency. In particular, the number of installments may have an effect on delinquency. This study investigates the relationship between the number of annual payment installments and the property tax delinquency rate using multivariate regression techniques and five years of data from Wisconsin municipalities. The results of the analysis indicate that increasing the number of installment payments from two to three per year reduced the delinquency rate by nearly a 1.2 percentage point decrease in delinquency. Allowing more than three installments, however, did not lead to a statistically significant reduction in the property tax delinquency rate.
Keywords: Property tax, Delinquency, Installments, Administration

About the Author

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Acknowledgements

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Introduction

The property tax delinquency rate has risen in many Wisconsin communities over the past couple years. The rise in the delinquency rate is undoubtedly related to the Great Recession and to the near collapse of the U.S. housing market. In Wisconsin as elsewhere, housing prices have dropped sharply and the foreclosure rate has increased dramatically. At the same time, the unemployment and poverty rates have risen throughout the state. The economic situation has complicated the financing of municipal and county governments in Wisconsin. The 2011-13 biennial state budget reduced state financial assistance to local governments and included a provision to freeze property tax levies (Walker, 2011). With the state-imposed limit on tax levies, municipal and county governments may not be able to rate property tax rate to replace delinquent property tax payments. They are thus under increasing pressure to take whatever steps possible to reduce the rate of property tax delinquency.

While treasurers and local government officials have almost no ability to influence economic and housing market trends, they may be able to affect the rate of property tax delinquency by making administrative changes in the property tax collection process. By reducing delinquency rates, local governments may therefore gain "revenue frequently not available through other means" (Mikesell, 1976, p. 41). Of particular interest is the impact the number of payment installments has on real estate property tax delinquency rates. The State of Wisconsin provides a good environment to address this question. While some jurisdictions allow (non-escrow) property taxpayers to pay their annual property tax bills in two installments, other municipalities allow more than two installments. Jurisdictions also vary in their utilization of other administrative and collection practices, such as imposing late penalties and issuing reminder notices.

The core of this study will be a multivariate regression analysis designed to explain variations across jurisdictions and over time in the property tax delinquency rate, with the variable of particular interest being the number of allowable installment payments. The study will involve gathering data on delinquency rates, on the number of installment payments allowed, and on other administrative characteristics of the collection process, such as penalties for late payments, and other economic, housing market, and institutional variables that might help explain variations in property tax delinquency rates. Hopefully, results from this regression analysis will help inform administrative practices, property tax policy, and future research.

Background

Property tax administration varies greatly across Wisconsin, and can even vary within each of its 72 counties. One of the largest variations is in the number of real estate property tax payment installments and who collects these installments. (Personal property taxes, by contrast, are not allowed to be collected in multiple installments in Wisconsin.) Of Wisconsin's 1850 municipalities, approximately only 60 have ordinances allowing multiple (i.e. more than two) installments for real estate taxes (Wisconsin Department of Revenue, 2011a). These municipalities are generally larger, as 22 of Wisconsin's 38 municipalities with populations over 20,000 administer multiple installments. Of these installment options, the standard way for Wisconsin counties and municipalities to administer property tax payments is with two installments, with at least half of one's taxes being due on January 31 and the rest due on July

31. However, if a municipality or county passes an ordinance it may have more than two installments for property taxes (Wis. Gen. Law. ch. 74, § 11-12, 2010). If a jurisdiction adopts such a measure, the final installment must still be due on July 31 of the year. The City of Milwaukee is a special case in the state in that it has 10 installments due at the end of every month from January through October (Olin, 2011).

The literature on the effect of property tax administration on delinquency is limited and existing research comes to different conclusions about the optimal number of payment installments. For example, Lowell (1976) argued that multiple installments may be more convenient and easier to pay for citizens. Similarly, Anderson and Dokko's (2009) study of California, Minnesota, and Maryland concluded that "the payment shock associated with property tax bills accelerates the pace of mortgage delinquency" (p. 55). The authors' (2009, 2011) results indicated that escrow accounts, which break up payments into multiple installments, may help reduce delinquency. In their recent examination of the effect of escrow accounts, Carbal and Hoxby's (2010) also suggest that breaking property tax payments over multiple installments may make people less opposed to higher tax rates. To the extent that multiple payments administered by local governments mimic escrow accounts, these research results indicate that they may then help jurisdictions raise more revenue. By contrast, O'Flaherty (1990) argued for less (preferably only one, in his view) payment installment. He supports this by stating that multiple installments "provide strong incentives for inefficient speculation with public funds, and these incentives have caused serious dislocations in urban real estate markets" (p. 305). Such speculation is then argued to cause more people to choose to go into delinquency. A review of the existing literature discovered no previous efforts to estimate the effect of local government installment practices on delinquency.

It is important to consider how jurisdictions handle and penalize delinquencies. In Wisconsin municipalities with two-installments, if a property owner does not pay at least half of his or her tax bill by February 1st, then he or she is labeled as delinquent. Being characterized as delinquent forfeits the right to pay in multiple installments and forces the taxpayer to pay the full year's tax immediately. One similarly becomes delinquent if all taxes are not paid within five days of the second installment's due date. If there are more than two installments, a taxpayer becomes delinquent if any installment is not paid in full. Again, the taxpayer must then pay all taxes immediately and the taxpayer remains in delinquent status for the rest of the year. However, in Milwaukee's ten installment system one does not forfeit the right to pay in multiple installments if one is late on a single payment (Klajbor, 2011). Delinquent property taxes are charged an interest rate of 1 percent a month "from the preceding February 1, as opposed to the day on which they become delinquent" (Olin, 2011, p. 14). Counties also are able to charge an additional 0.5 percent penalty per month if the county chooses, and after two years the county can sell a property whose owner remains delinquent.

Collection methods for delinquent payments vary across and within Wisconsin counties. Some municipalities collect their own delinquent taxes, while many others give the county this responsibility. If counties are responsible, then after the collection period they are required to pay municipalities any owed taxes (Olin, 2011). Counties are often able to keep the revenues gained by charging the 0.5 percent penalty; however, if the county fails to collect the full amount owed, it is still required to pay municipalities in full (Gawenda, 2011).

Methodology

In order to investigate how the probability of being delinquent relates to various administrative procedures, including the number of installment payments allowed, information on delinquency rates and other factors was collected for the years 2005 through 2009.

Dependent Variable: Delinquency Rates

Being the dependent variable under examination, delinquency rates are the most important information to gather. However, in Wisconsin this was the most difficult data to compile and compare across municipalities. The state does not collect delinquency amounts for the July 31 deadline in two installment municipalities and does not make available any delinquency data for multiple installment municipalities. Instead, these data must be collected by contacting each individual municipal or county treasurer and asking for the data. Overall, I contacted over 50 local government officials for delinquency data. Of these, 37 municipalities were able to provide data in a timely fashion. See Appendix A for a list of participating municipalities. In Wisconsin, some cities and villages belong to multiple counties, each with different tax rates and government administration. If a municipality belonged to multiple counties then each county's portion of that municipality was treated as if it was its own municipality. Some officials could not provide information for each year requested. While some municipalities had delinquency amounts and rates readily available electronically, others only had paper files that needed to be inputted into the computer or scanned. Across the state the availability, specificity, and dates attributed to delinquency rates varied.

While each municipality and county is required to fill out certain forms at different stages of the property tax collection process, such as the "sale book" report after the August settlement for delinquencies, municipalities organize and store their records differently. Despite attempts to get uniform data from officials the dates which municipalities and counties claimed to have information varied as well. Given the time constraints of this study, some counties were only able to provide information for the July 31 payment deadline while others provided information from after the August settlement process, and still others provided data at the end of calendar year. Many treasurers and administrative officials stressed that to make an "apples to apples" comparison between delinquency rates such variations needed to be controlled for. Others believed that the difference between the data after July 31 and after the settlement process was negligible. To compare as accurately as possible across municipalities, I included dummy variables in the regression that separates delinquency rates between information from soon after the July 31 deadline, the Sept. 1 "sales book" report, and end of the year records.

Finding a standard way to calculate total tax levies for local governments posed further difficulties in collecting property tax delinquency rates. Wisconsin municipalities receive tax credits from the state that act as property tax relief. These include the school levy credit, which is based on the "municipality's share of statewide levies" (Runde, 2011, p. 2); the lottery and gaming credit, which distributes a portion of state revenues from those sources; and the first dollar credit, which is distributed by multiplying a property's "gross school tax rate by a credit base value … or the property's fair market value, whichever is less" (ibid., p. 3). To compute a

municipality's "net general tax" these credits are subtracted from gross taxes (Olin, 2011). The delinquency rate is the amount delinquent divided by the net general tax levied on a municipality. Delinquency rates provided by municipalities would ideally be calculated using net levy figures. However, some municipalities were only able to provide gross levy figures in time for this report. To help control for this (as a gross levy denominator would create smaller percentages of delinquency than a net levy denominator), I created a dummy variable to control for municipalities that provided net versus gross levy amounts. Municipalities for which this could not be determined were coded as missing for this variable.

Ideally delinquency amounts and levy totals would also only include real estate property taxes and not any special charges. Such charges were separated out when possible, but many municipalities were not able to do so. Because such charges are included both in a jurisdiction's total levy as well as delinquent amounts, these figures may not bias delinquency rates greatly. The effect of having these charges included in many observations is assumed to be negligible, but the variation across observations should be noted. Again, these variations in levy and delinquency amounts were primarily because of differences in reporting mechanisms and administrative capacity.

Independent Variables

To help control for various factors that might have an impact on delinquency rates, I collected information on a variety of independent variables for Wisconsin's municipalities. Some of these measures (i.e. poverty rates, unemployment rates, and FHFA Housing Price Index) were not available for smaller municipalities. In these instances county, metropolitan statistical area, or state-level data were used. Whether a municipality has two or more installments was the most important independent variable for the purposes of this study. If reminder notices are sent prior to installment due dates and if a jurisdiction charges the optional extra 0.5 percent penalty rate for delinquency were also included as independent variables. Recent regression analysis evidence from Berger, Collins, Fuchs, Ley, and Rosen (2011) found that sending reminder notices and charging higher penalties were strongly correlated with lower delinquency rates for special fees for property taxes. The logic behind these results extends to real estate property taxes as well. This information was provided by treasury officials. Another administrative variable to consider is the property tax rate. Mikesell (1976) found a highly significant correlation between property tax rates and delinquency, and therefore Wisconsin Department of Revenue (2005a, 2006a, 2007a, 2008a, 2009a) municipal-level average full effective tax rate data were used in this analysis.

Beyond administrative factors, information on several other important socioeconomic and housing market variables were collected that may impact property tax delinquency. Population for each municipality was collected from Wisconsin's Department of Revenue (2006b, 2008b, 2009b, 2010a, 2011b). Poverty rates were collected from the U.S. Census Bureau's American Community Survey (American Community Survey, 2011). For larger municipalities these data were available for each year from 2005 through 2009, while for smaller municipalities poverty rates were either only available as a five year average or, if the municipality was too small to be covered by the survey, county level poverty rates were used instead. The same issues applied to

unemployment levels, though for these figures data were compiled from Wisconsin's Department of Workforce Development's (2011) WORKnet online database.

It is also important to consider the potential impact of changes in the housing market on property tax delinquency. If housing values drop below the value of outstanding mortgages, homeowners are more likely to become delinquent on their mortgage payments and face the possibility of foreclosures. In those cases, the probability of property tax delinquency. I measure changes in housing prices by using the repeat-sale housing price index produced by the Federal Housing Finance Agency (2011a, 2011b). As illustrated by Figure 1, housing prices have fallen in Wisconsin in recent years.

Figure 1: Wisconsin Housing Price Index 2005-2009
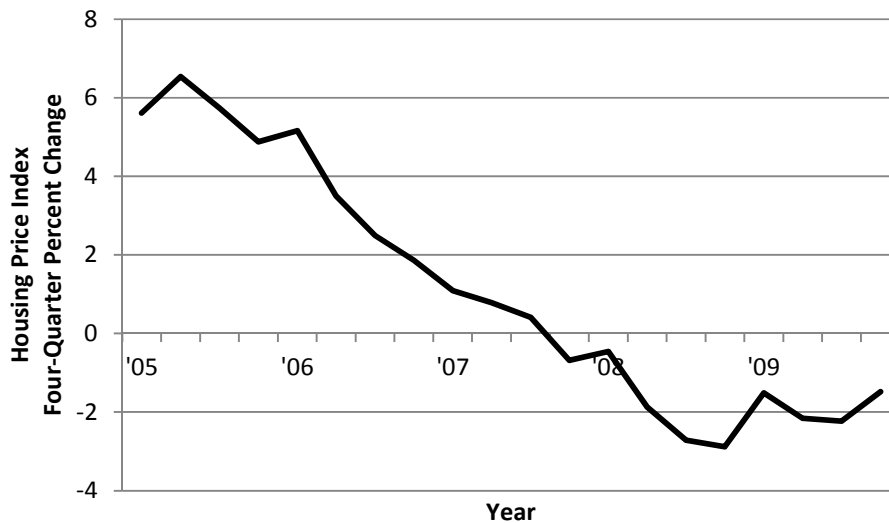
Source: Author, using Federal Housing Finance Agency (2011b) data

For similar reasons I included per-capita equalized property values for Wisconsin municipalities. The proportion of equalized property values that is residential also was added to control for the possibility that residential property is more likely to become delinquent. As shown in Figure 2, total state equalized property values have plateaued after having risen for years. Fortunately, Wisconsin Department of Revenue (2006c, 2007b, 2008c, 2009c, 2010b) equalized value data is available for each municipality for 2005-2009. These figures were then divided by each jurisdiction's population to attain per capita values.

Finally, it was important to capture the effect of foreclosures on delinquency. To do this, RealtyTrac (2011) data were used. Unfortunately, only April, 2011 data is currently publicly available. While using this data for each observation for 2005-2009 is admittedly a very crude estimate, it still captures differences across municipalities in the frequency of foreclosures and provides an indicator of especially weak housing markets. See Appendix B for a list for descriptive statistics for all variables included.

Figure 2: Wisconsin Equalized Property Values 2005-2009
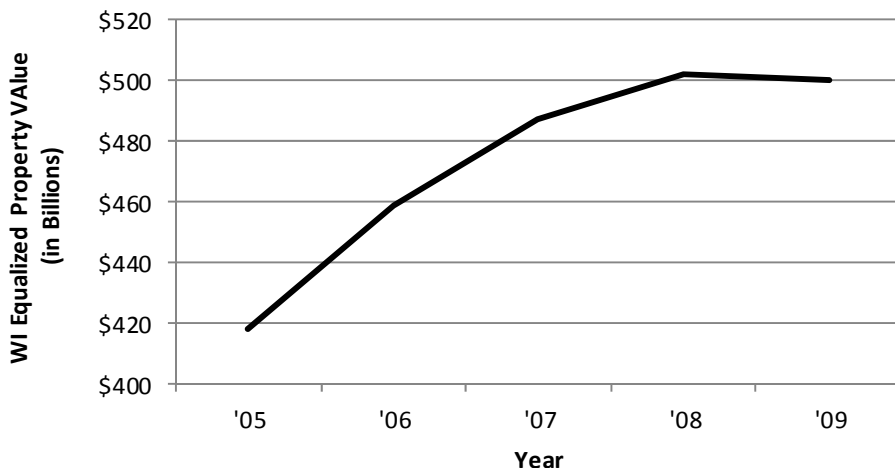
Source: Author, using Wisconsin Department of Revenue (2011c) data.

Variables considered but not included

I initially hoped to capture the "5 working day" grace period for each deadline established with the 2005 Wisconsin Act 349 (Wisconsin State Legislature, 2006). Since this grace period only became effective for collections in 2007 for the 2006 tax year, delinquency rates may be lower in the years after the implementation of grace periods. In the end, a dummy variable controlling for the years with a grace period was not included for two reasons. First, the dummy variable caused multicollinearity issues as the variable appeared to be capturing socioeconomic and housing market factors, already included in the regression model. Second, including a grace period would be most helpful if data were collected for each deadline date. For most instances this was not the case, however.

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Results

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Holding the discussed independent variables constant, I ran a multivariate regression to test the following null and alternate hypotheses relating to the effect of administrative practices on real estate property tax delinquency:

H_{01}: There is no difference in delinquency when a municipality has multiple payment installments
H_{A1}: Having multiple (more than two) installments correlates with lower delinquency rates

H_{02}: Having reminder notices sent ahead of installment deadlines has no effect on delinquency rates
H_{A2}: Having reminder notices sent ahead of installments correlates with lower delinquency rates

H_{03}: The optional penalty for delinquency has no effect on delinquency rates
H_{A3}: Greater penalties for delinquency correlate with lower delinquency rates

To test these hypotheses information for 185 observations was incorporated into an Ordinary Least Squares (OLS) regression. A time-series fixed effects model could not be used because the binary variables for notices and penalties in this model did not vary within any municipality over the observed years. As part of this OLS regression, clustered robust standard errors were incorporated to control for heteroskedasticy (when the variation in a regression's error terms is different across observations) and for variation within municipalities across observations due to unobserved characteristics of that specific municipality. Equation 1 uses a dummy variable to indicate municipalities that collected property taxes using multiple (more than two) installments.

Equation 1: Ordinary Least Squares Regression for Delinquency Rates

$$\gamma[\text{Percent delinquent}] = \beta_0 + \beta_1[\text{Multiple installments}] + \beta_2[\text{Population}]$$
$$+ \beta_3[\text{Housing Price Index}] + \beta_4[\text{Percent foreclosure}] + \beta_5[\text{Per capita equalized}$$
$$\text{property value}] + \beta_6[\text{Percent average effective tax rate}] + \beta_7[\text{Percent unemployment}]$$
$$+ \beta_8[\text{Percent poverty}] + \beta_9[\text{Reminder notices}] + \beta_{10}[\text{Penalty}] + \beta_{11}[\text{Net levy}]$$
$$+ \beta_{12}[\text{Sept. 1 sale book data}] + \beta_{13}[\text{Post-sale book data}] + \varepsilon[\text{Error}]$$

The dummy variable for July-August (pre-sale book) data was not be included in the regression because of multicollinearity, and is instead part of the constant term.

In this initial regression, shown in Table 1, the percent in poverty, the per capita equalized property value, and an indicator of whether the data came from the sale book period were statistically significant at the 95 percent confidence level ($p < 0.05$). The Housing Price Index and the foreclosure rate were the only variables significant at the 99 percent confidence level ($p < 0.01$). For these two variables the small coefficient on the Housing Price Index (-0.0914) illustrates a relatively small effect size on delinquency rates, compared to a nearly 7 percentage point increase in delinquency a one percentage point increase in the foreclosure rate. The key variable of interest, the dummy variable for a municipality that has multiple installments, was not quite statistically significant, with a p-value of 0.141. That is, there is an 85.9 percent probability that the true effect of having multiple installments will decrease delinquency between 1.822 and 0.267 percentage points, with an estimated effect of a 0.776 percentage point decrease. Because this estimate did not have a p-value of less than 0.05, there is insufficient statistical evidence with this regression model to suggest that simply having more than two installments, regardless of the number, decreases delinquency. The variables indicating whether a jurisdiction provides reminder notices or utilizes the extra 0.5 percent penalty were not statistically significant, with p-values of 0.641 and 0.550, respectively. Hypotheses H_{A2} and H_{A3} in this model are thus not statistically supported.

The "goodness of fit" of this model, identified by the adjusted R-squared statistic, was 0.5734. This is a quite high R^2 considering the imprecision of some of the independent variables and the complexity and range of factors that contribute to property tax delinquency.

Table 1: Regression Results with a Dummy Variable for Multiple Installments, with Percent Delinquent as the Dependent Variable

Variables	Coefficients	T-test statistic	P-value
Multiple Installments	-0.7765	-1.51	0.141
	(0.5158)		
Population	-0.00000161	-0.72	0.476
	(0.00000224)		
Housing Price Index	-0.0914***	-3.76	0.001
	(0.0243)		
Percent foreclosure	7.1620***	3.22	0.003
	(2.2245)		
Per capita equalized property value	-0.000013**	-2.63	0.013
	(0.00000494)		
Percent average effective tax rate	-0.2323	-0.29	0.776
	(0.8103)		
Percent unemployment	0.000185	0.53	0.600
	(0.000350)		
Percent poverty	0.0851**	2.107	0.046
	(0.0411)		
Reminder Notices	0.2387	0.47	0.641
	(0.5069)		
Penalty	0.2573	0.60	0.550
	(0.4258)		
Net levy data	0.5311	1.31	0.197
	(0.4042)		
Sept. 1 sale book data	1.7373**	2.54	0.016
	(0.6843)		
Post-sale book data	-0.6852*	-1.75	0.089
	(0.3925)		
Constant	1.5242	0.76	0.451
	(1.9989)		
Observations	185		
R-squared	0.5734		

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Robust standard errors are in parentheses. The coefficients represent the estimated change in percent delinquency from either a one percent change or (if the variable is a dummy variable) if the observation has that characteristic, holding all other factors constant.

Using a dummy variable to indicate the use of multiple installments may not be the best or most accurate way of estimating the effect of installments on delinquency. To better examine the effects of having three, four, or (in Milwaukee's case) ten installments, dummy variables were included for each of these. Doing so allows one to see the impact for each of these on delinquency compared to the standard two-installments.

This regression model seeks to test the following additional hypotheses:

H_{04}: Having three installments has no significantly different effect on delinquency than two installments
H_{A4}: Having three installments correlates with lower delinquency than two installments

H_{05}: Having four installments has no significantly different effect on delinquency than two installments
H_{A5}: Having four installments correlates with lower delinquency than two installments

H_{06}: Having ten installments has no significantly different effect on delinquency than two installments
H_{A6}: Having ten installments correlates with lower delinquency than two installments

It is also worth noting that since Milwaukee is the only municipality with ten (let alone more than four) installments in the state, having a dummy variable for ten installments is in effect a dummy variable for the City of Milwaukee.

Equation 2: Regression Model with Dummy Variables for Three, Four, and Ten Installments

$$Y[\text{Percent delinquent}] = \beta_0 + \beta_1[\text{Three installments}] + \beta_2[\text{Four installments}]$$
$$+ \beta_3[\text{Ten Installments}] + \beta_4[\text{Population}] + \beta_5[\text{Housing Price Index}]$$
$$+ \beta_6[\text{Percent foreclosure}] + \beta_7[\text{Per capita equalized property value}]$$
$$+ \beta_8[\text{Percent average effective tax rate}] + \beta_9[\text{Percent unemployment}]$$
$$+ \beta_{10}[\text{Percent poverty}] + \beta_{11}[\text{Reminder notices}] + \beta_{12}[\text{Penalty}]$$
$$+ \beta_{13}[\text{Net levy}] + \beta_{14}[\text{Sept. 1 sale book data}] + \beta_{15}[\text{Post-sale book data}] + \varepsilon[\text{Error}]$$

The results from estimating equation 2 are shown in Table 2. Compared to equation 1, housing market and socioeconomic variables, as well as municipal population have increased statistical significance. This indicates that the previous model's dummy variable for multiple installments was correlated with many of these factors, thus making it difficult to identify the independent effect of these other variables. In this model the housing price index, and the percent in foreclosure remained highly significant ($p<0.01$) predictors of delinquency. Of these, the percent foreclosure still had by far the largest impact on delinquency, as a one percentage point increase in a jurisdiction's foreclosure rate (the number of properties out of 1000 that are foreclosed) correlates with an estimated 7.22 percentage point increase in delinquency. The percent of a population in poverty was statistically significant at the 95 percent confidence level, but the effect size of this on delinquency is very small.

Several of the administrative variables did not meet statistical significance in this model. The fact that the property tax rate variable is not significant may reflect that the variation in tax rates across the sample is quite small. Whether a municipality sent reminder notices was not statistically significant. Having the extra penalty for delinquency was also statistically insignificant. Thus, there is insufficient evidence to support H_{A2} and H_{A3}. Perhaps, an increase in the late payment penalty would have a measureable impact on the delinquency rate.

The dummy variable for having three installments had a p-value of 0.031 with a coefficient of -1.23. Holding all other factors constant, there is thus a 96.9 percent probability that there is between a 1.77 and 0.682 percentage point decrease in delinquency from having three installments as opposed to two installments, with an estimated effect of a -1.23 percentage point decrease in delinquency. For a municipality that had the average delinquency rate for this sample, 2.49 percent, adding a third installment may reduce the delinquency rate by nearly half. This provides sufficient statistical evidence to reject H_{04} and support H_{A4}.

The variable for having four installments is statistically insignificant. One reason for this high p-value is that there were relatively few observations with four installments (nearly half that of those in the sample with three installments); fewer observations increase standard errors and make it more difficult to reach statistical significance. Alternatively, these results may suggest that while there may be a benefit from adopting three installments over two, the marginal benefit of adding a fourth installment is not statically significant. Finally, there is the possibility that some unobserved characteristics correlated with four installment municipalities that could affecting these results.

The variable for ten installments returned a p-value of 0.052, which is significant at the 90 percent confidence level ($p<0.10$), but the direction of the coefficient is positive instead of negative. It is important to emphasize that as only Milwaukee utilizes ten installments, this variable serves as a Milwaukee dummy variable. As the average delinquency rate in Milwaukee, 3.78 percent, is higher than the state average, the ten installment variable is really reflecting this higher rate. It is likely that other unmeasured factors, unrelated to the frequency of property tax payments, are driving the higher rate of delinquency in Milwaukee.[1]

With an R-squared of 0.62, 62 percent of the variation in delinquency is explained by the independent variables included in this regression. Again, this suggests a relatively strong "goodness of fit" for this regression model.

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[1] When population was removed from the equation, the coefficient to the ten installment variable became negative and insignificant. Also, taking the ten installment variable out of the regression produces virtually no change in the other regression coefficients.

Table 2: Regression Results with Dummy Variables for Three, Four, and Ten Installments, with Percent Delinquent as the Dependent Variable

Variables	Coefficients	T-test statistic	P-value
Three installments	-1.2276**	-2.25	0.031
	(0.5458)		
Four installments	-0.3115	-0.75	0.460
	(0.4166)		
Ten installments	4.229*	2.01	0.052
	(2.104)		
Population	-0.00000946**	-2.45	0.019
	(0.00000386)		
Housing Price Index	-0.0834***	-3.56	0.001
	(-0.0234)		
Percent foreclosure	7. 2164***	3.59	0.001
	(2.0080)		
Per capita equalized property value	-0.0000113**	-2.21	0.033
	(0.00000512)		
Percent average effective tax rate	-0.4259	-0.55	0.588
	(0.7785)		
Percent unemployment	0.0002	0.76	0.450
	(0.0003)		
Percent poverty	0.0966**	2.55	0.015
	(0.0379)		
Reminder Notices	-0.0309	-0.06	0.951
	(0.5047)		
Penalty	0.3070	0.77	0.445
	(0.3972)		
Net levy data	0.5647	1.28	0.208
	(0.4401)		
Sept. 1 sale book data	1.6366**	2.50	0.017
	(0.6540)		
Post-sale book data	-0.8392**	-2.28	0.029
	(0.3684)		
Constant	2.1423	1.09	0.283
	(1.9658)		
Observations	185		
R-squared	0.6201		

*** p<0.01, ** p<0.05, * p<0.1

Robust standard errors are in parentheses. The coefficients represent the estimated change in percent delinquency from either a one percent change or (if the variable is a dummy variable) if the observation has that characteristic, holding all other factors constant.

Implications and Conclusions

Despite the limitations encountered in this regression analysis, there are relevant conclusions with real policy implications. First, the revised regression model indicates that housing market and socioeconomic factors are indeed important to control for, and that the recent recession has taken a toll on citizens and municipalities alike. To help raise revenue, jurisdictions in Wisconsin may wish to consider imposing the optional 0.5 percent per month penalty for delinquencies. This analysis suggests that such a penalty is small enough to not significantly increase delinquency.

This analysis also results shed light on the important question of how the number of payment installments impacts delinquency. The results provide strong statistical evidence that having three installments as opposed to two leads to a 1.23 percentage point decline in delinquency. For the average Wisconsin municipality surveyed, this reduces delinquency in half. Having four installments, by contrast, appears to not provide a marginal benefit great enough to say with statistical significance that four installments are an improvement. The limited nature of the sample used in this study makes it difficult to assess the impact of Milwaukee's ten installment system. Currently the number taxpayers with escrow accounts, which break property tax payments into several installments, is rising. Some large lenders, such as JPMorgan Chase, have since 2007 required escrow accounts for all new subprime loans (Anderson and Dokko, 2009). All Federal Housing Administration approved mortgages require escrow accounts as well (U.S. Federal Housing Administration, 2011). Over time, the importance of the number of property tax payment installments may decline as the proportion of taxpayers using escrow accounts increases. Each jurisdiction must judge for itself if the estimated benefits of reducing delinquency by going to a three installment system outweigh any potential administrative costs in doing so. However, this study's results provide valuable information that help inform such decisions as well as inform future research on property tax administration.

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Appendix A: Table of Municipalities Providing Data

The following table lists the municipalities participating in this study, with some simple descriptive statistics for each.

Table A.1: Participating Municipalities

Municipality	County	2009 Population	Installments	Extra penalty	Reminders
Appleton	Outagamie	60,200	3	No	No
Appleton	Winnebago	960	3	No	Yes
Ashwaubenon	Brown	17,820	2	Yes	Yes
Beloit	Rock	37,000	4	Yes	Yes
Brookfield	Waukesha	39,600	2	Yes	Yes
Cedarburg	Ozaukee	11,440	2	Yes	Yes
De Pere	Brown	22,780	2	Yes	Yes
Fitchburg	Dane	23,520	2	Yes	Yes
Franklin	Milwaukee	21,250	3	Yes	No
Germantown	Washington	19,930	2	Yes	No
Grand Chute	Outagamie	20,550	2	No	Yes
Green Bay	Brown	103,500	2	Yes	Yes
Greenfield	Milwaukee	36,300	3	Yes	No
Janesville	Rock	63,500	2	Yes	Yes
Madison	Dane	227,700	2	Yes	Yes
Manitowoc	Manitowoc	34,700	4	No	Yes
Marshfield	Wood	18,750	2	No	Yes
Menasha	Winnebago	17,437	4	No	Yes
Menomonee Falls	Waukesha	34,600	2	Yes	Yes
Mequon	Ozaukee	23,660	2	Yes	Yes
Milwaukee	Milwaukee	584,000	10	Yes	Yes
Muskego	Waukesha	23,100	3	Yes	Yes
Neenah	Winnebago	25,800	4	No	Yes
New Berlin	Waukesha	39,300	3	Yes	Yes
Oak Creek	Milwaukee	32,600	4	Yes	No
Oshkosh	Winnebago	65,900	4	No	Yes
Port Washington	Ozaukee	11,200	2	Yes	Yes
South Milwaukee	Milwaukee	21,250	3	Yes	No
Stevens Point	Portage	26,200	2	Yes	Yes
Sun Prairie	Dane	26,100	2	Yes	Yes
Superior	Douglas	27,100	2	No	No

Municipality	County	2009 Population	Installments	Extra penalty	Reminders
Two Rivers	Manitowoc	12,570	3	No	Yes
Watertown	Jefferson	14,580	3	No	No
Watertown	Dodge	8,585	3	No	No
Waukesha	Waukesha	68,800	3	Yes	Yes
Wauwatosa	Milwaukee	45,800	3	Yes	No
West Allis	Milwaukee	60,600	3	Yes	No
West Bend	Washington	30,400	4	Yes	No

Appendix B: Summary Statistics for Regression Variables

The following table lists each variable incorporated in this study's regression models with descriptive statistics for each.

Table B.1: Variable Summary Statistics

Variable	Variable Type	N=	Mean	Std. Dev.	Min	Max
Multiple installments	Dummy/Binary	185	0.573	0.496	0	1
Three installments	Dummy/Binary	185	0.368	0.483	0	1
Four installments	Dummy/Binary	185	0.178	0.384	0	1
Ten installments	Dummy/Binary	185	0.027	0.163	0	1
Penalty	Dummy/Binary	185	0.632	0.483	0	1
Reminder notices	Dummy/Binary	185	0.562	0.497	0	1
Ney levy	Dummy/Binary	185	0.568	0.497	0	1
July-August data	Dummy/Binary	185	0.400	0.491	0	1
Sept. 1 sale book data	Dummy/Binary	185	0.286	0.453	0	1
Post-sale book data	Dummy/Binary	185	0.314	0.465	0	1
Percent delinquent	Discrete	185	2.489	1.892	0.004	12.084
Poverty rate	Discrete	185	10.250	5.356	2.578	26.210
April 2011 percent foreclosure	Discrete	185	0.186	0.072	0.031	0.350
Average full effective tax rate	Continuous	185	1.973	0.244	1.450	2.464
Housing Price Index	Continuous	185	1.643	3.691	-3.745	9.405
Per capita equalized property value	Continuous	185	84571	32794	38687	193898
Population	Continuous	185	52260	97208	932	592765
Average full effective tax rate	Continuous	185	1.973	0.244	1.450	2.464
Housing Price Index	Continuous	185	1.643	3.691	-3.745	9.405

For dummy/binary variables a 1 equals a "yes" to having that characteristic