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Foreclosures and local government revenues from the property tax: The case of Georgia school districts

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Abstract

Historically, local governments in the United States have relied on the property tax as their main source of own-source revenues. With the recent collapse of housing prices and the resulting increase in foreclosures that followed the "Great Recession", many observers have speculated that the local governments would suffer significant revenue losses, either immediately or in the near future. However, to our knowledge there is no existing work that examines the impacts of these recent foreclosures on property values and the subsequent impacts on property tax revenues and other dimensions of the property tax system. We use proprietary information from RealtyTrac on annual foreclosure "activity" (e.g., the flow of newly foreclosed properties into foreclosure filings), for the period 2006 through 2011, merged with information on local government revenues and economic data, to estimate the impacts of foreclosures on local government property tax revenues, as well as on market values and property tax levies. We focus on school districts in the State of Georgia, and address the question: How have recent foreclosures stemming from the Great Recession affected the property tax system of local governments? Across various specifications, we find that foreclosure activity had significant impacts on property tax bases, levies, and revenues.

Keywords: property tax, local government finance, assessment, tax base elasticity
JEL codes: H2, H7, R3, R5

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ABSTRACT

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1. Introduction

Historically, local governments in the United States have relied on the property tax as one of their main sources of own-source revenues. With the collapse of housing prices and the resulting increase in foreclosures that followed the "Great Recession", many observers speculated that local governments would suffer significant revenue losses, either immediately or in the near future. However, the actual impact of foreclosures on property tax revenues is, surprisingly, unknown at present. While there are several studies of the effect of foreclosures on value of foreclosed property and its immediate surrounding properties, to our knowledge there is no existing work that examines the impacts of these recent foreclosures on property tax revenues, as well as on other aspects of the property tax system. Our purpose in this paper is to explore the effect of foreclosures on the property tax base, its levy, and its revenues.

To conduct this research we obtained annual information from RealtyTrac for the period 2006 through 2011 on foreclosure "activity" (e.g., the flow of newly foreclosed properties into foreclosure filings).[1] For either activity or inventory data, these data are available at the zip code level. This period both precedes and follows the Great Recession, which lasted officially from December 2007 to June 2009. We use these data, along with demographic and economic controls, to estimate the impacts of foreclosures on property values, property tax levies, and revenues for school districts in the State of Georgia in an attempt to address the question: How have recent foreclosures stemming from the Great Recession affected the property tax system of local governments?

We focus on a single state (Georgia) rather than all states or a group of states. Looking at differences across local school systems within a single state has some advantages over considering differences across states. By focusing on a single state, we need not consider how to control for the

[1] These propriety data were purchased from RealtyTrac, with the Lincoln Insitute of Land Policy providing funding for the purchase. RealtyTrac also provides these data on a monthly and quarterly basis, and also makes available information on the "inventory" of foreclosed properties (e.g., the stock of foreclosures).

many ways in which institutional factors may differ across states; of particular relevance for this paper, we also need not consider how to control for the impacts of foreclosure laws and assessment practices, both of which vary widely across states. Georgia is also a good state to use to study the effects of the Great Recession and its impact on foreclosures. Georgia is in many ways roughly an "average" state. For example, Georgia's median household income in 2006 was $46,832, ranking it 24th in the U.S.; local share of funding for K-12 in 2006 was 47.8 percent in Georgia compared to 43.7 percent for the U.S.; in 2006, property tax revene as a share of state and local tax revenue was 28.7 percent for Georgia and 30.8 percent for the U.S. Of some note, Georgia was hit hard by the Great Recession; Georgia's unemployment rate went from 4.7 percent in 2006 to 10.2 percent in 2010 while the U.S. unemployment rate went from 4.6 percent to 9.6 percent.

We examine detailed information on the property tax system for local school districts in the State of Georgia, focusing on the impact of foreclosures (and other factors) on the property tax base, its levy, and its revenues. Our empirical analysis indicates that larger increases in personal income per capita, in population, and in employment all positively and statistically significantly affect the percentage change in the tax base; importantly, our results also show significant negative effects of foreclosures. We also estimate regressions to see whether foreclosure activity affects the property tax levy and property tax revenues, with other factors (e.g., income, population, and employment growth) held constant. Again, we find that foreclosure activity has significant impacts. For example, a rise in foreclosures is associated with a reduction in the levy, and foreclosures have a negative impact on revenues, after controlling for changes in the base and other factors. Overall, we find that foreclosure activity had significant impacts on the property tax base, on property tax levies, and on property tax revenues.

2. Housing prices, foreclosures, and school district property tax revenues

Local governments in the United States typically rely on several sources of own-source revenues, including individual income taxes, general sales taxes, specific excise taxes, fees and charges, and local property taxes. Of these, the dominant source is by far the property tax. In 2011, local property taxes accounted for roughly three-fourths of total local government tax revenues and for nearly one-half of total local own-source revenues (including fees and charges).[2]

The Great Recession had serious and negative effects on the level of economic activity, and these effects have in turn depressed tax revenues, especially for taxes whose bases vary closely with economic activity, like income and sales taxes (Anderson, 2010; Mikesell and Mullins, 2010; Boyd, 2010). However, an important feature of the property tax is that its base (i.e., assessed value) does not automatically change over time since, in the absence of a formal and deliberate change in assessment, any change in the market value of housing does not necessarily translate into a change in assessed value. Lags in these re-assessments, combined with caps on the amount by which assessed values can be changed in any given year and with deliberate changes in millage rates, mean that changes in the overall level of economic activity that may affect housing values may not actually affect property tax revenues in any immediate or obvious way.[3]

There are several channels by which changes in the housing market may affect local government tax revenues (Lutz, Molloy, and Shan, 2011). The most obvious is of course via the property tax, and it is this channel upon which we focus.[4]

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[2] See http://www.census.gov/govs/estimate.

[3] The assessment process is analyzed in detail by Diaz (1990), Quan and Quigley (1991), Wolverton and Gallimore (1999), and McAllister et al. (2003).

[4] Note that other channels are also possible, including those more closely linked to economic activity. For example, real estate transfer taxes depend upon the volume and the value of real estate transactions, although these taxes are of relatively little importance. Also, a decline in the housing market may depress new housing construction, thereby reducing sales tax revenues generated by the materials used in construction and by the furnishing for a new home, and a decline in home construction and the resulting fall in employment may also reduce income taxes. Finally, a decline in housing values may reduce consumer expenditures (and so sales tax revenues) via wealth effects.

As a *general* framework in which the property tax might be modeled, consider a simple setting. Suppose a local jurisdiction imposes a property tax at tax rate t on a tax base B. Revenues R equal $R = t\,B$. Suppose now that either the tax rate or the tax base of each tax changes. Then the percentage change in tax revenues equals:[5]

$$\Delta R/R = \Delta t/t + \Delta B/B\,; \qquad (1)$$

that is, the percentage change in tax revenues equals the percentage change in the tax rate plus the percentage change in the tax base. Finally, suppose that the tax base of the property tax is some function of the level of economic activity, denoted Y. With a change in the level of economic activity, the percentage change in any tax base due to a changed economic environment can be written as $\Delta B/B = \varepsilon(\Delta Y/Y)$, where ε is the elasticity of the tax base with respect to the level of economic activity. The percentage change in total revenues now becomes:

$$\Delta R/R = \Delta B/B + \Delta t/t + \varepsilon\,(\Delta Y/Y), \qquad (2)$$

where $\Delta B/B$ now represents the deliberate administrative or policy change in the tax base, $\Delta t/t$ represent the administrative change in the tax rate, and $\varepsilon(\Delta Y/Y)$ denotes the (automatic) change in the tax base stemming from its link with economic activity. This equation summarizes the various channels by which revenues of any tax are affected by a change in policy actions or in external circumstances. Revenues can change if the tax rate or the tax base changes; revenues can also change if the level of economic activity changes, provided that the tax base is linked in some way to economic activity, as measured by ε. If the tax base cannot change, either because it is not responsive to economic activity, because it requires a deliberate but unforthcoming policy action, or because it is administratively constrained, then the only remaining source of a change in revenues is from a change in the tax rate.

[5] Note that for simplicity equation (1) ignores the cross partial term (or $\Delta t \Delta B$) since this term will be of a second order.

Using this general framework as a starting point, we argue that the more *specific* framework between foreclosures and property tax revenues in a geographic area runs as follows: weak economic conditions and declining house prices increase foreclosures; foreclosures decrease market values of the foreclosured houses and also of nearby homes in the community; these decreases in housing prices eventually get translated into decreases in assessed value through the assessment process; and decreases in assessed value lead local governments to change the property tax rate. The final result could be either a decrease or no change in property tax revenues. Note that this framework suggests that foreclosures also affect property tax assessments and tax rates. It is this framework that forms the basis for our estimations.

There are several papers that estimate the effect of foreclosures on individual house values; see Frame (2010) for a survey. Typical of the effect of a foreclosure on the house value are the findings of Campbell, Giglio, and Pathak (2011), who show that a foreclosure reduces the home value by 22 percent; similar effects have been found by Shilling, Benjamin, and Sirmans (1990) and, more recently, by Pennington-Cross (2006). Studies have also found that foreclosures reduce the value of neighboring homes but that the effect is small and is contained within a short distance of the foreclosure. For example, Immergluck and Smith (2006) find that property price declines about 1.0 percent as a result of a foreclosure within one-eighth of a mile, and by about 0.15 percent for a foreclosure between one-eighth and one-quarter of a mile away; see also Leonard and Murdoch (2009), Lin, Rosenblatt, and Yao (2009), and Campbell, Giglio, and Pathak (2011)

The link between the change in housing value and assessed value has been explored by Lutz (2008), who estimates that it generally takes about three years for changes in housing prices to feed through in any significant way to property tax revenues. His empirical results suggest a long-run elasticity of property tax revenue with respect to home prices of only 0.4, in part because it takes time

for local officials to adjust assessed values to market values and in part because local officials generally reduce millage rates in response to increases in housing prices. He also finds asymmetric responses of property tax revenues to increases versus decreases in home prices. Relatedly, Lutz, Molloy, and Shan (2011) present evidence that the non-property tax channels have been of relatively little importance in their effects on state and local government revenues, either in the housing market boom/bubble of the early-to-mid-2000s or in the more recent collapse of housing prices during the Great Recession.

Doerner and Ihlanfeldt (2011) focus more directly on the effects of house prices on local government revenues, using detailed panel data on Florida home prices during the 2000s. They conclude that changes in the real price of Florida single-family housing have an asymmetric effect on government revenues: housing price increases do not raise real per capita property tax revenues, but decreases tend to dampen revenues. Like Lutz (2008), they conclude that these asymmetric responses are due largely to lags between changes (positive or negative) in market prices and assessed values, to caps on assessment increases, and to decreases in millage rates in response to increases in home prices. They also find that the indirect links between home prices and local government revenues (e.g., real estate transfer taxes, sales tax revenues on home construction materials, income taxes on construction-related employment, wealth effects from home values on sales tax revenues) are generally small, with the exception of an additional channel via impact fees, which are of some importance for many Florida local governments and which are affected in significant ways by changes in home prices. There is some other recent work that focuses more specifically on the effects of property tax limitations on local government revenues, but this is not directly relevant to the current research.[6]

[6] There is a large literature on the effects of tax limitations. For useful general discussions, see Preston and Ichniowski (1991), O'Sullivan, Sexton, and Sheffrin (1995), Dye and McGuire (1997), and Haveman and Sexton (2008). The entire

Alm, Buschman, and Sjoquist (2011) document the overall trends in property tax revenues in the United States from 1998 through 2009, and they find substantial regional and local variation. Their data indicate that local governments, on average, seem to have avoided the significant and negative budgetary impacts seen most clearly for state and federal governments, at least through 2009. Alm, Buschman, and Sjoquist (2009) examine the effect of economic conditions on education expenditures for the 1990-2006 period, a period that covers two recessions. In related work, Alm and Sjoquist (2009) examine the the impact of economic factors on Georgia school system finances for the 1998-2009 period, using detailed information on property tax assessments and property tax rates, and show the relevance of economic factors (including state responses to local school district conditions). However, the last year for their data (or 2009) reflected only the very start of the housing crisis associated with the Great Recession.

Importantly, none of these studies examine the impact of foreclosures per se on property tax revenues, especially the recent foreclosures generated by the Great Recession. The next section discusses the foreclosure process in Georgia, and the following sections present our data, our approach for examining this issue, and our results.

3. The foreclosure process in Georgia

To understand how foreclosures have affected the property tax system of Georgia local school districts, it is important to understand first how the foreclosure process works in the state. Alexander (2011) provides details of this process in Georgia, and his discussion provides the basis for the following summary.

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issue of *Public Budgeting & Finance* (Volume 24, Number 2, December 2004, "Tax and Expenditure Limitations: A Quarter Century after Proposition 13") is devoted to tax limitations.

Georgia is a non-judicial (power-of-sale) foreclosure state, and only in rare cases involving special situations are judicial foreclosures conducted in Georgia. The ability to conduct a power-of-sale foreclosure is determined by the expressed terms of the debt instrument, and thus language allowing this foreclosure process is included in the mortgage instruments. If the property is a residence, then Georgia law requires that the creditor give notice to the current owner, by certified mail, of the intent to foreclose, and to do so at least 30 days prior to the published date of the foreclosure sale. The creditor must advertise the proposed foreclosure sale weekly for four weeks in the appropriate legal organ. The sale is then held on the first Tuesday of the month on the court house steps. Unlike some states, there is no requirement of a judicial confirmation of a foreclosure sale, and there is also no statutory right to redemption on the part of the debtor. Thus, foreclosures can be completed in about 6 weeks. A recent 2009 federal law provides that the tenant (i.e., the owner who has been foreclosed) can retain possession of the property, but the possession can be terminated by giving a 90-day notice to vacate the premises. Under Georgia law, a foreclosure sale not only extinguishes the right of redemption, but also divests all junior encumbrances on the property that do not predate the mortgage.

The overwhelming majority of foreclosure sales are made to the creditor, who is required to act in "good faith". The sales price does not have to be the fair market value, but the Georgia Supreme Court has ruled that it cannot be "grossly inadequate". If the sales price is less than the indebtedness, the creditor can seek judicial confirmation of the foreclosure sale in order to get a money judgment against the property owner. In a judicial confirmation of a foreclosure sale, the creditor is required to establish the fair market value of the property in order to get a judgment for the balance due the creditor. The proceeds of the foreclosure sale are first distributed to cover the costs

and fees of the foreclosure and to satisfy the mortgage debt. Any remaining surplus is distributed to the debtor.

4. Data

Data used in this paper are taken from several sources. To measure foreclosure activity, we use proprietary data from RealtyTrac covering the period 2006 through 2011. RealtyTrac reports foreclosure "activity" in terms of foreclosure legal filings and notices on a zip code basis. We measure foreclosure activity using RealtyTrac's "notice of trustee sale" counts for each year, aggregating zip code observations into the corresponding counties.[7]

We obtained from the Georgia Department of Revenue the annual property tax base (referred to as "Net Digest" in Georgia) for each of the 180 school districts in Georgia for 1997 through 2011, extending two years beyond the official end of the Great Recession.[8] We also calculated property tax levies for all school districts for the same periods using the net digest and reported millage rates obtained from the Georgia Department of Revenue. The tax base is as of January 1st of the respective year. The millage rate and resulting levy are set in the spring with tax bills being paid in the fall, the revenue from which would be reported in the following fiscal year. School districts are on a July 1st to June 30th fiscal year, and thus (say) the 2009 tax base and levies would be reflected in revenues for fiscal year (or school year) 2010. We use data from the Georgia Department of Education on property tax revenues collected for maintenance and operations (M&O) for school districts over the same

[7] Foreclosure data for zip codes that cross county lines are allocated to the particular counties in proportion to the numbers of owner-occupied housing units in the zip code that are located in each county.

[8] Of the 180 Georgia schools systems, 159 are county systems, while the rest are city systems. The net digest consists of all property. We considered using just the residential component of the net digest. However, for many of the school districts, there are often quite large year-to-year changes in the percentage of the net digest that is residential, with large increases in one year being followed by large decreases in a subsequent year. While this is possible if (say) certain properties change from residential to commercial and then back, we were not confident that the data accurately reflected residential property values each year.

period, which accounts for 98 percent of property taxes collected for education purposes.[9] Because income, population and employment variables used in our regressions are on a county level, digest and revenue variables for city school districts are added to those for the county school systems in the same counties to obtain countywide totals.[10] Table 1 contains descriptive statistics for these variables.

Georgia is broadly similar to other states in the local government practice of and reliance upon property taxation, although there are some distinctive Georgia features. Property tax assessment is conducted only by county governments in Georgia. Property tax bases are all evaluated by the state every year, comparing actual sales of improved parcels during the year to assessed values to determine if they are at the appropriate assessment level relative to fair market value, which is legally set at 40 percent.[11] The resulting "Sales Ratio Studies" report an "Adjusted 100% Digest" figure for each school district in the state, along with the calculated ratio. We use these adjusted digest data, covering the periods 2000 through 2011, as a measure of the market value of property in the jurisdiction.

Georgia has very few institutional property tax limitations. School district boards can generally set their property tax millage rates without voter approval, provided that the property tax rate for county school districts, but not city school districts, cannot exceed 20 mills without voter approval.[12] Also, there is no general assessment limitation, although one county has an assessment freeze on homesteaded property. Note that in 2009 the State of Georgia imposed a temporary freeze on assessments across the state, potentially affecting property tax revenue only in school year/fiscal

[9] See Rubenstein and Sjoquist (2003) for a detailed discussion of the Georgia school finance system. Georgia's school finance system consists of a foundation program and a guaranteed tax base program. The foundation program, which is by far the larger of the two, requires that local school district contribute 5 mills based on the 40 percent equalized property tax base.

[10] Five city school systems operate in two counties each, but digest and levy data are reported separately by county. Revenues are allocated to the counties in proportion to the levy.

[11] If the actual assessment ratio is not between 36 and 44 percent of fair market value, then a penalty of $5 per parcel is imposed. If the ratio is less than 36 percent, then the county is also required to pay the difference between the actual property tax revenue that the state collects from its 0.25 mill property tax rate and the level that the state would have collected if the digest had been assessed at 40 percent.

[12] This cap is currently binding on only 5 school systems.

year 2010. However, with net and adjusted digests declining on a per capita basis for most counties in 2009 through 2011, it is not likely that the freeze has had a material negative effect on assessments. Figures 1 and 2 show the distributions of annual changes, respectively, in per capita net digest and per capita adjusted 100% digest across the 159 counties from 2001 through 2011. (Note that the bar in the box represents the median change, the box captures the observations in the 2nd and 3rd quartile, the whiskers equal 1.5 times the difference between the 25th and 75th percentiles, and the dots are extreme values.) For all years through 2008, both measures were consistently positive. However, the changes in per capita net digest and in per capita adjusted 100% digest became negative in 2009, and have remained negative through 2011.

State and local school districts contribute about equal amounts of revenue for K-12 education. The bulk of the grant to local districts is through a foundation program; the state has a small equalization grant program as well.[13] There were no changes in the nature of the funding formula during the period of our analysis.

Figure 3 shows local revenue per full time equivalent (FTE) student and property taxes per FTE in Georgia over the period 2001 through 2011 for the maintenance and operation (M&O) budget for all local school systems. Note first that, for the M&O budget in 2011, property taxes accounted for about 96 percent of total local school revenues and 98 percent of all property taxes collected by local school systems.[14] This is the highest portion of total local source revenues over the last decade; for 2009 and 2006, property taxes accounted for about 93 percent of the total, and property taxes accounted for 91 percent in 2001. Although property taxes per FTE peaked in 2009 along with the

[13] For a detailed description of Georgia school funding program, see Rubenstein and Sjoquist (2003).
[14] Only 2 percent of school district property tax revenue is used for capital expenditures since school districts use the revenue from the education local option sales tax (ELOST) for capital projects. ELOST revenue cannot be used for M&O.

total, the decline in other local revenues (e.g. local option sales taxes) has been sharper, or a 10.9 percent real decline for property taxes compared to an 11.1 percent real decline in overall revenue.[15]

There is considerable variation across the school systems in the annual changes in property tax revenues. Figure 4 depicts the distribution of nominal changes by county in total M&O property tax revenues since 2001. (Recall that the bar in the box represents the median change, and the box captures the observations in the 2nd and 3rd quartile.) Even in the latest three years of declining property values, about half or more of counties each year realized positive nominal growth in property tax revenue.

Table 2 provides some basic summary statistics on foreclosures by zip code, where foreclosures are measured by the number of properties put up for public auction (i.e., those properties subject to a notice of trustee sale). There are 982 zip codes in Georgia, although only 733 have positive populations according to the Census Bureau. While RealtyTrac reports positive foreclosures in a handful of zip codes with no reported population, we ignore these zip codes. Total foreclosures almost doubled between 2006 and 2010, before declining in 2011. The mean number of foreclosures is much larger than the median, implying that the distribution is highly skewed. The distribution of foreclosures per capita is also skewed, but not as pronounced.

Table 3 shows the distribution of the number of Georgia zip codes by the number of years that the zip code had non-zero foreclosures. Over 65 percent of the zip codes had foreclosures in each of the 6 years, while only 7 percent had no foreclosures in all 6 years.

Figures 5 and 6 show the distribution each year of foreclosures per 100 housing units and per 1000 population, respectively, in each of Georgia's 159 counties. The median number of foreclosures by county increased from 0.17 per 100 housing units in 2006 to 1.18 per 100 units in 2010, more than

[15] There are 10 school systems that are allowed to use a local sales tax to fund current operations. Most school systems impose a 1 percent sales tax, but the revenue can only be used for capital expenditures.

a six-fold increase in the median (Figure 5). Relative to population, the increase was of roughly the same magnitude, from a median of 0.74 per 1000 population to 5.26 (Figure 6). For both measures, foreclosures increased significantly, especially beginning in 2009.

There is a high positive correlation between foreclosure activity in 2006 and 2011 across the counties. This correlation is 0.78 when foreclosures are measured relative to housing units and 0.74 when they are measured on a per capita basis, indicating that counties with above (below) average foreclosure activity before the housing crisis remained above (below) average at its peak. Figure 7 presents a scatter diagram of foreclosures per 100 housing units by county in 2006 and 2010, and shows that the increase in foreclosures from 2006 to 2010 was common to all counties as all points are above the 45 degree line, albeit only slightly in a few cases.

Map 1 shows the distribution of total foreclosures by zip code across the state for the period 2006 to 2011. (Since there is a high correlation across years in the number of foreclosures, the maps for each individual year are quite similar.) Because zip codes differ in size and housing density, we also map the number of foreclosures per owner occupied housing unit using housing units for 2010 in Map 2. Using housing units for 2010 will tend to understate the number of owner occupied housing units that could be subject to foreclosure since foreclosures prior to 2010 will likely have reduced the number of owner occupied housing units. Unfortunately, data on owner occupied housing units are not available for intercensal years. Note that zip codes marked in white either have no foreclosures or are missing the foreclosure data.[16]

As one would expect, urban and suburban counties (particularly in the Atlanta metropolitan area) have the most foreclosures on an absolute basis. However, there are large numbers of foreclosures in many of the less urban zip codes as well. While there is some difference in the

[16] For example, an airport might have its own zip code, but no housing and thus no foreclosures. However, these zip codes are small and generally not visible on the map.

geographic distribution of total foreclosures and foreclosures per owner occupied housing unit, the pattern of greater foreclosure activity in the urban and suburban areas is similar under either measure.

5. Regression analysis

As noted above, property tax revenue will be affected by changes in market value, the translation of changes in market value to taxable value, and changes in the property tax rate. To understand the effect of the recent rise in foreclosure activity on the local government property tax system, we estimate regressions with different dependent variables related to possible channels through which an effect on the system might occur: the property tax base, its levy, and its revenues. Because the years differ for which the various data elements are available, the period used for various regressions also differs.

As we argued earlier, one channel is that foreclosed properties tend to sell at discounted prices, and studies suggest that foreclosures have spillover effects on the market values of other properties in the jurisdiction. However, changes in market values are driven by general economic conditions as well as by foreclosures, which are also driven in part by the same general economic conditions. Thus, we estimate regressions of the adjusted 100% digest (as a proxy for market values) on county-level per capita income and population, both in terms of year-to-year percent changes and lagged one year to correspond to the beginning of the fiscal year, as well as on lagged measures of foreclosure activity.[17] To account for the likelihood that foreclosure activity and market values are jointly affected by the local severity of the recent recession, we include a measure of the local labor market in some regressions; specifically, we include the lagged percent change in the number of persons

[17] Income data are from the Bureau of Economic Analysis (BEA), and population data are U.S. Census Bureau midyear estimates, also obtained from the BEA. See BEA Local Area Personal Income & Employment data, Table CA1-3 (updated Nov. 26, 2012), downloaded from http://www.bea.gov/regional/index.htm.

employed.[18] Finally, it is likely that property values do not immediately revert to their pre-foreclosure level at the time the foreclosed property is returned to the private market, and also that a new foreclosure in one period is not necessarily returned to the private market in that period. Indeed, an accumulation of foreclosed properties that have not yet been resold by lenders to new homeowners may continue to depress prices in the area in subsequent periods. Thus, the effect of a foreclosure in one period will likely extend into future periods. Accordingly, we include lagged values of foreclosures (e.g., a one year lag and a two year lag) in some regressions. Results of these different base regressions are presented in Table 4.

The regression in the first column of Table 4 is a pooled regression with panel-corrected standard errors (PCSE), while the other 6 regressions are fixed effects regressions with cluster-robust standard errors (FE). The first three columns of results in Table 4 use data for the period 2000 to 2011 and do not include foreclosures. As expected, larger increases in personal income per capita, population, and employment are positively and statistically significantly affect the percentage change in the 100% digest. The regressions in columns 4 and 5 of Table 4 use foreclosures per housing unit, lagged one and two years, while those in columns 6 and 7 use foreclosures relative to population (again, lagged one and two years).

These regressions show significant negative effects of foreclosures on the 100% adjusted property tax base, controlling for income and population growth, and the coefficient estimates do not change materially when employment growth is included. Somewhat surprising is that, while the coefficients on the change in employment is positive, the standard errors are much larger than in the 3rd column. The coefficient estimates on foreclosures per 100 housing units suggest that a marginal increase of one foreclosure per 100 homes, which is approximately the increase in median

[18] County employment data, also lagged one year, are from the Bureau of Labor Statistics, Local Area Unemployment Statistics program, downloaded from http://www.bls.gov/lau/#tables.

foreclosures from 2006 to 2011, is associated with about a three percent decline in the adjusted 100% digest over each of the two following years. Similarly, an increase of one foreclosure per 1000 population is associated with about a 0.7 percent decline in the adjusted 100% digest over each of the two following years.[19] The magnitudes of the effect are consistent with existing work that finds a small spillover effect of foreclosures on the value of other properties as well as on the foreclosed home. Given the median level of foreclosures per 100 housing units in 2008 and 2009 of about 0.54 and 1.03, respectively, our results suggest a combined effect on the adjusted 100% digest of about -4.7 percent in 2010, all else held constant. The median adjusted 100% digest change for 2010 was -4.0 percent, also reflecting offsetting effects of other observed and unobserved factors.[20]

As suggested by our earlier theoretical discussion, additional channels of foreclosure effects on the property tax system are also possible. The effect of changes in property market values should be reflected in the tax base (i.e., the net digest) and thus the property tax levy, but with an expected lag. However, a change in property market values would not necessarily lead to a change in property tax revenues since the local governments may change millage rates to maintain revenues. Ross and Yan (2011) suggest that governments set the levy as necessary to fund planned expenditures, which are determined by demands for public expenditures; once the total taxable values are known, millage rates are then determined as a residual. If this description is accurate, then neither the levy nor revenues would be expected to respond directly to any impact that foreclosures may have on property values. However, there may be a wealth effect of changes in property values on demands for public expenditures and thus an indirect effect of foreclosures on the levy and on revenues.

[19] The increase in median foreclosures by this measure was about 4.5 per thousand population.
[20] It should be noted that the one-year and two-year lagged values of the foreclosure variables are highly correlated. Nonetheless, the coefficients on these variables are both statistically significant when both are included. If we drop either of the lagged foreclosure variables, then the values of the coefficients on the remaining lags are -0.049 for the one-year lag alone and -0.065 for the 2-year lag alone, both of which are statistically significant at the 1 percent level.

We therefore estimate regressions of the change in the property tax levy (Table 5) and of property tax revenues (Table 6) on foreclosure activity measures and income, population, and employment growth, as well as alternative measures of the property tax base. We use the adjusted 100% digest in the Table 5 regressions since the mechanism we posit for how foreclosures effect property taxes is through their effect on property value, as measured by the adjusted 100% digest. We use the net digest in Table 6 because it is the measure of the official property tax base. Since market value changes reflect the effect of foreclosures, we include foreclosures in the regressions to determine whether foreclosures have an additional effect on the property tax system beyond their effect through changes in property values.

The first three regressions in Table 5 do not include foreclosures. We include the 100% digest per capita in current and one- and two-year lag values, and obtain positive coefficients, although the two-year lag is statistically significant (marginally) only when the change in employment is included. The results when we include foreclosures suggest that, even after controlling for property values (in addition to the variables based on income, population, and employment), a rise in foreclosures is associated with a reduction in the levy. An increase of one foreclosure per 100 housing units is associated with about a 1.5 percent subsequent decline in the levy. Similarly, one more foreclosure per 1000 residents is associated with a decline in the levy of about 0.4 percent. Given an aggregate public school property tax levy of about $6.17 billion for Georgia in 2008, a 0.4 percent decrease amounts to nearly $25 million statewide; a 1.5 percent decline amounts to more than $92 million. A two-year lag of foreclosures, included in additional regressions that are not reported, did not have a statistically significant effect, and did not materially change the coefficient on the other variables.

The revenue regressions in Table 6 indicate that foreclosures also have a negative impact on revenues. The property tax levy and property tax revenue are certainly highly correlated, but they

differ somewhat since the collection rate is not 100 percent and property tax payments may also be delayed.[21] This raises a concern with measuring the effect of foreclosures on property tax revenue. Forecloures are expected to reduce property tax revenues because of the decline in collections. However, if over time these delinquent property taxes are paid, then at some point the decrease in revenues due to new foreclosures may be offset by the revenues from delinquent payments. This suggests that lagged foreclosures be included in the regression.

Accordingly, we begin with a simple model, including only the net digest, income, and population variables in a pooled regression. In columns 2 and 3, we add employment and a dummy variable to indicate periods since the beginning of the housing crisis in pooled and fixed effects regressions. Finally, we substitute the foreclosure measures for the crisis dummy in columns 4 and 5.

All of these regressions suggest a negative relationship between foreclosures and property tax revenue, all else constant. It is possible, of course, that increased foreclosures are correlated with unobserved factors that are influencing levy decisions or affecting revenue collections. However, inclusion of the change in employment (in addition to per capita income changes) should account for most of the differences in severity of the recession in income terms, while inclusion of the adjusted or net digest should already account for foreclosure effects on the tax base. Thus it appears that differences in foreclosure activity have effects on levy decisions that are in addition to their effects on the tax base or the income effects of the recession.

We also consider the possible effects of differences in federal stimulus funding (as a percent of the prior period levy or local source revenues) under the American Recovery and Reinvestment Act (ARRA), suspecting that greater stimulus funding might substitute for property tax levies to allow schools systems to better maintain pre-recession spending levels. If this was the case, then districts

[21] In terms of year-to-year percent changes over the last 14 years of data, the correlation between revenues and the corresponding levies (lagged one period) is 0.67.

may be less inclined to raise millage rates to offset weak property values resulting from foreclosures. One would thus expect to find a negative relationship between ARRA funding and property tax levies or revenues, and for the apparent effects of foreclosures in the models of Tables 5 and 6 to vanish. In fact, this is not the case; coefficient estimates on ARRA funding are not statistically significant in the levy or revenue regressions, and the estimates on the foreclosure or other variables are not materially affected.

Finally, it is certainly possible that foreclosures are endogenous; that is, our theoretical framework argues that more foreclosures cause declines in, say, property values, when it is also possible that declining property values cause more foreclosures.[22] A full analysis of this issue requires that we identify time-varying instrumental variables in order to correct for this possible endogeneity in fixed effects models similar to those presented in Tables 4, 5, and 6. Unfortunately, we were unable to find such time-varying instruments. However, we were able to identify several possible instruments based on their values prior to the Great Recession, including population density, percentage of homes built between 2000 and 2004, and percentage of homes with mortgages in 1999. We used these time-invariant variables as instruments in pooled two stage least squares (2SLS) models. We find that estimates of the effects of foreclosures on the different aspects of the property tax system (e.g., the base and the levy) change slightly, as compared to the results presented in Tables 4, 5, and 6. However, our basic conclusions remain unchanged. For example, the coefficients on the lagged foreclosure variables in 2SLS estimates of the tax base model are somewhat smaller than those reported in Table 4, but are still highly significant and are not sensitive to which instruments we exclude. The coefficients on the other variables in the 2SLS regressions are also very similar to those reported in Table 4. We find similar results for the levy and the revenue estimations. Thus, our results are robust to accounting for endogeneity.

[22] We are grateful to an anonymous referee for helping us to clarify our thinking on this issue.

6. Conclusions

How have foreclosures driven by the Great Recession affected the property tax system of local governments? We focus on school districts in Georgia for the period before, during, and after the Great Recession, and we estimate the impact of foreclosures on market values, property tax levies, and, especially, property tax revenues. Our results clearly suggest that foreclosure activity has had significant impacts on market values, on levies, and on tax revenues. Of course, these results have been found only in a single state (Georgia) and they may not hold for other states. Georgia had one of the highest levels of foreclosures per capita, and as noted above, the state was hit hard by the Great Recession. Still, as measured by housing price increases in the Atlanta metropolitan area, the housing bubble was not especially pronounced in Georgia (Follain and Giertz, 2013). Nonetheless, our results are consistent with other research regarding the effect of foreclosures on property values.

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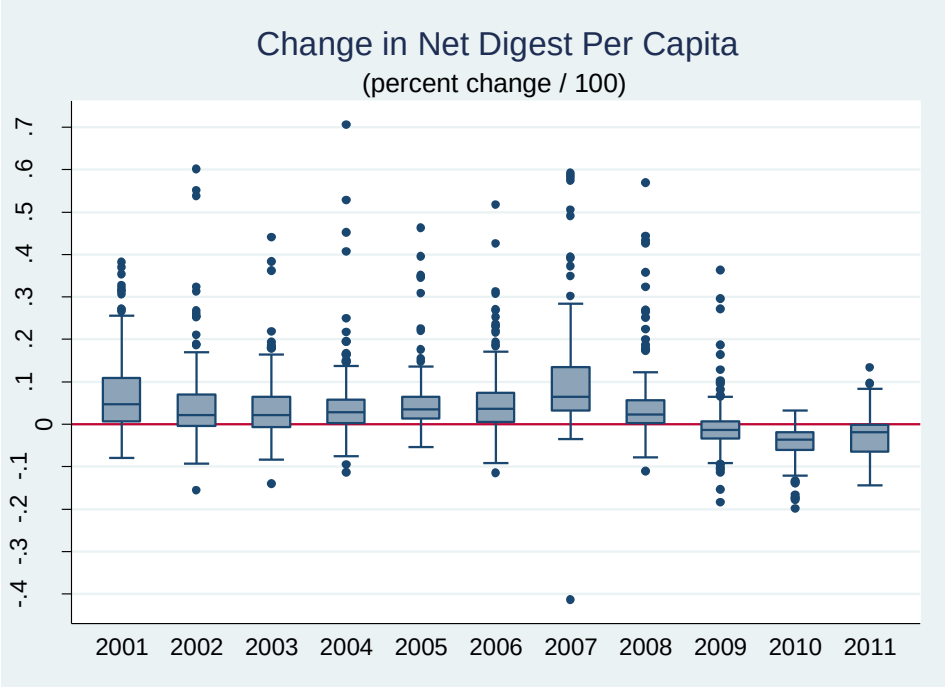
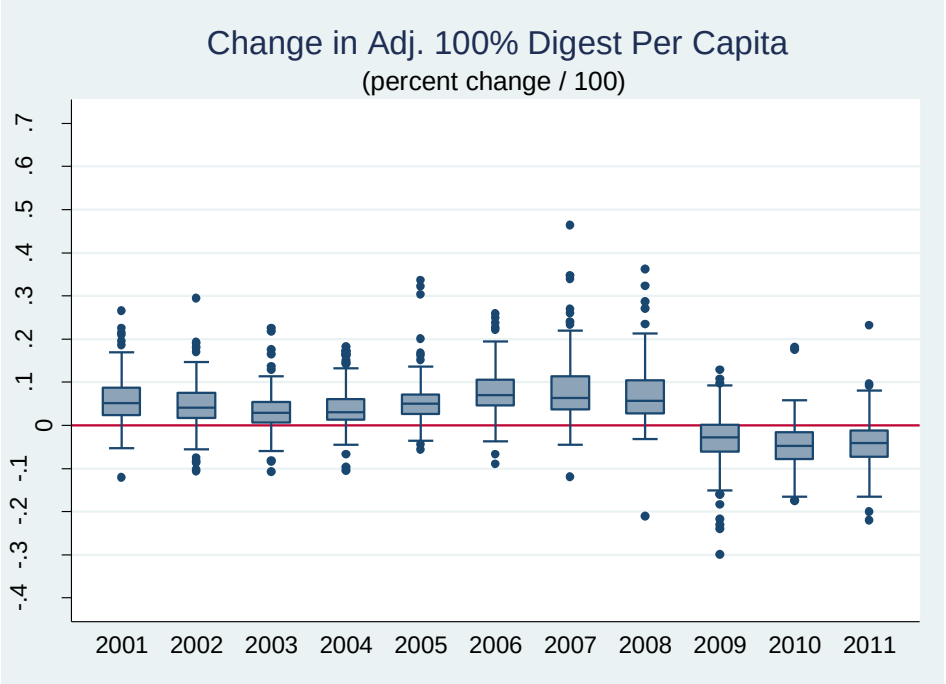
Figure 1. Distribution of Net Digest changes by county, 2001-2011



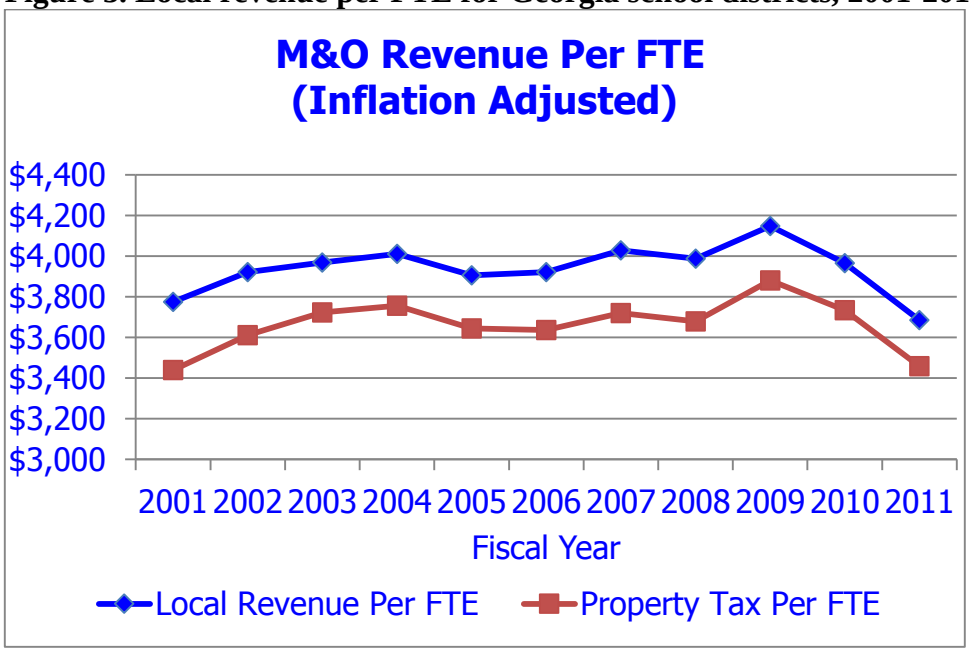
Source: Authors' calculations from Georgia Department of Revenue data.

Figure 2. Distribution of Adjusted 100% Digest changes by county, 2001-2011



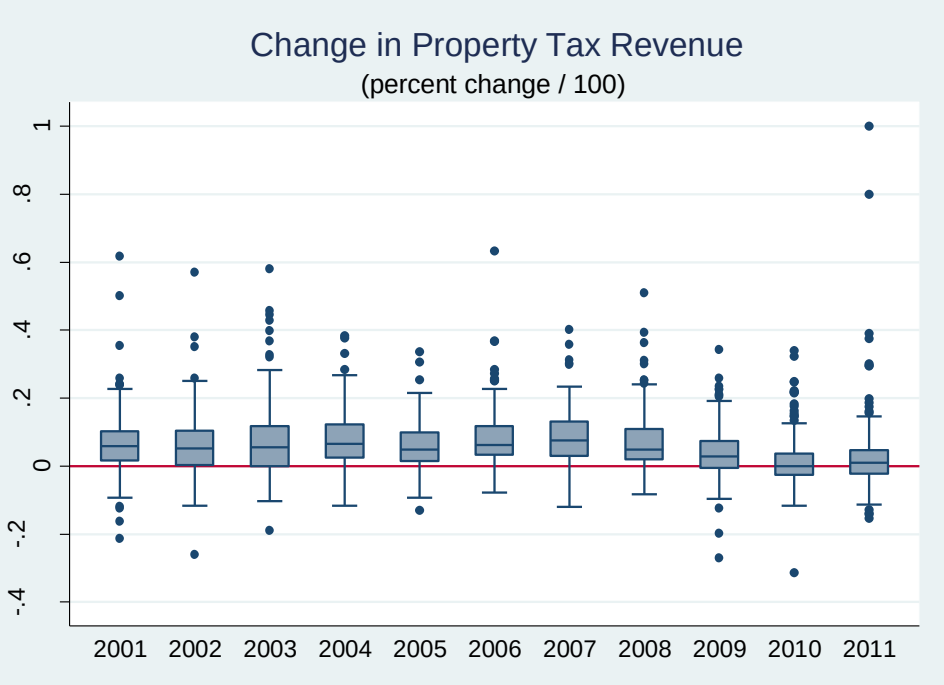
Source: Authors' calculations from Georgia Department of Revenue data.

Figure 3. Local revenue per FTE for Georgia school districts, 2001-2011



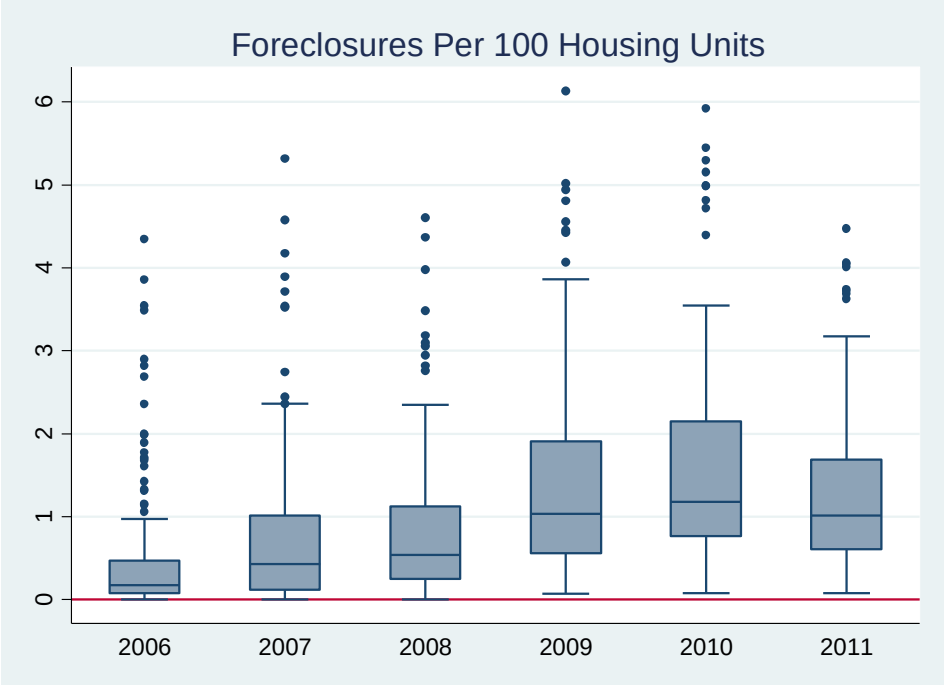
Source: Authors' calculations from Georgia Department of Education data.

Figure 4. Distribution of property tax revenue changes by county, 1998-2011



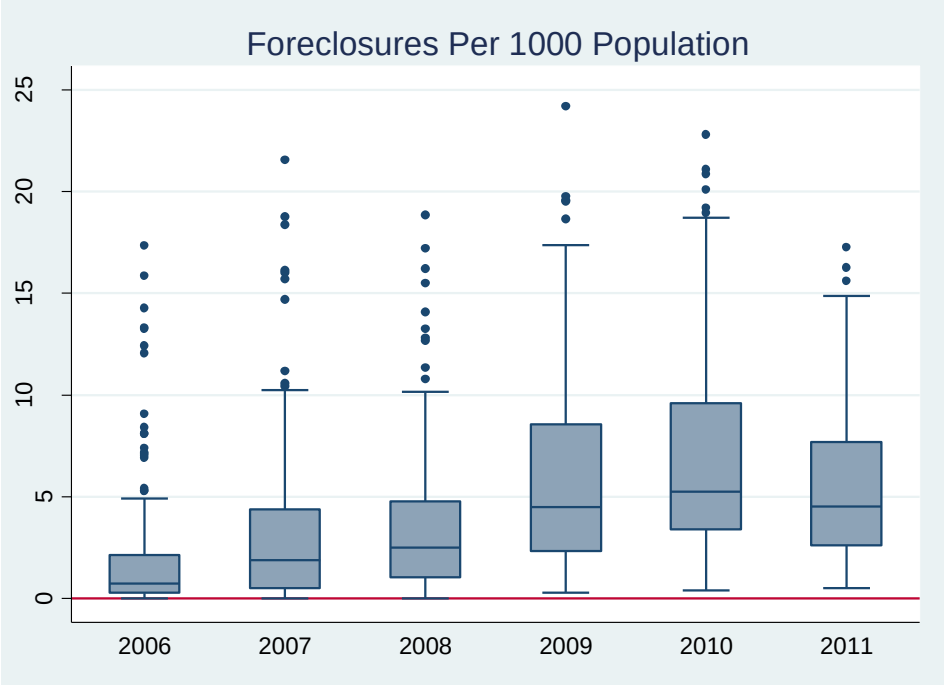
Source: Authors' calculations from Georgia Department of Education data.

Figure 5. Foreclosures per 100 housing units by county, 2006-2011



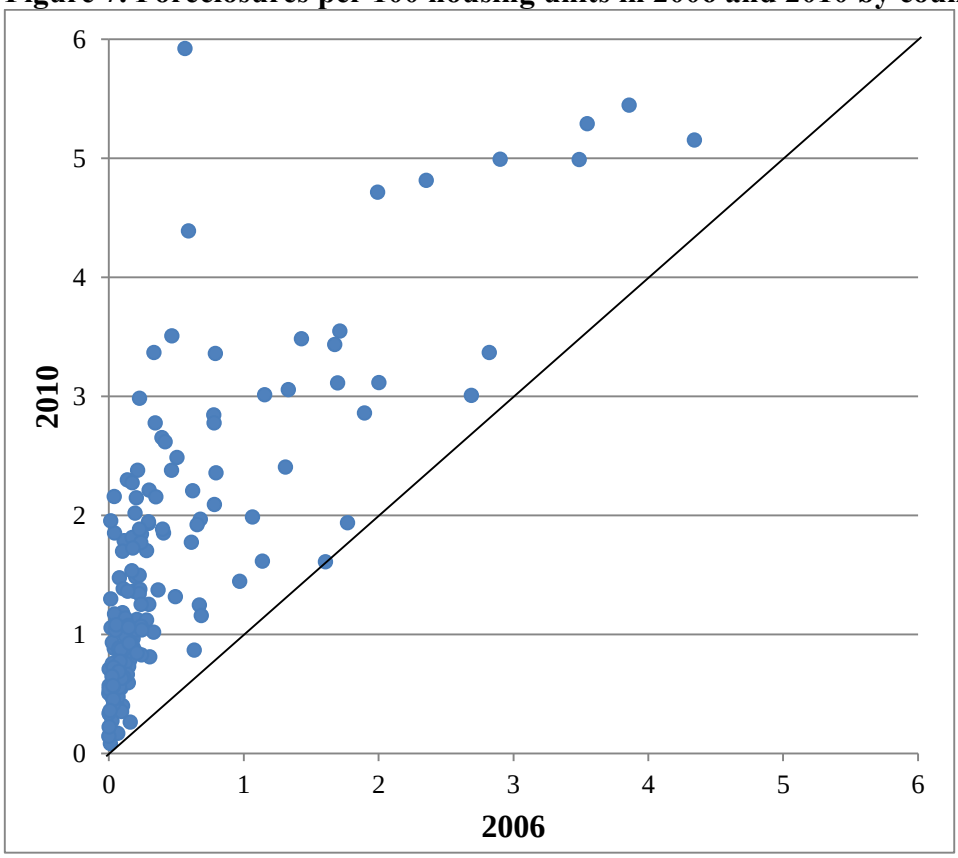
Source: Authors' calculations from RealtyTrac data.

Figure 6. Foreclosures per 1000 population by county, 2006-2011



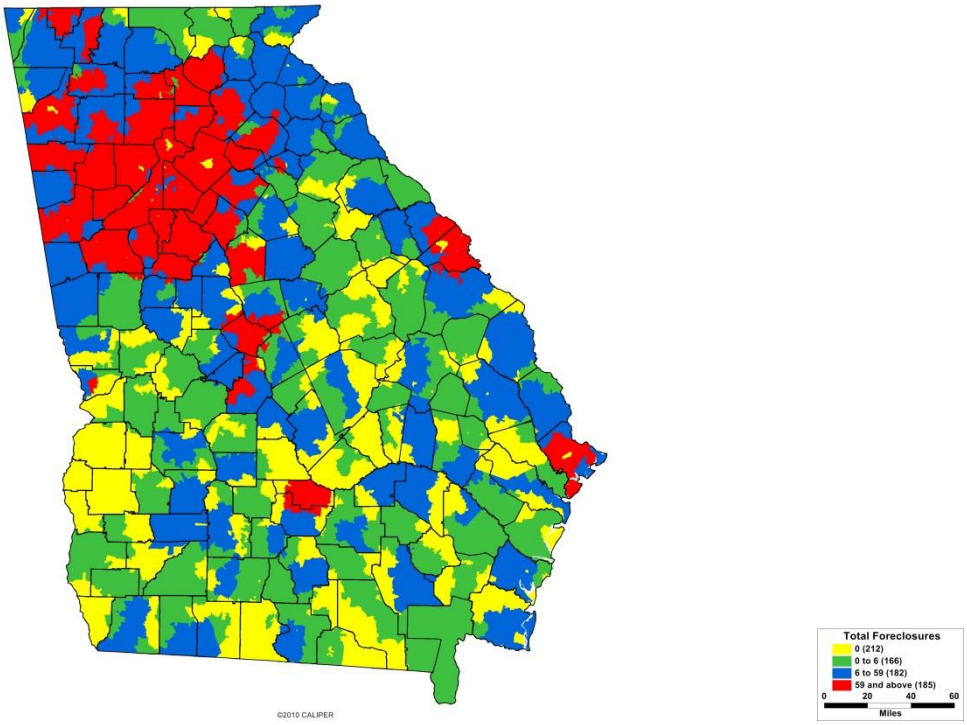
Source: Authors' calculations from RealtyTrac data.

Figure 7. Foreclosures per 100 housing units in 2006 and 2010 by county



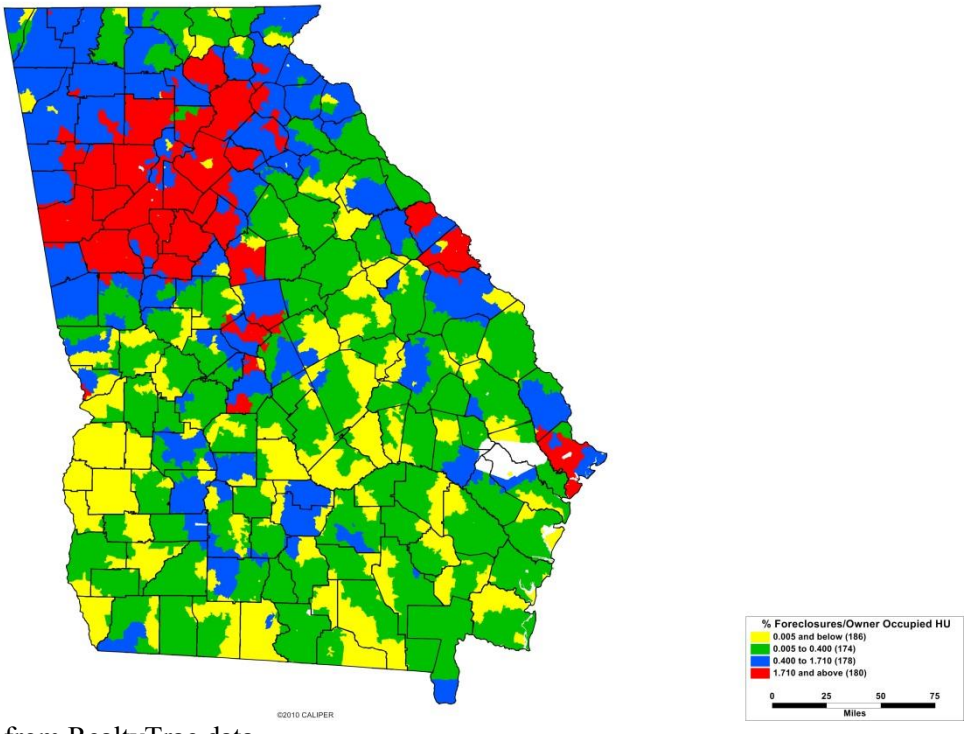
Source: Authors' calculations from RealtyTrac data.

Map 1. Total Foreclosures by zip code, 2010



Source: Authors' calculations from RealtyTrac data.

Map 2. Foreclosures as a percent of owner-occupied housing by zip code, 2010



Source: Authors' calculations from RealtyTrac data.

Table 1. Data summary

Variable	Median	Mean	Std Dev	Obs	Periods
Adjusted 100% Digest	0.043	0.043	0.078	1,749	11
Adjusted 100% Digest Per Capita	0.031	0.030	0.075	1,749	11
Net Digest	0.031	0.049	0.095	2,385	15
Net Digest Per Capita	0.019	0.035	0.091	2,385	15
Property Tax Levy	0.039	0.056	0.089	2,383	15
Property Tax M&O Revenue	0.047	0.060	0.096	2,385	15
Personal Income Per Capita	0.034	0.031	0.036	2,385	15
Population	0.011	0.013	0.020	2,385	15
Employment	0.006	0.006	0.051	2,226	14
Foreclosures Per 100 Housing Units	0.734	1.054	1.063	954	6
Foreclosures Per 1000 Population	3.293	4.560	4.427	954	6

Note: All variables are expressed as percent change/100, except the foreclosure variables.
Source: Authors' calculations.

Table 2. Foreclosures by zip code, 2006-2011

Year	Total Foreclosures	Mean Number	Median Number
2006	55,615	75.87	4
2007	75,191	102.58	11
2008	75,307	102.74	16
2009	97,195	132.60	30
2010	110,963	151.38	38
2011	85,865	117.14	31
Total, 2006-2011	500,136	682.31	136

Source: Authors' calculations from RealtyTrac data.

Table 3: Number of zip codes with positive foreclosures by year

Years with Positive Foreclosures	Number of Zip Codes	Percent
6	478	65.21
5	85	11.6
4	49	6.68
3	31	4.23
2	16	2.18
1	23	3.14
0	51	6.96
Total	733	100

Source: Authors' calculations from RealtyTrac data.

Table 4. Regression Results for Adjusted 100% Digest - Georgia School Districts (consolidated by county)

Dependent Variable: Adjusted 100% Digest (percent change / 100)							
Estimation Method:	PCSE	FE	FE	FE	FE	FE	FE
Personal Income Per Capita[+]	0.4412 **	0.5909 ***	0.4932 ***	0.3004 ***	0.2199 **	0.2838 ***	0.2003 **
	(0.208)	(0.069)	(0.072)	(0.079)	(0.098)	(0.078)	(0.097)
Population[+]	1.0294 ***	1.5305 ***	1.2677 ***	0.8802 **	0.7181 **	0.8471 **	0.6782 **
	(0.253)	(0.269)	(0.226)	(0.340)	(0.339)	(0.332)	(0.332)
Employment[+]			0.2809 ***		0.2202		0.2249
			(0.053)		(0.141)		(0.141)
Foreclosures Per 100 Housing Units (t-1)				-0.0305 ***	-0.0281 ***		
				(0.007)	(0.007)		
Foreclosures Per 100 Housing Units(t-2)				-0.0271 ***	-0.0317 ***		
				(0.009)	(0.010)		
Foreclosures Per 1000 Population (t-1)						-0.0076 ***	-0.0071 ***
						(0.002)	(0.002)
Foreclosures Per 1000 Population (t-2)						-0.0064 ***	-0.0074 ***
						(0.002)	(0.002)
Constant	0.0160	0.0065	0.0113 ***	0.0391 ***	0.0477 ***	0.0429 ***	0.0519 ***
	(0.016)	(0.004)	(0.004)	(0.013)	(0.014)	(0.011)	(0.012)
Observations	1749	1749	1749	636	636	636	636
Groups	159	159	159	159	159	159	159
Periods	11.00	11.00	11.00	4.00	4.00	4.00	4.00
R-Squared	0.0992	0.1444	0.1717	0.1600	0.1666	0.1635	0.1702
Within R-Squared		0.1407	0.1721	0.2433	0.2555	0.2515	0.2642
Rho	0.2131						
Fraction of Variance due to FE		0.0542	0.0587	0.2629	0.2720	0.2697	0.2795

Standard errors are in parentheses. *** indicates significance at the 1% level, ** at 5%, and * at 10%. [+] indicates percent change / 100.

Income, population, and employment variables are lagged to correspond to the start of the fiscal year. PCSE indicates pooled regressions with panel-corrected standard errors, correcting for groupwise heteroskedastic, cross-sectionally dependent, and autocorrelated errors. FE denotes fixed effects regressions with cluster robust standard errors, clustering on county.

Table 5. Regression Results for Property Tax Levy - Georgia School Districts (consolidated by county)

Dependent Variable: Property Tax Levy (percent change / 100)						
Estimation Method:	PCSE	FE	FE	FE	FE	FE
Adjusted 100% Digest Per Capita	0.4816 ***	0.4840 ***	0.4568 ***	0.3896 ***	0.3850 ***	0.3877 ***
	(0.053)	(0.043)	(0.047)	(0.064)	(0.064)	(0.063)
Adjusted 100% Digest Per Capita(t-1)	0.1780 ***	0.1935 ***	0.1924 ***	0.2185 ***	0.2145 ***	0.2221 ***
	(0.049)	(0.043)	(0.043)	(0.056)	(0.057)	(0.059)
Adjusted 100% Digest Per Capita(t-2)	0.0611	0.0608	0.0697 *	-0.0120	-0.0151	-0.0053
	(0.050)	(0.039)	(0.041)	(0.050)	(0.050)	(0.054)
Personal Income Per Capita[+]	0.0882	0.0648	0.0016	-0.0480	-0.0494	-0.0540
	(0.087)	(0.055)	(0.059)	(0.077)	(0.077)	(0.077)
Population[+]	0.6714 ***	0.4350 **	0.2656	0.1073	0.0987	0.0944
	(0.118)	(0.179)	(0.173)	(0.335)	(0.337)	(0.338)
Employment[+]			0.2098 ***	0.2278 **	0.2270 **	0.2254 **
			(0.072)	(0.098)	(0.098)	(0.097)
Foreclosures Per 100 Housing Units (t-1)				-0.0152 **		
				(0.007)		
Foreclosures Per 1000 Population (t-1)					-0.0039 **	-0.0039 **
					(0.002)	(0.002)
ARRA Revenue / Lagged Levy						0.0123
						(0.023)
Constant	0.0198 ***	0.0228 ***	0.0263 ***	0.0446 ***	0.0465 ***	0.0453 ***
	(0.007)	(0.003)	(0.003)	(0.010)	(0.011)	(0.011)
Observations	1430	1430	1430	794	794	794
Groups	159	159	159	159	159	159
Periods (average)	8.99	8.99	8.99	4.99	4.99	4.99
R-Squared	0.2807	0.2637	0.2729	0.3185	0.3168	0.3160
Within R-Squared		0.2535	0.2607	0.3293	0.3300	0.3302
Rho	-0.0598					
Fraction of variance due to FE		0.0447	0.0422	0.0942	0.0970	0.0984

Standard errors are in parentheses. *** indicates significance at the 1% level, ** at 5%, and * at 10%. [+] indicates percent change / 100. Income, population, and employment variables are lagged to correspond to the start of the fiscal year. PCSE indicates pooled regressions with panel-corrected standard errors, correcting for groupwise heteroskedastic, cross-sectionally dependent, and autocorrelated errors. FE denotes fixed effects regressions with cluster robust standard errors, clustering on county.

Table 6: Regression Results for Property Tax M&O Revenue - Georgia School Districts (consolidated by county)

Dependent Variable: Property Tax M&O Revenue (percent change / 100)						
Estimation Method:	PCSE	PCSE	FE	FE	FE	FE
Net Digest Per Capita	0.3330 ***	0.3107 ***	0.2833 ***	0.3140 ***	0.3194 ***	0.3251 ***
	(0.033)	(0.029)	(0.030)	(0.040)	(0.041)	(0.041)
Personal Income Per Capita[+]	0.1682 *	0.0831	0.0552	0.0319	0.0466	0.1097
	(0.100)	(0.080)	(0.056)	(0.073)	(0.074)	(0.089)
Population[+]	0.9846 ***	0.7966 ***	0.7197 ***	0.5514 **	0.6195 **	0.6151 **
	(0.160)	(0.158)	(0.167)	(0.280)	(0.292)	(0.288)
Employment[+]		0.0712	0.0644	0.0032	0.0094	0.0389
		(0.053)	(0.058)	(0.067)	(0.067)	(0.079)
Post-SY2007 Dummy		-0.0260 ***	-0.0289 ***			
		(0.008)	(0.004)			
Foreclosures Per 100 Housing Units (t-1)				-0.0179 ***		
				(0.006)		
Foreclosures Per 1000 Population (t-1)					-0.0031 **	-0.0034 **
					(0.001)	(0.001)
ARRA Revenue / Local Revenue						0.0423
						(0.032)
Constant	0.0315 ***	0.0461 ***	0.0502 ***	0.0468 ***	0.0408 ***	0.0371 ***
	(0.007)	(0.007)	(0.003)	(0.009)	(0.010)	(0.010)
Observations	2226	2226	2226	954	954	954
Groups	159	159	159	159	159	159
Periods	14.00	14.00	14.00	6.00	6.00	6.00
R-Squared	0.1656	0.1919	0.1686	0.1701	0.1725	0.1720
Within R-Squared			0.1526	0.1666	0.1636	0.1655
Rho	-0.1016	-0.1245				
Fraction of Variance due to FE			0.0304	0.0630	0.0569	0.0593

Standard errors are in parentheses. *** indicates significance at the 1% level, ** at 5%, and * at 10%. [+] indicates percent change / 100.
Income, population, and employment variables are lagged to correspond to the start of the fiscal year. PCSE indicates pooled regressions with panel-corrected standard errors, correcting for groupwise heteroskedastic, cross-sectionally dependent, and autocorrelated errors. FE denotes fixed effects regressions with cluster robust standard errors, clustering on county.