



The effect of the housing crisis on the finances of central cities

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ABSTRACT

In 2015, eight years after the start of the Great Recession, average per capita revenue in the nation's largest central cities was 7% below pre-recession levels, a decline that in both depth and duration is the most severe in the post-war period. In this paper, we address the role of the housing market in this decline. We analyze the impact of the boom and subsequent collapse in housing prices and the unprecedented surge in mortgage foreclosures on the finances of central cities. To link city finances to housing conditions, we draw on a specially created data base that takes account of the revenues and spending of all the local governments that provide services to city residents. Our regression analysis, which employs data from 2000 through 2014 for 90 large central cities, finds statistically and economically significant effects of both housing price changes and foreclosure rate changes on property tax revenues. We also find that property tax levy limits dampened the fiscal response to the housing bubble and bust. During the housing bubble period, property tax revenues and capital expenditures rose significantly faster in non-levy limit cities than in cities subject to levy limits, but then fell more sharply during the housing bust period. We estimate that the direct effect of the housing bust was responsible for 21% of the decline in the general revenue of large central cities from 2009 to 2011.

1. Introduction

The Great Recession was precipitated by a severe housing crisis with housing prices falling by more than 50% in some areas, and with a more than six-fold increase in the number of housing foreclosures between 2004 and 2011. While there already exists a large literature on the price dynamics of the housing market before, during, and after the recession and on the causes of the sharp rise in foreclosures, to date there has been very little research on the impact of the recession and the housing crisis on the ability of local governments to finance the delivery of public services.¹

In this paper, we focus on the impacts of the housing crisis on the financing of large American central cities. As we will show, the decline in housing prices and the rise in foreclosures led to substantial reductions in both revenues and spending of the nation's largest central cities. The fiscal impacts of the housing crisis were not only severe, but long lasting. Although the Great Recession ended in 2009, in 2016 real per capita expenditures in many central cities were lower than they had been in 2006, the year prior to the recession.²

This paper provides the first comprehensive analysis of how the housing crisis impacted the revenues of a nationwide sample of large central cities. As we will describe in more detail below, the focus of

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¹ See Ferreira and Gyrouko (2015) for a review of much of the literature on housing prices and foreclosures during and after the Great Recession.

² In 77 of 150 large central cities included in the Fiscally Standardized Cities (FiSC) database, real per capital general expenditures in 2016 were below their levels in 2006. The FiSC database is described in the next section of this paper.

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most of the existing literature has been exclusively on the relationship between changing housing prices and property tax revenues.³ In this paper, we provide an in depth analysis of the property tax channel and also explore the direct effect of the housing market on the general revenues (from all sources) of cities. Nearly all the existing research used data on housing prices and property tax revenues for periods that ended prior to or during the Great Recession. Because changes in property tax revenue tend to lag changes in housing prices by several years, these studies were too early to directly observe the full fiscal impact of the housing crisis. Furthermore, most of the existing literature relies on national data, data at the state or metropolitan area level, or focuses on local governments in a single state. Providing a better understanding of how changes in the housing market affects local government finances is important for the smooth functioning of cities. Public services such as education, public safety, sanitation, and infrastructure investment are essential not only for the well-being of city residents, but also play a crucial role in supporting housing values.⁴

Any effort to analyze the impacts of the housing crisis on the financing of U.S. cities faces the problem that the governmental structure and organization of cities varies substantially across the country. Direct comparisons across municipal governments are often highly misleading because public services provided to central city residents and businesses often come from a variety of different governments. In a few cities, the municipal government finances and provides nearly all local government public services, while in many other cities, the responsibilities for financing and providing services is divided between the municipal government and several overlying independent governments, such as counties, school districts, and various kinds of special districts.

To deal with these variations in governmental structure, we have constructed a unique central city database called *fiscally standardized cities*, or FiSCs. The creation of FiSCs, which we describe in more detail later in the paper, involves accounting for all revenue and spending of a central city municipal government and those portions of revenue and spending by independent school districts, county governments, and special districts that are collected from or flow to central city residents and businesses.

To explore the linkages between changes in the housing market and the fiscal condition of central cities, we construct an empirical model of the relationship between several measures of housing market performance and the property tax revenue and the total general revenues of FiSCs. Our analysis utilizes 2000 through 2014 housing market and fiscal data for 90 FiSCs representing most of the nation's largest central cities. We pursue an estimation strategy that employs city and year fixed effects plus multi-year lags between housing market characteristics and local government revenues. The lag structure is consistent with the administrative procedures used to implement the property tax. These steps eliminate or reduce any possible endogeneity that may exist between contemporaneous characteristics of the housing market and local government fiscal behavior. In Section 6, we include a detailed explanation for the plausible exogeneity of the major explanatory variables used in our analysis.

The most important channel through which the housing market impacts local government finance is through the property tax. We find both statistically and economically significant effects of housing price changes

and foreclosure rate changes on property tax revenues, with the housing price effect about two times as great as the foreclosure effect. The elasticity of the property tax with respect to the housing price index centers on 0.20. Property tax revenues responded similarly to both housing price increases and decreases. Sharp housing price declines were strongly correlated with subsequent increases in foreclosures rates. The net effect is that housing price declines, and the associated foreclosures that followed, can explain more than $\frac{3}{4}$ of the decline in property tax revenues from 2009 to 2014. These declines were reinforced by declining income in most of the sample cities. We estimate that the decline in median income from 2009 to 2013 was associated with an additional decline of almost three percentage points in property tax revenues.

The severity of the housing crisis was also linked to the broader local and even state economies, with greater housing market stress associated with significant declines in total city revenues. We estimate that the direct effect of the decline in the housing market was responsible for about 21% of the decline in general revenues. Given the correlation between income changes and housing market stress, this estimate is likely to understate the full effect of the housing market on the decline in the general revenue of FiSCs.

Section 2 provides a brief review of the small literature on the fiscal impacts of the Great Recession and the boom and bust housing market cycle on the financing of local governments. In Sections 3 and 4, we describe the methodology used to construct our fiscally standardized cities dataset and then present data on the changes in the various sources of revenue of central cities (represented by our 90 FiSCs) for the period starting in 2007, the year the Great Recession began, through 2015. In Section 5, we discuss changes in the housing market in the 90 central cities in our sample. We trace the pattern of the CoreLogic housing price index and of foreclosure rates before, during, and after the Great Recession.

To help ascertain the impact of changes in the housing market on the financing of central cities, we estimate several models using data from 2000 through 2014. Section 6 describes our modeling strategy, followed in Sections 7 and 8 by brief discussions of the data and estimation issues. In Section 9, we present the results of our empirical analysis by first focusing on the impacts of changes of housing prices on property tax revenue and general revenues. We then address the independent effects of changes in the foreclosure rates in Section 10. In Section 11, we investigate the extent to which the housing price and foreclosure results are influenced by the existence of property tax levy limits. Finally, in Section 12, we summarize the results and discuss some of the policy implications.

2. Literature review

A small literature exists on the impacts of changes in the housing market on the financing of state and local governments in the United States. The Great Recession and the boom and bust cycle in housing prices during the first decade of this century has clearly spurred interest in this topic. Using national data from 1976 through 2007, Lutz (2008) explores the relationship between changes in housing prices and property tax revenues. He finds that changes in housing prices are reflected in changes in property tax revenues with a lag of three years, and that the long-run elasticity of property tax revenue is 0.4. Lutz finds little evidence that declining house prices have an impact on property tax revenues, although he is careful to caution that his data includes only limited and quite short experiences with falling house prices.⁵

In July 2011, *Regional Science and Urban Economics* (RSUE) published

³ This focus on the property tax is hardly surprising given its important role in local government finance. In fiscal year 2017, property tax revenues accounted for 47% of the own-source revenues of local governments and 72% of local government tax revenue (U.S. Census Bureau, 2019).

⁴ Starting with the seminal paper by Wallace Oates (1969), there is a large literature on the capitalization of local public services. In a recent study drawing on national data, Bayer, Blair, and Whaley (2020) find that after controlling for local taxes, school spending is capitalized into higher housing prices.

⁵ Goodman (2018) uses city and county-level Zillow housing price and Census property tax data for 1998–2012 to replicate the econometric analysis of Lutz (2008). His results are similar; a three-year lag between changes in housing prices and changes in property tax revenues and elasticities of property tax revenue with respect to housing prices of between 0.3 and 0.4, suggesting that the elasticity estimates are robust to declines in the housing market.

a special issue on “the effect of the housing crisis on state and local government finances.” In that volume, Lutz et al. (2011) use national data to identify five channels through which the housing crisis influenced state and local government finance. Only one of their five channels, the property tax, focuses on local governments. Using data that runs through 2009, they find that as housing prices fell sharply between 2006 and 2009, property tax revenues did not decline. They attribute this finding in part to lags between changes in the market value of property and changes in property tax revenue.

In the same volume, Chernick et al. (2011) forecast per capita spending between 2009 through 2013 in 109 central cities. Using revenue data from 1997 through 2008, they predicted that per capita spending in real terms would decline during the forecast period by approximately 7%, and that spending cuts would be much larger in cities that were hardest hit by the Great Recession and the housing market collapse. Alm et al. (2011), using data from a non-random national sample of local governments, also find a several year lag between changes in housing prices and property tax revenue. These results are reinforced by the authors’ analysis of school district data in Georgia. In both of these analyses, the authors find that at least through 2009, the latest year for which they had data, property tax revenues continued to increase despite large drops in housing prices and the market value of property.⁶

Using data from the 2005 through 2011 Comprehensive Annual Financial Reports (CAFRs) of the 35 largest American cities, Ross et al. (2015) find that although property tax levies declined in many cities, in 2010 and 2011 most municipal governments were able to prevent or reduce spending cuts by reducing net assets and drawing down various fund balances. One shortcoming of the reliance on municipal CAFRs is that overlying governments play very different roles in the 35 cities included in the Ross et al. study. While municipal governments in four cities collect 100% of the property tax revenue from property located within city boundaries, in two cities, municipal governments collect less than 10% of total property taxes and in 17 cities less than half. As a result, data from CAFRs may paint a misleading picture of fiscal conditions in central cities.

We are aware of only one paper that discusses the relationship between foreclosure and local government finance. Alm et al. (2012) present a preliminary analysis for school districts in Georgia. Using data from 1997 to 2011, they find that an increase of one foreclosure per 100 homes (approximately the increase in median foreclosures in Georgia from 2006 to 2011) is associated with a roughly 3% decline in market value over each of the two following years. Their analysis does not link changes in property tax base to changes in tax revenue.

3. Fiscal comparisons among central cities: the construction of FiSCs

Direct comparison across city governments of revenues by source can be highly misleading, because responsibility for financing the array of public services provided to city residents and businesses varies widely across cities.⁷ To deal with variation in organizational structure, we use a specially constructed data set known as FiSCs. FiSCs add up all the revenue collected from or on behalf of central city residents and businesses, and similarly, all local government spending flowing to central city residents, businesses, or visitors. FiSC revenue and spending consists of all

revenue and spending of the municipal government, plus a prorated portion of revenue and spending by county governments, independent school districts, and special districts that is associated with central city residents and businesses.⁸ The proration factor for county governments is the city’s share of the county’s population. For school districts, the proration factor is the percentage of students in a school district who live in the central city.⁹ For nearly 500 of the nation’s largest special districts, we determined each district’s service area, and then allocated fiscal variables to each FiSC based on the city’s share of population in each special district’s service area. For smaller special districts, the determination of service areas was based on the type of special district. For example, airports, seaports, and transit utilities typically serve an entire metropolitan area, so fiscal variables were allocated based on each city’s share of their metropolitan area’s population. Hospital districts, library districts, and park districts generally serve a county or smaller geographic area, so allocations were based on the city’s share of county populations.¹⁰

In this paper, our sample includes the 91 FiSCs for which we have obtained detailed housing market data from CoreLogic. Collectively, the population of the 91 central cities in our sample account for 57% of the total population of all “principal cities” in the U.S. metropolitan areas, equaling 18.5% of the U.S. population in 2014. Data from CoreLogic on various housing market characteristics, such as the number of mortgage delinquencies and foreclosures, are available for 2000 through 2014. We use fiscal data for that time period as the basis for our analysis.

4. Fiscal conditions in the nation’s large central cities

No economic downturn since the depression of the 1930s has had as steep and as long-lasting impact on city revenues and expenditures as the Great Recession. In the FiSC sample, average real per capita general revenues peaked in 2007 and continued to fall through 2014.¹¹ In 2015, six years after the end of the Great Recession, average real per capita revenues were still 6.8% lower than in 2007.¹²

Fig. 1 illustrates the distribution of revenues by source in the average FiSC in 2007, just prior to the recession. The single most important source of revenue was state aid, which on average accounts for nearly a third of the general revenue of FiSCs. In contrast, direct revenues from the federal government were relatively small, making up only 6.3% of total FiSC revenues.¹³ The two largest sources of locally-raised revenues were the property tax (23.8%) and user charges (15.8%). Other taxes, primarily sales taxes, accounted for 13.8% of revenue. It is important to note that there was a great deal of variation across cities in the mix of revenue sources. For example, the property tax accounted for over 96% of total tax revenues in Gary, Worcester, and Providence, but less than 35% in Birmingham, New York, and Philadelphia.

Fig. 2 illustrates the changes in real per capita revenue by source in the average FiSC between 2007 and 2015. Although state aid in the

⁸ A public-use version of the database can be found at <http://datatoolkits.lincolninst.edu/subcenters/fiscally-standardized-cities/>.

⁹ To allocate school district fiscal data, we use GIS on school district enrollment in block groups or tracts and information on the boundaries of cities and school districts from Census TIGER shapefiles.

¹⁰ For a more detailed description of the methodology used in constructing the FiSC database see Chernick, Langley, and Reschovsky (2015) and Tannenwald (2014).

¹¹ Because it has no state government, the District of Columbia is excluded from our FiSC sample in calculating the statistics presented in this section. The District of Columbia is also excluded from the regression models discussed in the next section.

¹² Not surprisingly, average per capita current spending (in constant dollars) also declined. By 2013 it had fallen by 7.6% from its peak in 2009. In 2015, real per capita spending remained 4% below its pre-recession (2007) level.

¹³ A portion of federal grants to states are passed through to local governments, but the amounts and shares are not reported in the municipal revenue data from the Census of Governments.

⁶ The RSUE volume also includes several other papers that address linkages between housing prices and property tax revenue but focus exclusively on a single state. Doerner and Ihlandfeldt (2011) analyze data Florida data and Skidmore and Scorsone (2011) data from Michigan.

⁷ For example, Boston and Baltimore have no independent school districts or county governments and thus nearly all service responsibilities are devolved to the municipal government. By contrast, municipal governments in El Paso, Texas and Las Vegas, Nevada collect only about one-quarter of the revenues that finance the delivery of public services within their boundaries.

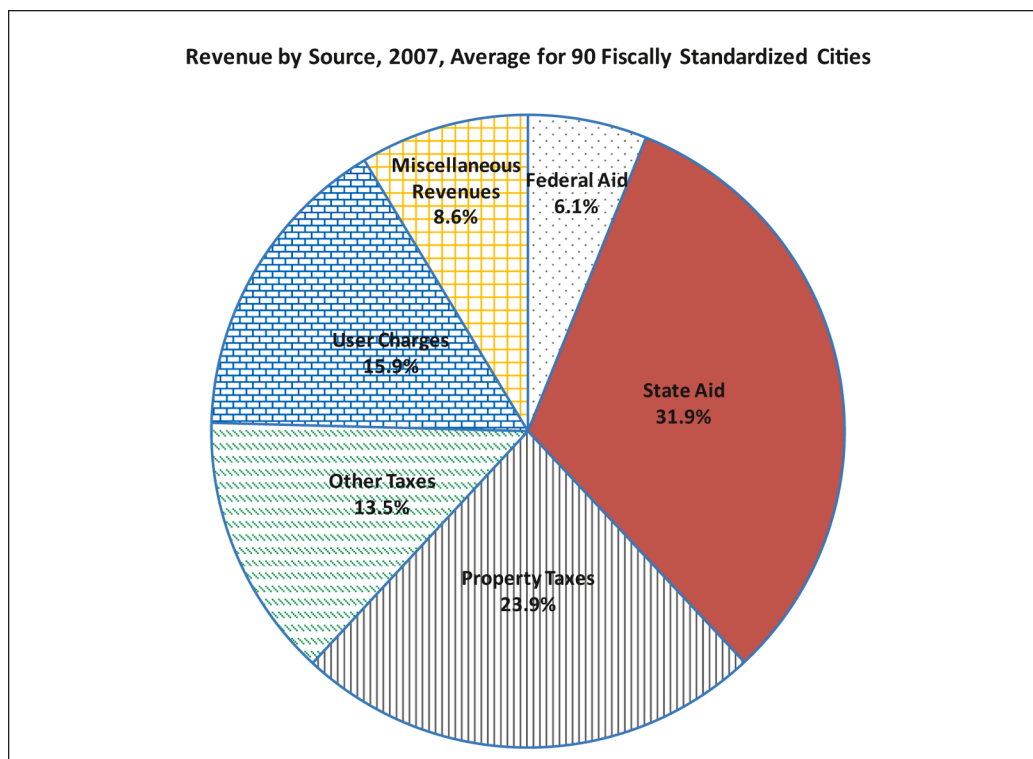


Fig. 1. Revenue by Source, 2007, Average for 90 Fiscally Standardized Cities.

average city has been rising since 2013, in 2015 it remained 10.7% below its pre-recession level. Property taxes rose by 4% to reach a peak in 2009, then fell between 2009 and 2014. In 2015, real per capita property tax revenues were 6.5% below their level in 2007, while revenues from other taxes have returned to pre-recession level. After an initial decline, direct federal aid to FiSC governments rose above 2007 levels in 2010–2012, reflecting the increase in federal aid associated distributed as part of the American Recovery and Reinvestment Act. Since then, real per capita federal revenues have been declining. In 2015, revenue from federal grants in the average FiSC was 8.9% below its level in 2007.¹⁴ The only source of revenue that rose in almost every year since 2007 was user charges. In 2015, charges were 12% above their level in 2007.

5. Housing market developments in the nation's central cities during and after the great recession

The national pattern of house price dynamics during this tumultuous period hides considerable heterogeneity by geographic area. Very few studies, however, focus on cities as the unit of analysis.¹⁵ In this paper, we use data from CoreLogic to calculate housing price indices at the city level. Fig. 3 illustrates the average pattern of housing prices from 1997 through 2014 in the 91 central cities in our sample. The dispersion of

housing prices across central cities increased considerably over the boom years and remained relatively high in 2014. In 2000, the gap between the 10th and 90th percentile value of the housing price index was 22 points. By 2006, at the peak of the housing bubble, the gap had reached 163 points. By 2014, the gap had declined to 105, a large drop, but high by historical standards. Fig. 3 also shows the housing price index for Las Vegas, a city that perhaps most clearly illustrates the boom-bust cycle in housing prices, and for Houston, a city that largely escaped both the boom and the bust in housing prices. Prices in both cities closely tracked prices in the average city from 1997 through 2003. In 2003, the housing price index was about 125 in both cities, but in the next three years the index rose to 229 in Las Vegas, while peaking at 147 in Houston. Prices in Houston then declined modestly, falling back to their 2004 levels, while in Las Vegas, by 2011 prices had plummeted all the way back to their level in 1997. Since 2012, housing prices in Houston have quite closely tracked prices in the average city. While prices in Las Vegas are rising, in 2014 they remained substantially below average.¹⁶

A defining characteristic of the housing market during and after the Great Recession was the dramatic rise in mortgage foreclosures. The relationship that has received the most attention in the literature to date

¹⁴ Two of the largest federal grant programs, which provide supplemental education spending for low-income students, and families, and aid for students with disabilities, are passed through the state, and are included in state aid in the Census of Governments.

¹⁵ Glaeser et al. (2012) observe that there is considerable house price growth variability within MSAs, with prices likely to rise faster in areas close to city centers. Sinai's (2013) analysis, which weights MSAs by their 1990 household population, implies that the greatest growth in house prices, trough-to-peak, in the 2000s were in the largest cities.

¹⁶ Using factor analysis, we divided the central cities in our sample into several groups representing different ways in which they were impacted by changes in the housing market in the period between 2005 and 2012. We identify four distinct groups of cities, which we named: *boom no bust*; *boom and bust*; *status quo*; and *secular decline*. Although property tax revenues declined in all four types of housing markets, the steepest reductions in property tax revenues occurred in *boom and bust* and *secular decline* cities. Only *boom, no bust* cities were able to maintain property tax revenues at levels equal or higher than their pre-recession levels.

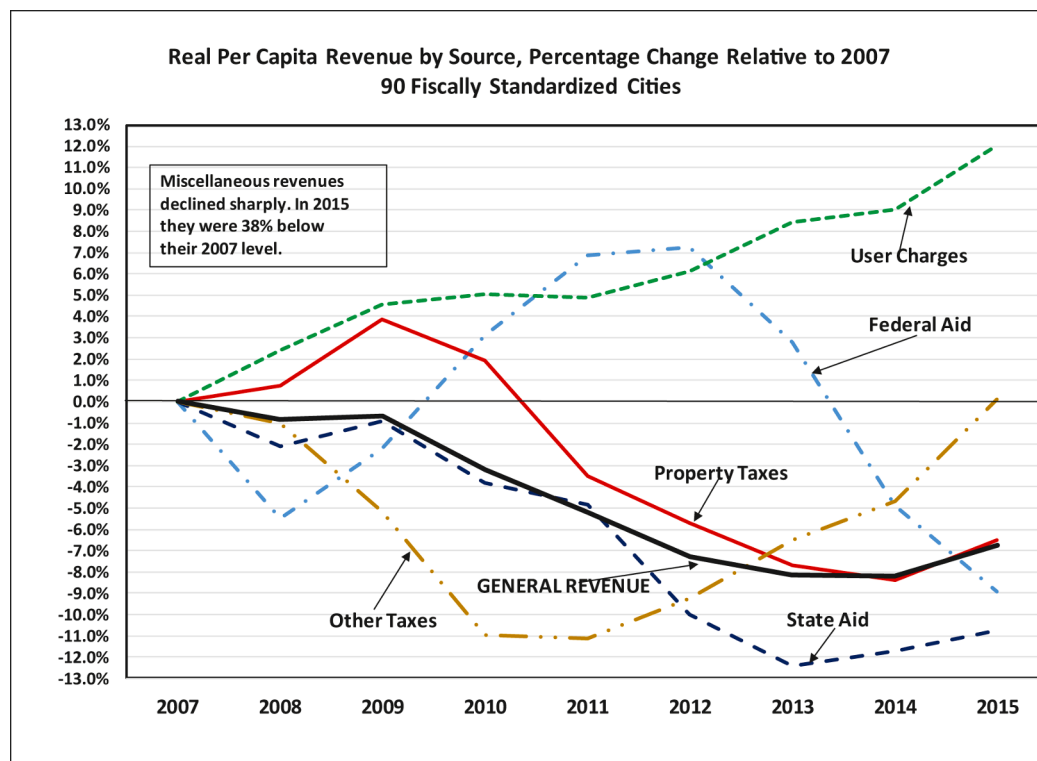


Fig. 2. Real Per Capita Revenue by Source, Percentage Change Relative to 2007 90 Fiscally Standardized Cities.

is between housing prices and foreclosures.¹⁷ We will explore whether foreclosures had an independent impact on the property tax and general revenues of central cities.

Fig. 4 illustrates the pattern of foreclosure rates in the 91 sample cities. Foreclosure rates were calculated as the number of foreclosures divided by the number of mortgage loans. Through 2006 the average rate remained consistently below 1%, although the maximum rate grew steadily from 3.2% to 7.8%. The average rate in the 91 cities peaked in 2011 at 4%. By 2014, it had fallen to 2%, still double the pre-recession foreclosure rate. The maximum rate, which peaked at 19.4% in Detroit in 2011, declined to 7.3% in 2014.

6. Modeling strategy

To explore the linkages between conditions in the housing market and city revenues, we estimate a set of multivariate statistical models, focusing first on the property tax and then on the *general revenues* of FiSCs.¹⁸ Our

modeling strategy is based on the assumption that the primary direction of causation runs from changes in the housing market to changes in city government revenues. Although changes in local government revenues and spending may influence housing prices (through capitalization), because of the way that the property tax is administered, changes in housing prices and the foreclosure rate are reflected in changes in property tax revenues with a lag of several years. As outlined in the previous section, the nation experienced historically large changes in the housing market during the Great Recession. Given the magnitude of these shocks and the built-in lags between the shocks and changes in property tax revenues, we argue that the housing market changes dominate the relationship between the housing market and local government finance.

The most direct link between changes in the housing market and city government revenues is through the property tax, which comprised over half of tax revenue in 74 of the 90 FiSCs in our sample, and over 3/4th of tax revenue in 21 FiSCs. Although levied on both residential and business property, over half of the property tax base in cities is composed of residential property (Lincoln Institute of Land Policy, 2018). It would thus be very surprising if the housing bubble and bust of the past decade and the rapid rise in the number of mortgage delinquencies and housing foreclosures did not have a direct effect on the property tax base of central cities, and on their property tax revenues.

While sales and income tax revenues are likely to reflect contemporaneous changes in the local economy, the effect of changes in housing prices on the property tax depends on the timing of reassessment and the responses of local officials to changes in *assessed values*. Most states employ an annual to every five-year reassessment schedule, although in nine states, state law does not specify the frequency of reassessments (Higginbottom, 2010). Some states phase in changes in assessed values by placing limits on the annual rate of change. In most cities, the assessed values assigned to individual residential properties are determined using a hedonic approach, under which the estimated coefficients from regression analysis of the market value of recently sold housing units on a wide variety of physical and location characteristics are used to obtain a predicted value for each housing unit.

¹⁷ Several recent papers document the relationship between markers of default risk – particularly mortgage delinquencies and foreclosures – and housing prices (Chan et al. 2013; Archer and Smith 2010; Demyanyk et al. 2011; Mian et al. 2015). Campbell et al. (2011) find that selling a property as *distressed*—that is, in foreclosure—drives down prices by about 30%. Mian et al. (2015) report that foreclosures can lead to a large decline in house prices, and that the primary channel of influence between foreclosures and housing prices is through the increase in the number of houses for sale. They estimate that in the 2007–2009 period, foreclosures accounted for 20 to 30% of the decline in house prices. Calomiris et al. (2013) find that although foreclosures suppress housing prices, the effect of housing prices on foreclosures is larger. They report evidence that the lag time between house price changes and changes in the foreclosure rate is approximately two years.

¹⁸ The census definition of the general revenues of local governments includes all revenue from taxes, intergovernmental revenues, from charges and fees, and from miscellaneous revenues, such as interest payments. General revenues do not include revenues generated by publicly-owned enterprises, such as utilities and liquor stores, and revenues associated with social insurance trust funds.

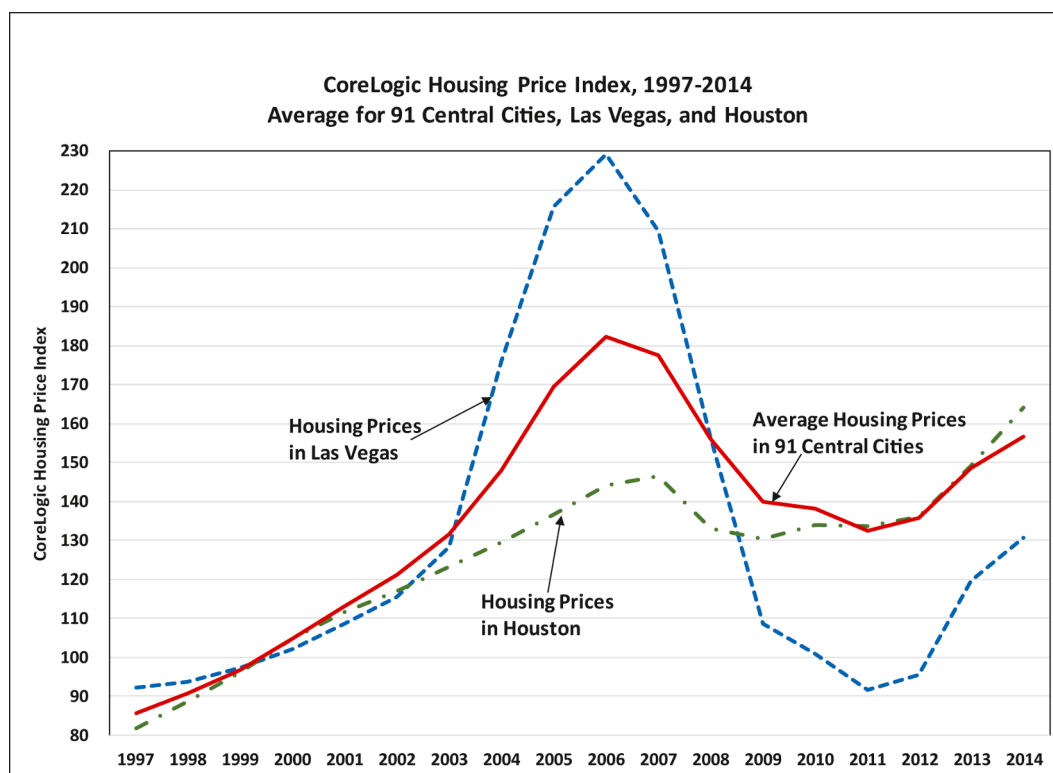


Fig. 3. CoreLogic Housing Price Index, 1997–2014 Average for 91 Central Cities, Las Vegas, and Houston.

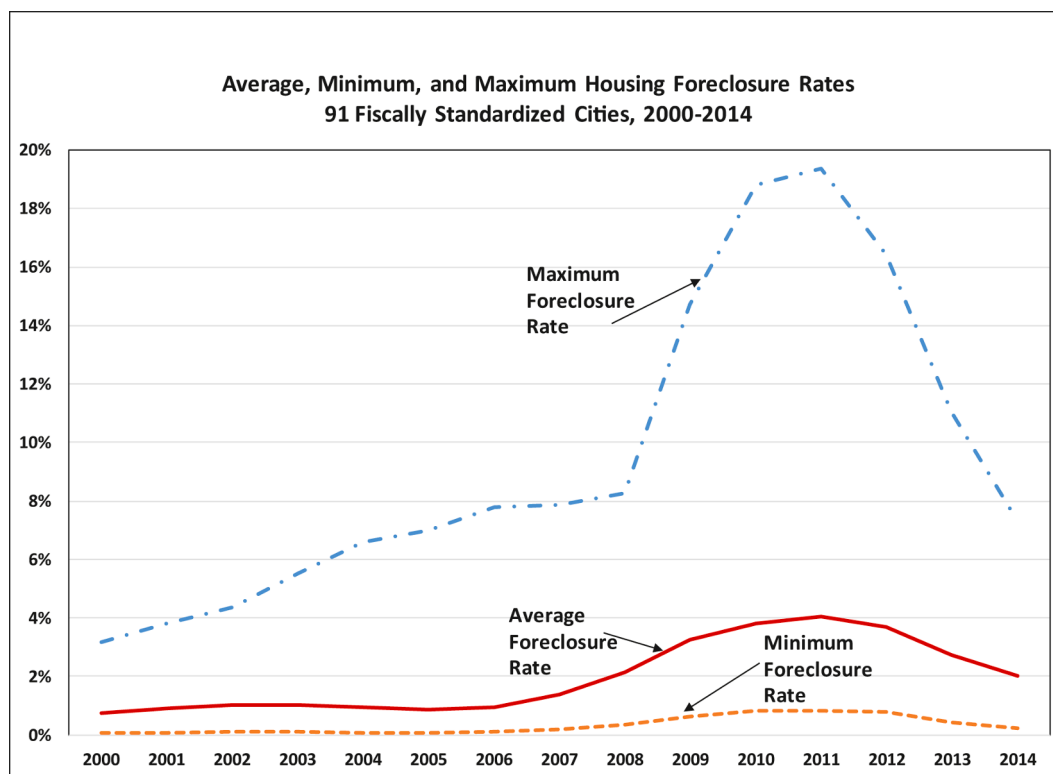


Fig. 4. Average, Minimum, and Maximum Housing Foreclosure Rates 91 Fiscally Standardized Cities, 2000–2014.

Upon reassessment, the new values serve as the basis for tax calculations in the following year. Thus, even in cities where all reassessments occur on an annual cycle, the lag between changes in housing prices and potential changes in property tax revenue is at least two years. Fig. 3 showed that on average, housing prices in the 91 central cities in our sample peaked in 2006, while (as illustrated in Fig. 2) per capita property tax revenues did not peak until 2009. In modeling changes in property tax revenue, we assume a multi-year lagged relationship between changes in housing prices and changes in property tax revenues.¹⁹

Tax revenue is the product of a tax rate (or rates) applied to a tax base. Property taxes differ from other commonly used local government taxes in that local officials are able to raise or lower the tax rate on an annual basis and have at least some degree of influence over the property tax base, whereas their ability to change local sales, excise, or income tax rates or bases is quite limited. Although local governments may be given the option by their state government to levy a local sales or income tax, maximum tax rates and tax bases are generally determined by state statute.²⁰ The authority to offset declines or increases in property values by changes in nominal rates is one reason why property tax revenue has historically been more stable over a business cycle than sales and income tax revenues.

In most states, the two largest forms of state aid to local governments are for public education and for road maintenance. State aid is generally non-matching and individual allocations are formula based, implying that once formulas are set, individual local governments have almost no ability to influence their state aid allocations. As illustrated in Fig. 2, real per capita state aid in the average FiSC was 12% lower in 2013 than in 2007. These state aid reductions were primarily due to large reductions in the state aid budgets in the majority of states. We assume that from the perspective of local government officials, the resulting changes in their state aid allocations were largely exogenous.

A number of federal grants, particularly for education, are passed through from states to localities, but states typically rely on formulae to distribute this assistance. Though we find some evidence that higher spending cities receive higher levels of direct federal aid, the largest federal grants are formula-based. Hence, at least in the short run, the bulk of federal aid is also relatively independent of local government expenditures.²¹ In our property tax and general revenue equations, state and federal aid are entered with a lag of one period to reflect potential adjustment in property tax rates in the subsequent year in response to exogenous changes in intergovernmental aid.

Local governments also rely on revenue from user charges, fees, and fines. Although local governments have some margin for adjustment, and there is wide variation in the degree of reliance on this source of revenue, state governments generally mandate that fees and charges cannot exceed the cost of providing a service.²² As user charges, particularly for water and sewers, are generally determined contemporaneously with property tax revenues, they enter our revenue equations with no lag.

Hence, the only major source of revenue over which local governments have substantial control is the property tax, which is generally considered

to be local governments' residual or marginal source of revenue. The gap between budgeted spending and expected revenue from all sources other than the property tax equals the desired property tax levy for the next fiscal year. Dividing this amount by the total assessed value of property in the previous year generates a property tax millage rate.²³ Consistent with their ability to adjust nominal rates, all the existing literature has reported property tax revenue elasticities with respect to housing prices to be less than one.

Relative to other taxes, local governments have substantial control over their property tax revenues. Their degree of control, however, is likely to vary depending on state- or locally- imposed restrictions on the ability of local governments to change property tax assessments, rates, or levies.²⁴ More than 90% of the cities in the FiSC sample are subject to some form of voter-approved or state-imposed property tax limitation, with two thirds of the sample subject to limitations on the growth in residential property tax levies. The model specifications which follow will take account of the presence or absence of tax limitations.

As was illustrated in Fig. 4, the Great Recession and its immediate aftermath were characterized by a sharp rise in the number of foreclosures. To the extent that owners of foreclosed properties stop paying property taxes, an increase in foreclosures may have a direct impact on property tax collections. Although no comprehensive data exist on the link between mortgage foreclosures and tax foreclosures, a number of central cities experienced a substantial increase in tax foreclosures in the years immediately following the Great Recession.

A sizable literature has emerged on spillover effects related to foreclosures. In a survey of the early literature, Frame (2010) reports that foreclosures not only lowered the price of foreclosed properties, but also depressed home prices in nearby neighborhoods, with the effect falling off sharply with distance. Campbell et al. (2011), using 20 years of housing transactions data from Massachusetts, conclude that foreclosed houses sell at a discount of 27%, and that foreclosures result in a price reduction of about 1% for houses within 0.05 miles of a foreclosed housing unit. In an examination of the "contagion effect" of foreclosures, Towe and Lawley (2013) find that a foreclosed property increases the probability of foreclosure of neighboring properties. Hartley (2014) and Anenberg and Kung (2014) both explore the mechanism through which foreclosures reduce prices of neighboring homes. They conclude that competitive factors (increased housing supply) are more important than the disamenity effects of foreclosures, although Anenberg and Kung find disamenity effects of foreclosures in high density, low price neighborhoods. Recent papers by Huang et al. (2018) and Gupta (2019) find further causal evidence of spillover effects of foreclosures on both housing prices and additional foreclosures. Although these spillover effects are spatially limited, the affected areas grow when the density of spillovers is high.

Property tax revenue of FiSCs is derived not only from the taxation of residential property, but also from the taxation of commercial and industrial property. Although the national share of the residential property in the overall property tax base is at least 60% (Lincoln Institute of Land Policy, 2018), non-residential property is likely to be substantially more

¹⁹ As indicated previously, the literature reports multi-year lags (Lutz, Molloy, and Shan, 2011; Lutz, 2008; Alm, Buschman, and Sjoquist, 2011; and Chernick, Langley, and Reschovsky, 2012, Goodman, 2018).

²⁰ For a full discussion of local government tax autonomy in the United States, see Dougherty, Harding, and Reschovsky (2019).

²¹ Although Medicaid is financed through a federal matching grant, with the exception of New York State, these grants go directly to state governments. In New York, the non-federal share of some Medicaid spending is shared equally between the state and county governments.

²² In Wisconsin, for example, the revenue from fees and charges cannot exceed the costs of providing the related services and cannot be used as general revenue by local governments (Scharff, 2016). In a study of the role of user fees in the funding of public education, Downes and Killeen (2014) find that counter to their expectations, the role of user charges did not grow during and immediately after the Great Recession. They attribute this finding in part to the limited possibilities for fee-based financing in public education.

²³ The budget setting process may well be iterative. If the desired spending requires a change in tax rate or in property tax levy that is politically unacceptable, the level of desired expenditures will have to be reduced until an acceptable property tax-spending mix is achieved.

²⁴ There exists a substantial literature on the impacts of tax and expenditure limitations on revenues, spending, and public service provision. Downes and Figlio (2015) provide a recent review of the literature on the impact of limitations on education finance. They conclude that there is strong evidence that binding limitations reduce school revenues and spending, and in some cases lead to reductions in education quality.

Table 1

Summary Statistics for Variables Used in Regression Analysis 90 Fiscally Standardized Cities, 2000 and 2014.

	2000	Mean	Stand. Deviation	Minimum	Maximum
Real Per Capita Property Tax Revenue		\$1116.6	\$367.2	\$423.4	\$2129.4
Real Per Capita General Revenue		\$5041.9	\$1280.7	\$3168.0	\$8803.6
Housing Price Index		104.6	3.5	96.8	117.4
Foreclosure Rate		0.008	0.006	0.001	0.032
Real Per Capita State Aid		\$1704.7	\$710.0	\$365.9	\$3200.7
Real Per Capita Federal Aid		\$266.4	\$172.8	\$45.0	\$911.4
Other (Non-Property) Per Capita Tax Revenue		\$696.4	\$431.9	\$16.3	\$2530.1
Per Capita User Charges and Fees		\$808.7	\$406.2	\$308.5	\$2469.9
Median Household Income		\$38,053.7	\$9035.3	\$23,483.0	\$76,579.0
Per Capita Market Value of Property		\$64,636.3	\$27,451.6	\$9853.1	\$165,844.6
Levy Limit Indicator		0.6333	0.4846	0	1
	2014	Mean	Stand. Deviation	Minimum	Maximum
Real Per Capita Property Tax Revenue		\$1255.4	\$433.4	\$535.6	\$2876.0
Real Per Capita General Revenue		\$5408.9	\$1573.2	\$3039.7	\$11,644.0
Housing Price Index		155.1	40.0	75.7	265.3
Foreclosure Rate		0.020	0.018	0.002	0.073
Real Per Capita State Aid		\$1666.7	\$789.1	\$473.1	\$4448.5
Real Per Capita Federal Aid		\$351.5	\$272.3	\$21.0	\$2005.9
Other (Non-Property) Per Capita Tax Revenue		\$764.2	\$507.9	\$22.8	\$3383.2
Per Capita User Charges and Fees		\$1038.5	\$584.4	\$365.9	\$3138.5
Median Household Income		\$47,803.1	\$13,084.3	\$25,764.0	\$105,355.0
Per Capita Market Value of Property		\$78,178.3	\$37,550.0	\$12,031.6	\$196,119.3
Levy Limit Indicator		0.6333	0.4846	0	1

important in cities than in the nation as a whole.²⁵ Because of higher effective tax rates on non-residential property in many cities, data on market values may understate the importance of non-residential property in the property tax revenues of cities.²⁶ To explore the role played by non-residential property in explaining changes in property taxes and general revenue, we utilized data on the per capita “estimated actual value of all taxable property” from cities’ CAFRs. Changes in estimated market value provide a potentially more inclusive measure than house prices alone of the effect of the recession and the housing crisis on real property values in cities.

The final variable in the property tax model is household income. Income influences property tax revenues via two channels. First, the level of income affects the demand for public services, and hence the willingness of residents to pay property taxes. Many studies have shown that the demand for local public goods rises with income. Second, cities with higher levels of household income are generally associated with both higher housing prices and higher commercial rents.²⁷ Hence, higher median incomes are associated with a higher value property tax base. Both channels imply a positive effect of income on property tax revenues.

²⁵ No comprehensive data on residential shares of market value are available, however an example is illustrative. In 2014, 42.3% of the City of Milwaukee’s market value came from commercial and industrial property, while in the rest of Wisconsin, the share was 22.2% (Wisconsin Department of Revenue, 2016).

²⁶ A recent study of the effective tax rates on owner-occupied property and commercial property in the largest city in each state demonstrates that, in many central cities, tax rates on commercial property are substantially higher than tax rates on owner-occupied residential property (Lincoln Institute of Land Policy and Minnesota Center for Fiscal Excellence, 2017). An extreme example is New York City, where in 2014, 42% of property taxes were paid by non-residential property, while its share of market value was 27%. The property tax classification system used in New York ensures that the non-residential share of the property tax substantially exceeds its share of market value (Citizens Budget Commission, 2013).

²⁷ Based on commercial rent data for a sub-sample of 24 of the largest metropolitan areas, the correlation between the change in commercial rents between 2006 and 2014 and the change in household median income is 0.43, while the correlation with median income per person equals 0.68.

7. Data

Detailed revenue data for FiSCs comes from the Census Bureau’s individual unit of government files generated from the *Annual Survey of State and Local Government Finance*. Data on housing prices and on foreclosures were obtained from CoreLogic. The CoreLogic data were available for 91 of the 150 central cities in the FiSC database. Washington, DC is excluded from our regression models because it has no overlying state government, and hence no data on state aid. Thus, our multivariate models are based on a sample of 90 FiSCs.

CoreLogic data include repeat-sale nominal housing price indices and the number of foreclosures at the zip code level for the 2000 to 2014 period. We aggregated monthly data to an annual level, and within each city summed data for all zip codes within city boundaries. For zip codes that straddled central city boundaries, the data were adjusted to account for the share of zip codes’ 2010 population living within the central city. Foreclosure rates were calculated by dividing the number of foreclosures by the number of mortgage loans (also from the CoreLogic dataset).

The Lincoln Institute of Land Policy’s *Significant Features of the Property Tax* (2018) database includes annual information on property tax limitations that were in effect in each state. Information is available on state-imposed limits on the annual growth of property tax levies and on limits on the growth of assessed values. 64% of the 90 FiSCs face limits on increases in their property tax levies, about a third also have a limit on the rate of growth of residential assessed values, and a quarter had an assessment limit, but no levy limit.

Data on the annual market value of real property were compiled from each city’s CAFR.²⁸ These data were missing for all or some years in the CAFRs filed by some cities. With the exception of Gary, Indiana, we obtained the missing data from other city government sources. Data on

²⁸ Market values are typically estimated by dividing the assessed value of each parcel as determined by local assessors by an estimate of the average ratio of assessed to market value. For most residential property, the average ratio is based on recent sales. Market values for non-residential properties that sell infrequently are more difficult to ascertain. Various methods, often tied to the income generated by the properties, are used to estimate market value. As a result, non-residential market value data reported in CAFRs may be imprecise, with the degree of imprecision differing across cities.

median household incomes comes from the 2010 decennial census and from the 2007, 2010, and 2013 3-year American Community Surveys. To impute the missing years, we increased or decreased median incomes in each city in proportion to the percentage annual change in state per capita personal income in the relevant state. Annual state per capita personal income data come from the Bureau of Economic Analysis of the U.S. Department of Commerce.

Table 1 shows summary statistics for the variables in our regression analysis. All dollar amounts are in inflation-adjusted 2014 dollars. Except for state aid, the average values of all the dollar denominated variables are higher in 2014 than in 2000. The standard deviations and the minimum and maximum values indicate the high degree of variation in the fiscal, housing, and economic characteristics of the 90 central cities in our sample. The differences across cities in housing prices, foreclosure rates, and in median household income grew over the analysis period, with most of the growth occurring at the top end. For example, while the minimum value of real median household income grew by less than 10% between 2000 and 2014, the maximum value grew 37.5%.

8. Estimation

Following the modeling strategy outlined above, we estimate equations for property tax revenues and general revenues. All revenue sources are measured in real per capita terms, and the models are estimated in log form for dollar-denominated variables and for the housing price index. All models are estimated with city fixed effects and year effects. Given the lags inherent in the process of reassessing the market value of property, we expect the housing variables to enter the property tax and general revenue equations with a lag. While our review of the literature suggests a lag of at least two years for housing prices, we allow the empirical patterns to determine the most appropriate lag length. Although there is little prior evidence regarding the timing of foreclosure effects, if the main channel is through the effect of foreclosures on housing prices, then the lag would be similar to that for housing prices. Intergovernmental aid is entered with a lag of one period, to reflect potential adjustment in property tax rates in the subsequent year in response to changes in intergovernmental aid.

9. Regression results-fiscal impacts of changes in the housing price index

9.1. Property tax results

Regression results for the property tax are shown in Table 2. Assessment lags imply that changes in housing prices and foreclosure rates will affect property tax revenues with a lag. The first model in Table 2 incorporates a three-period lag for the two housing variables, while model 2 lags the housing variables by one-period. We also estimated a model with two-period lags and a model with lags of one, two, and three years.²⁹ We find that the strongest results were for the three-year lag (model 1). The one-period lag coefficient for housing prices (model 2), is not significant, the two-period lag coefficient has the expected sign but is not as large as the three-year lag, and the results from the three-lag model are much weaker than the single three-year lag model.

By allowing the housing price coefficient to vary depending on the direction of change in housing prices, model 3 explicitly tests whether there is an asymmetric revenue response to housing price increases and decreases. The insignificant coefficient on the price increase term indicates that property tax revenues rose and fell at approximately the

same rate in response to a given change in the housing price index.

The coefficient on the housing price index in both models 1 and 3 implies an elasticity of 0.20. The model predicts that the 50.7-point rise in the average housing price index from 2003 to 2006 led to a 6% increase in property tax revenues, while the 50-point decrease in the HPI from its 2006 peak to its 2011 trough led to an almost equal decline in property tax revenue.

Median household income is positively correlated with property tax revenues, with an estimated elasticity between 0.78 and 1.17, depending on the specification. The average of real median household income fell by 9% between 2006 and 2013. This decrease implies a decline in average property taxes between 7% and 9%.

The state and federal aid coefficients underline the importance of intergovernmental aid to city revenues. Excluding model 5, the estimated elasticity of the property tax with respect to state aid ranges between -0.09 and -0.13 , implying that a 10% increase in state aid leads to a reduction of about 1% in property tax revenues. These results suggest that revenues from the major local tax source are largely independent of the amount of state aid. Federal aid does not have a statistically significant effect, implying that federal aid is additive to property taxes. Other local government taxes are either insignificant or have a small negative relationship with property tax revenues, implying that these taxes, primarily local sales and excise taxes, are also additive, as opposed to substitutive, to the property tax.

User charges have been a growing share of the revenue of FiSCs since 2001. Our results for user charges show that the substitution effect on property taxes is statistically significant in most of the specifications, with elasticities ranging in magnitude from -0.08 to -0.11 . In the average FiSC, user charges increased by 20% from 2003 to 2014. The estimated coefficients imply that this increase is associated with a reduction in property taxes of about 2%. The relatively small size of the substitution effect between user charges and the property tax is not surprising. The most important categories of charges are for hospitals, and sewers, neither of which are easily fungible. Moreover, state laws frequently limit the ability of local governments to treat charges and fees as general-purpose revenues.

Model 5 in Table 2 replaces the housing price variable with an estimate produced by each city of the market value of its entire property tax base, including both residential and commercial-industrial property. Because we lack data on the non-residential share of the property base, this specification is designed to test whether market prices and assessed values of non-residential property move in tandem with residential housing prices. The larger the share of residential property in the property tax base, or the more strongly price changes in residential and non-residential property are correlated, the more the housing price index coefficient will provide an accurate measure of the effect of changes in housing prices on property tax revenues. The results from model 5 of Table 2 show that the estimated elasticity of market value, equal to 0.22, is quite close to the estimated housing price coefficient. This result suggests that the coefficient of the housing price series is not affected by the exclusion of non-residential property and provides an adequate measure of changes in the value of the property tax base.

9.2. General revenue results

Table 3 examines the effect of the housing related variables – housing prices and foreclosure rates – on the per capita general revenue of FiSCs. General revenue is the sum of own-source revenues and intergovernmental transfers. Hence, all included revenue sources function as identities, which will affect the housing variable estimates only if there is significant multicollinearity between the housing variables and the non-property tax revenue sources.

The first model in Table 3 uses the same specification as model 1 in the property tax regressions (Table 2). The housing price coefficient, lagged three periods, is statistically significant and positive, with an estimated

²⁹ In the two-period lag equation, the housing price coefficient (with t statistics in parentheses) is .144 (5.37). In the equation including one, two, and three period lags, the results are -0.411 (5.24), 0.413 (3.30), and 0.083 (1.03), respectively.

Table 2

Real Per Capita Property Tax Revenues: Regression Results 90 Fiscally Standardized Cities, 2003 to 2014.

Dependent variable:	Per Capita Property Tax Revenue				
	(1)	(2)	(3)	(4)	(5)
Housing Price Index (t-3)	0.195*** (7.32)		0.195*** (7.34)	0.260*** (9.64)	
Housing Price Index (t-1)		0.0104 (0.38)			
Foreclosure Rate (t-3)	-1.107*** (4.98)		-1.118*** (5.02)	-0.982*** (4.55)	-1.097*** (5.15)
Foreclosure Rate (t-1)		0.300 (1.56)			
Real Per Capita State Aid (t-1)	-0.128*** (4.76)	-0.094*** (3.64)	-0.126*** (4.61)	-0.101*** (3.83)	-0.106*** (4.08)
Real Per Capita Federal Aid (t-1)	-0.0078 (0.66)	0.0107 (1.02)	-0.0075 (0.63)	-0.0100 (0.87)	-0.0135 (1.19)
Other (non-property) Per Capita Tax Revenue	-0.0178 (0.75)	-0.0374 (1.84)	-0.0170 (0.72)	0.0003 (0.01)	-0.0631* (2.72)
Per Capita User Charges and Fees	-0.0754** (2.85)	-0.0350 (1.50)	-0.0752** (2.84)	-0.0803** (3.13)	-0.1180*** (4.55)
Median Household Income	0.777*** (7.37)	1.171*** (12.68)	0.778*** (7.38)	0.949*** (9.10)	0.916*** (9.80)
Housing Price Index (t-3) * Levy Limit Indicator				-0.225*** (8.08)	
Housing Price Index (t-3) Increase			-0.0017 (0.73)		
Market Value of Property (t-1)					0.219*** (7.80)
Constant	-0.550 (0.50)	-4.439*** (4.50)	-0.591 (0.53)	-2.310* (2.11)	-3.105*** (3.11)
Number of Observations	1080	1260	1080	1080	1068
Adjusted R-squared	0.365	0.378	0.365	0.405	0.393

Notes: t statistics in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

All models were estimated with city fixed effects and year effects.

All variables except for the foreclosure rate are in log form.

elasticity of 0.033.³⁰ The size of the coefficient is 17% of the housing price coefficient in model 1 in Table 2. The property tax made up on average 24% of general revenue. If there were no offsetting correlated effects on general revenue from the other covariates, we would expect that the estimated coefficient would be 0.047.³¹ The upper bound of the 95 percent confidence interval on the housing price coefficient is 0.054, which easily exceeds the 0.047 value. Hence, the general revenue effects of the housing price variable are consistent with the hypothesis that the main channel through which housing prices affect general revenues is through their effect on property taxes.

The estimated elasticities of the non-property tax sources of general revenue are consistent with their respective shares in the general revenue

of FiSCs. For example, user charges made up 16% of general revenue in 2007, very close to our estimated elasticity of revenue with respect to charges of 0.17. The estimated income elasticity of general revenue is 0.31. This elasticity compares to the income tax elasticity of property tax revenue of 0.78.³²

10. Regression results-fiscal impacts of changes in foreclosure

10.1. Property tax results

The foreclosure rate, lagged three periods, has a significant negative effect on property tax revenues in all specifications. In model 2, which lags the foreclosure rate by one period, the coefficient is positive and

³⁰ Model 2 in Table 3 lags the housing price index by one-year. The estimated coefficient is statistically insignificant. We also estimated a model with one, two, and three-year lags. The respective coefficients (with t-statistics in parentheses) are -0.058 (1.78), 0.129 (2.49), and -0.076 (2.28). Note that the lags in this model almost completely cancel each other out.

³¹ This number is the product of the property tax share of general revenue (0.24) and the lagged housing price coefficient in the property tax regression (0.195).

³² This difference is due primarily to the fact that intergovernmental revenues are either uncorrelated or negatively correlated with city income levels. In most states, state education aid formulas are equalizing, meaning that they provide more state aid to school districts with lower incomes and property values.

Table 3

Real Per Capita General Revenue: Regression Results. 90 Fiscally Standardized Cities, 2003 to 2014.

Dependent variable:	Per Capita General Revenue		
	(1)	(2)	(3)
Housing Price Index (t-3)	0.0327** (3.00)		
Housing Price Index (t-1)		0.0189 (1.70)	
Foreclosure Rate (t-3)	-0.251** (2.78)		
Foreclosure Rate (t-1)		-0.117 (1.47)	
Real Per Capita State Aid	0.232*** (21.07)	0.251*** (23.74)	0.254*** (25.18)
Real Per Capita Federal Aid	0.0585*** (12.74)	0.0699*** (16.52)	0.0699*** (16.77)
Other (non-property) Per Capita Tax Revenue	0.115*** (11.79)	0.122*** (14.55)	0.118*** (14.05)
Per Capita User Charges and Fees	0.166*** (15.29)	0.169*** (17.55)	0.164*** (17.23)
Median Household Income	0.310*** (7.17)	0.314*** (8.19)	0.282*** (8.60)
Market Value of Property (t-1)			0.039*** (4.14)
Constant	1.189** (2.65)	0.926* (2.27)	0.952** (2.74)
Number of Observations	1080	1260	1246
Adjusted R-squared	0.655	0.684	0.711

Notes: t statistics in parentheses. * $p < 0.005$, ** $p < 0.01$, *** $p < 0.001$.

All models were estimated with city fixed effects and year effects.

All variables except for the foreclosure rate are in log form.

statistically insignificant.³³ The effect of three-year lagged foreclosure on property tax revenue is nearly identical in model 1, which includes the lagged housing price index, and in model 5, which substitutes the market value of property, lagged one period, for the housing price index. The average rate of foreclosures quadrupled from 2006 to 2011, going from 0.9% to 4.0%. Using the foreclosure coefficient of -1.1 from model 1 in Table 2, this increase in the foreclosure rate implies a decline in property tax revenues of 3.4% (3.1×-1.1) from 2007 to 2012. The estimated impact is a little more than half of the impact of the estimated impact of the decline in housing prices.

We can use our results to divide the total effect of the increase in foreclosure rates on property tax revenues into the direct effect through decreases in the selling price of foreclosed homes and the spillover effects of foreclosures through depressed home prices in nearby neighborhoods. As cited above, Campbell et al. (2011) estimate that foreclosed houses sell at a discount of nearly 30%. In our sample, on average two thirds of homeowners have mortgage loans. Multiplying the 3.1 percentage point increase in the average foreclosure rate between 2006 and 2011 by the 30% price discount implies a decrease in the market value of residential

Table 4

Annual Foreclosure Rates, 2006 - 2014. 91 Fiscally Standardized Cities.

Year	Average Across 91 Cities	Average Across 7 Florida Cities	Average Across 15 California Cities
2006	0.9%	0.5%	0.3%
2007	1.4%	1.6%	1.0%
2008	2.1%	5.2%	2.2%
2009	3.2%	10.5%	3.3%
2010	3.8%	13.3%	3.1%
2011	4.0%	14.3%	2.8%
2012	3.7%	12.9%	2.1%
2013	3.7%	12.9%	2.1%
2014	2.0%	5.6%	0.6%

properties with mortgages of 0.9%. Assuming that two-thirds of owner-occupied housing units have mortgages, the effect of foreclosures on market value would be roughly 0.6%. The estimate from Model 5 in Table 2 is that a 1% decline in market value decreases property tax revenues by 0.22%. In contrast, the direct estimate from Model 1 is that the 3.1 percentage point increase in the average foreclosure rate lowered property tax revenues by 3.4% (0.031×-1.107).

We conclude that the total effect of increased foreclosures on property tax revenues substantially exceeds the direct effect through decreases in the value of foreclosed properties. The higher total effect is likely due to two factors. First, consistent with the foreclosure literature, there are significant spillover effects of foreclosures on the value of nearby properties. Second, one precipitating factor for a foreclosure is a decline in the

³³ We also estimated the foreclosure rate effect on property tax revenues with alternative lag structures. Lagging the foreclosure rate by two periods, as opposed to three, yields a much smaller coefficient, -0.635 with a t-statistic of 3.16. We also estimated a model that includes all lags up to three periods. All three coefficients were not statistically significant. The one, two, and three-year lag coefficient estimates are -0.378, -0.465, and -0.328, respectively.

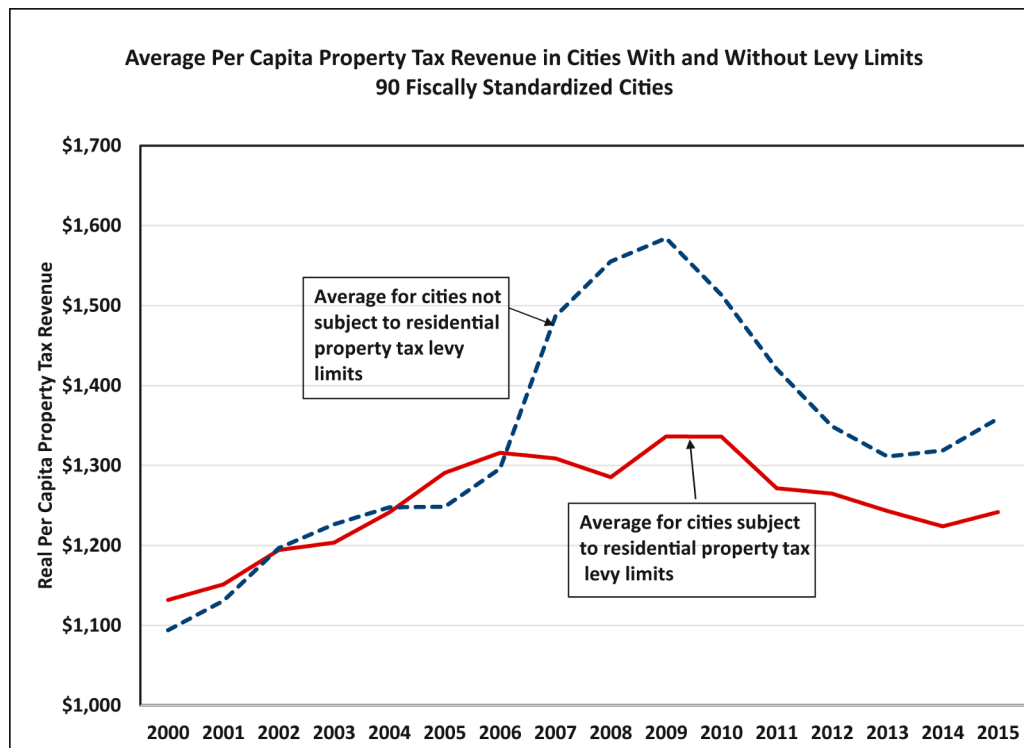


Fig. 5. Average Per Capita Property Tax Revenue in Cities With and Without Levy Limits 90 Fiscally Standardized Cities.

homeowner's household income. In our sample, we find a strong correlation between the rise in foreclosure rates and the decline in median income ($\rho = -0.23$). As discussed above, median household income has a strong effect on property tax revenues. Though we include median income as an independent variable, the collinearity between changes in foreclosure rates and changes in income means that our estimate of the foreclosure effect is likely to be amplified by the decrease in income that accompanies the increase in foreclosure rates.

Examining individual central cities, we observe that even after controlling for changes in housing prices, foreclosure rates vary substantially, with interstate differences being especially large. The strongest example is illustrated in Table 4, which shows the average foreclosure rates between 2006 and 2014 in the seven Florida cities and the 15 California cities in our sample.³⁴ The differences are striking. In 2006, foreclosure rates were low in both states (0.5% and 0.3%, respectively). In Florida, the average foreclosure rate peaked in 2011 at 14.3%, and then declined to 5.6% in 2014. In contrast, the average rate in California cities peaked in 2009 at 3.3% and then dropped to 0.6% by 2014.

Anecdotal evidence suggests that different legal institutions in Florida and California may help explain why foreclosure rates were much higher in cities in Florida compared to California cities even though cities in both states experienced equally sharp increases and declines in housing prices. California is a so-called *non-recourse* state in which lenders cannot pursue non-housing assets of a borrower. In Florida, however, lenders can seize other assets, and even garnish wages, if mortgage loans are not fully repaid. Hence, California lenders are likely to have had a stronger incentive to renegotiate mortgage terms and avoid foreclosure in depressed housing markets than lenders in Florida.

10.2. General revenue results

Model 1 in Table 3 indicates that foreclosure rates have a significant

³⁴ In 2014, 13% of Florida's population lived in the state's seven FiSCs. In California the population of the state's 15 FiSCs accounted for 29% of California's population.

negative effect on general revenues.³⁵ The estimated coefficient of -0.25 , is about one quarter as large as the coefficient on foreclosures in the property tax equation. This magnitude is consistent with the share of property taxes in general revenues and suggests that the principal channel through which increased foreclosures affected city revenues was through the effect on property taxes.

To approximate the *direct* effect of the housing market on the general revenue of cities, we multiply the estimated coefficients on the log of housing prices (0.0327) and the foreclosure rate (-0.251) from model 1 in Table 3 by the changes in their average values from the 2006 peak through the 2011 trough. Taking account of the three-year lag between house price and foreclosure rate changes and changes in general revenues, the result of this calculation is an 1.8% reduction in general revenues between 2009 and 2014. Given that real per capita general revenues declined by 8.6% in the average FiSC during this period, we conclude that 21% (1.8%/8.6%) of the total decline in general revenues during this period is directly attributable to the housing crisis. These calculations probably understate the overall effect of the housing market collapse. Although causality is unclear, the housing crisis was associated with falling incomes and cuts in state aid, both of which had additional negative impacts on general revenues.

11. The effect of property tax levy limits

To test whether the responsiveness of the property tax to changes in housing prices varies depending on the presence or absence of property

³⁵ We also estimated the effect of foreclosure rates on general revenues with alternative lag structures. With a two-period lag, the estimated foreclosure rate coefficient, with the t-statistic in parentheses, is -0.128 (1.43). This estimate is about $\frac{1}{2}$ of the estimate for the three-period lag shown in Table 3. In a model including all three lag periods, the estimated coefficient on the foreclosure rate lagged one year is unexpectedly positive: 0.928 (2.98). The coefficients on the foreclosure rate lagged two and three years are both negative but statistically insignificant: -0.777 (1.40) and -0.236 (0.62).

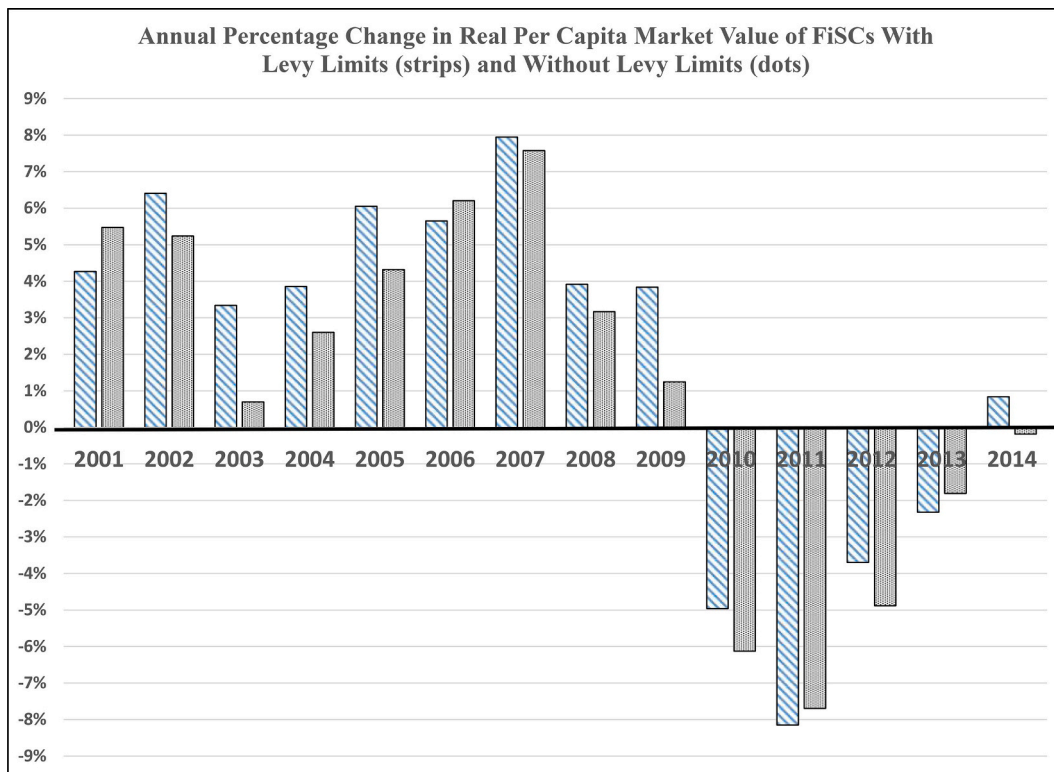


Fig. A1. Annual Percentage Change in Real Per Capita Market Value of FiSCs With Levy Limits (blue bars) and Without Levy Limits (red bars).

tax limitations, we estimated a specification which includes both the price index alone and the price index times an indicator variable denoting the presence of a tax limitation. We experimented with various types of limitations and found that the most robust was an indicator for any type of limit on property tax levies. 57 of the 90 cities in our sample were subject to levy limits, with all the limits imposed before the year 2000. The results are shown in model 4 in Table 2. The significant negative coefficient on the interaction term suggests that in cities with levy limitations, the responsiveness of property tax revenues to changes in housing prices is substantially lower than in cities lacking such a limitation. By contrast, assessment limitations, either alone or in interaction with housing prices, are insignificant. As expected, the housing price coefficient alone is larger in model 4 than in models 1 and 3. Model 4 indicates that in the almost two thirds of cities with levy limitations on residential property, the effect of changes in housing prices on property tax revenue is less than one fifth of the average elasticity of 0.195, while for cities without levy limitations, the elasticity is 33% higher than the average for all cities.³⁶

Fig. 5 plots average per capita property taxes by year for cities with a levy limit and cities without such a limit. The figure shows that the pattern of property taxes in both types of cities was quite similar before and after the housing boom and bust. However, from 2006 to 2009, property tax revenues in the non-levy limit cities increased substantially faster than in the levy limit cities and fell much faster between 2009 and 2013. The fact that annual percentage changes in the value of the property tax base were similar throughout most of the sample period in the two types of cities suggests that while levy limits were binding when market values grew, they were also associated with larger increases in nominal tax rates when market values declined.³⁷ Thus, while property tax levy limitations had

little effect on property tax revenues prior to the Great Recession, they played a significant role in limiting the volatility of property tax revenues during a period of unusual cyclical instability in the property tax base.

12. Conclusions

The housing crisis that precipitated the Great Recession led to significant fiscal stress for U.S. cities. On average, real per capita revenues peaked in 2006 and continued to fall through 2015. In 2015, per capita real operating expenditures were 4% below their 2007 level. Revenue and spending reductions during and after the Great Recession have been sharper and longer lasting than in any other post-war recession.

We use a specially created data base that accounts for revenues and spending of all the local governments that provide services to city residents and link it to data on housing conditions provided by CoreLogic. Our data cover the period from 2000 to 2014 and the sample includes 91 large central cities.

Housing prices were volatile in our sample of cities. After increasing by 74% from 2000 to 2006, they began a sharp 5-year decline, reaching a trough in 2011, bringing an index of housing prices back to its 2003 level. After a lag of several years, the decline in housing prices led to a sharp rise in mortgage delinquencies and foreclosures, which rose from less than 1% for the first half of the decade to a peak of 4% in 2011.

On average, real per capita property tax revenue declined by nearly 12% between 2009 and 2014. It takes three years for the full effect of changes in housing prices and in foreclosure rates to be translated into changes in property tax revenues. According to our estimates, the drop in housing prices predicts a 6% drop in property tax revenues, while the rise in foreclosures predicts an additional 3.4% revenue decline. Thus, the overall effect of the change in housing prices on property taxes was almost twice as great as the effect of rising foreclosures. Adding the two effects together, the housing market variables can explain more than ¾ of the decline in property taxes. The effects of increased foreclosures on property taxes far exceed plausible values of their direct effect on

³⁶ The levy limit effect is calculated as $(.26 - .225)/.195$.

³⁷ Fig. A1 illustrates that the average annual percentage changes in real per capita market values of FiSCs with and without levy limits were quite similar in most years between 2001 and 2014.

property values, suggesting that spillover effects on nearby properties, increased property tax delinquencies, and the correlation between increased foreclosure rates and declines in household income help to magnify the fiscal effects of the housing bust.

In cities with property tax levy limits, the response to housing price changes was substantially muted as compared to cities not subject to such limits. Thus, it appears that the wave of property tax limitations, which were enacted prior to 2000, were important in maintaining stability in property tax revenues in a period of booming housing prices and limiting reductions in property tax revenues when housing prices fell. However, while in the pre-boom period there was little or no difference in property tax revenues between the levy limit and non-levy limit cities, in the post-recession period, as housing prices rebounded, on average per capita property tax revenues were about 7% lower in cities subject to levy limits.³⁸

The average impacts of the housing market boom and bust cycle on the fiscal condition of central cities understates the housing market-fiscal linkages experienced by some cities. The experiences of the 90 cities in our sample are diverse. In some cities house prices plummeted by over 50% and foreclosure rates skyrocketed, while other cities largely escaped the housing price bubble and bust cycle. Although the Great Recession affected the whole country, the severity of the recession differed across cities and regions. And, as we have demonstrated, the mix of taxes, the different policies governing foreclosures, and the presence of property tax levy limits, all affected the magnitude of the fiscal effects of changes in the housing market. Among the cities that suffered above-average declines in real per capita general revenue were Miami, Gary, Las Vegas, Sacramento and Dallas. In Dallas the drop occurred despite a housing market that proved very resistant to the national boom and bust cycle of the housing market. The principal lesson from our analysis is that real estate bubbles carry with them significant fiscal risks for cities. Bubbles are invariably followed by busts, and busts lead to significant declines in local government revenues. If the busts are associated with an overall decline in a state's economy, the losses in local revenue are likely to be reinforced by declining state aid to its local governments. Because cities must balance their budgets from year to year, these declines inevitably mean that spending must be cut. Although, as demonstrated by Ross et al. (2015), municipal governments can initially avoid spending cuts by drawing down fund balances and monetizing capital assets, our data show that these efforts were insufficient to prevent cuts in public spending in many central cities. The typical city fiscal response to the Great Recession and the housing bust was to implement substantial reductions in spending, with the largest cuts occurring in capital outlays and in operating expenditures for elementary and secondary education.

Three policy recommendations flow from our analysis. First, states should pursue policies to try to minimize foreclosures during future housing market declines. Second, most cities increase revenues when housing prices rise. These revenue increases generally occur despite the presence of property tax limitations. As rising housing prices may foreshadow a coming housing price drop, local governments should exploit a period of rising housing prices by preparing for the fiscal consequences of a future drop in prices. This could be done by increasing fund balances (rainy day funds), or by utilizing additional revenues to pre-fund future capital infrastructure projects. Evidence suggests that cities that are relatively unconstrained by property tax limitations are more likely to follow the infrastructure strategy. Finally, because the fiscal effects of housing busts play out over a multiyear time horizon,

offsetting increases in federal aid, such as the American Recovery and Reinvestment Act of 2009, should be structured to provide increased fiscal assistance over multiyear time periods.

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³⁸ One important difference between levy limit and non-levy limit cities was in capital expenditures, which rose 10% faster in non-levy limit cities, but then fell more precipitously in the housing bust period. This pattern suggests that levy limits may undermine cities' ability to maintain and expand capital infrastructure.

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