

**Assessment Growth Limits and Mobility:
Evidence from Home Sale Data in Detroit, Michigan**

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Abstract

In 1994 a limit on the growth of property values for tax purposes was imposed in Michigan. One consequence of the taxable value growth cap was the emergence of a differential in effective tax rates between new property owners and long-time property owners. The purpose of this paper is to examine the degree to which this differential affects the probability that property owners will sell their homes. Using parcel-level data from Detroit, Michigan, we present new empirical evidence that homeowners who enjoy reductions in effective tax rates due to the taxable value growth cap are less likely to sell their properties. Estimates suggest that the average duration of property ownership is about five years longer for those who enjoy the average reduction in effective tax rates resulting from the taxable value growth cap. However, the magnitudes vary depending on length of tenure, property value and location.

Key Words: Property Tax, Assessment Growth Limit, Mobility

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Table of Contents

1. Introduction.....	1
2. Michigan Property Taxation and the Detroit Context.....	3
3. Literature Review.....	9
Assessment Growth Limits and Equity.....	10
Assessment Growth Limits and Mobility	11
4. Empirical Analysis.....	12
5. Conclusions.....	17
References.....	19
Appendix 1.....	22

List of Tables

Table 1: The Great Recession in Select Midwest Metropolitan Areas	2
Table 2: Detroit Property Tax Millage Rates, 2011*	4
Table 3: Summary Statistics	12
Table 4: Effective Tax Rate Regression Results.....	Error! Bookmark not defined.
Table 5: Delinquency Probit Estimation Results	15
Table 6: Delinquency Probit Marginal Effects by Property Value Quintile (SEV)	Error! Bookmark not defined.
Table 7: Delinquency Probit Estimation Results and Marginal Effect, by Cluster	Error! Bookmark not defined.

List of Figures

Figure 1: Percentage Change in Detroit Residential SEV, TV and Average Sale Price	5
Figure 2: Average Effective Tax Rates of Owner-Occupied.....	7
Residential Properties by Detroit Neighborhood, 2010.....	7
Figure 3: Parcel-level Effective Tax Rates between All Taxable Properties, 2010.....	8
Figure 4: Neighborhood Level Effective Residential Property Turnover Rate, 2010	9

Assessment Growth Limits and Mobility: Evidence from Home Sale Data in Detroit, Michigan

1. Introduction

A number of states have limitations on the growth rate of property value assessments.¹ The primary purpose of these limitations is to assure that property tax burdens do not increase too quickly, especially during periods of rapidly rising housing prices. Despite their popularity taxable value growth caps have the potential to generate several layers of undesirable outcomes. In addition to generating both horizontal and vertical inequities (Skidmore, *et al.*, 2010; Hodge, *et al.*, 2013a), there is evidence that taxable value growth caps reduce household mobility (i.e. create a “lock-in” effect), resulting in the additional social costs of increased labor market mismatches and reduced citizen support for local public goods. With taxable value growth caps, long-time property owners may enjoy substantial tax burden reductions relative to new homeowners; making a decision to move requires the long-time property owner to give up a potentially significant tax benefit.

In this paper we use parcel-level data from the City of Detroit to examine the degree to which Michigan’s taxable value growth limit has created a “lock-in” effect. As discussed in the literature review, there are now several studies that examine the “lock-in” effect in other states and contexts. Our study offers several contributions to this body of research. First, we use detailed parcel-level data to examine the degree to which tax savings created by the taxable value growth cap have an effect on the probability of property sale. Second, we look at this issue in the context of a state different than prior studies (Michigan) and in a single jurisdiction (Detroit) in which all properties receive services from the same government entities. Further, we consider the issue in the context of a faltering housing market. Finally, we estimate lock-in effects across different property value groups and different areas of the city where housing and neighborhood characteristics may differ substantially.

The City of Detroit has been in population decline for 60 years: Population decreased from more than 1.8 million in 1950 to less than 700,000 in 2012. Since 1990, Detroit has experienced population loss of more than 300,000. In the early 1990s, prior to the 1994 adoption of the taxable value growth cap, annual population decline averaged about 5,500 persons; from 1996 to 2001, losses averaged 13,600 a year. In the early years of this century, prior to the start of the Great Recession in 2008, Detroit residents were leaving at a rate of 23,200 annually. Since 2008, the numbers leaving dropped to about 17,300 annually.

Currently, Detroit has an unemployment rate of more than 20 percent. The average selling price of a single family residential home in 2011 was just \$7,000, evidence of a severely troubled housing market. Many cities across North America have suffered during the Great Recession, but

¹ O’Sullivan, Sexton and Sheffrin’ (1995) offer a comprehensive discussion of tax revolts and the rise of assessment growth limits. Haveman and Sexton (2008) identify at least 20 states that have some sort of assessment growth limitation. Such limitations have been referred to as “assessment growth caps,” “taxable value growth caps,” “assessment growth limits,” and “property value assessment limits.” These terms are used interchangeably in this paper.

Detroit is among the worst hit. As reported in Table 1, information on recession impacts for the 100 largest U.S. metropolitan areas from the Brookings Metro Monitor report (Friedhoff and Kulkarni, 2013) shows that Detroit ranks well below comparable areas like Cleveland and Pittsburgh; only Youngstown is similar to Detroit.

Table 1: The Great Recession in Select Midwest Metropolitan Areas

MSA	Recession Rank					Employment Peak to Trough
	Overall	Recovery	Gross Metro Product	Employment	Unemployment	
Detroit	98	91	99	98	93	21 quarters
Cleveland	60	65	79	71	13	13 quarters
Pittsburgh	6	15	20	9	16	7 quarters
Youngstown	82	75	96	92	79	16 quarters

Source: Friedhoff and Kulkarni, 2013.

In addition, 47 percent of property owners were delinquent in their tax payments in 2012 (Detroit News, 2013). Uncollected taxes amount to \$131 million, or about 12 percent of the City of Detroit’s general fund budget in FY2012. In 2013, Michigan Governor Snyder appointed an Emergency Financial Manager who subsequently sought bankruptcy protection for the City of Detroit. Currently, the City is beginning the process of bankruptcy proceedings. It is in this context that we examine the degree to which the taxable value growth cap has reduced mobility and deterred housing market transactions.

Detroit’s current circumstances are extreme, but hardly unique. Detroit is not the only city that is experiencing fiscal challenges, which are in large part due to tax base erosion and the underfunding of retiree compensation. A number of cities and states across the U.S. face the challenge of significantly underfunded retiree compensation. As one illustration, Chicago Mayor Rahm Emmanuel recently stated: “Should Chicago fail to get pension relief soon, we will be faced with a 2015 budget that will either double city property taxes or eliminate the vital services that people rely on.”² Further, many of these cities, including Chicago, have some form of assessment growth limit, which may exacerbate the fiscal challenges by narrowing the property tax base and creating inefficiencies in the housing market. Understanding how policies like assessment growth caps, even in an extreme circumstance such as Detroit, provides a useful contribution to policy discussions in other locations. Our evaluation provides evidence of a lock-in effect even in the midst of a faltering local housing market; if a lock-in effect persists in such adverse housing market conditions, it may persist in other markets as well. Further, such knowledge can be potentially useful in averting crises in other cities.

In the next section, we offer a detailed description of the Michigan property tax system and more specifically within the Detroit context. Section 3 offers a brief summary of the literature on assessment growth caps and their potential effects on mobility. In section 4, we present our empirical analysis and section 5 concludes.

² Lyman, Rick. 2013. “Chicago Pursues Deal to Change Pension Funding.” New York Times, December 5, New York edition, A1.

2. Michigan Property Taxation and the Detroit Context

Since the 1970s, Michigan has adopted several measures designed to protect targeted property owners from excessive property tax increases.³ Of particular interest to this paper is the passage of Proposal A in 1994. Two key features of Proposal A are most relevant for this paper. First, the statutory property tax rate of owner-occupied properties was reduced by introducing a distinction between “homestead property” and “non-homestead property”.⁴ Proposal A exempts qualified homestead properties from paying local public school operating millages up to 18 mills, whereas non-homestead properties (non-residential and rental properties) are subject to the statutory millage rate for school operating purposes.⁵ As a result of the homestead exemption, statutory millage rates were reduced by an average of about one-third statewide. However, the reduction in millage rates varied across jurisdictions; in 2010, homestead properties in the City of Detroit, where tax rates are particularly high, received a 17.83 mill reduction in their statutory rate relative to non-homestead properties (a 21 percent reduction).

The second key feature of Proposal A is that it limits the annual increase in taxable values to the rate of inflation or five percent, whichever is less.⁶ This limitation to annual increases in taxable value growth provides tax relief to homeowners who experience property value growth higher than the rate of inflation. However, when a property is sold, the taxable value is reset to reflect the market value for the new homeowner.⁷

Because of the taxable value growth cap, it is important to make a distinction between the *statutory* property tax rate and the *effective* tax rate. The statutory tax rate is the millage rate applied to the tax base. Detroit taxpayers face statutory millage rates that are much higher than the statewide average; the total 2010 millage rate for owner-occupied residential properties was 67.32 mills, as reported in Table 2.

³ These policies are clearly articulated and discussed in Feldman, Courant and Drake (2003) and Wassmer and Fisher (1996). One early policy was the Headlee Amendment (1978), which restricts property tax revenue growth to the rate of inflation plus taxes levied on new construction. Any potential revenue increases resulting from property value growth in excess of the Headlee limit requires rate reductions to bring revenues into line with the revenue growth restriction. This feature of the property tax revenue growth limit is known as the “Headlee Rollback.” Local residents can, however, choose to exceed the Headlee limitation by referendum. As a result, average millage rates across the state have been relatively stable, though communities use referenda processes to pass millage increases from time to time for various purposes (e.g. to replace expiring millages).

⁴ A homestead is defined as the homeowner’s principal residence.

⁵ Since the passage of Proposal A, one mill is defined as \$1 of tax per \$1,000 of taxable value.

⁶ The inflation rate has never exceeded five percent since the passage of Proposal A.

⁷ Most states that limit the growth of assessed values for property tax purposes require benefits to be forfeit once a homeowner sells his/her property (i.e. “pop up” effect). Two exceptions are California and Florida. In California, the passage of Propositions 60 (1986) and 90 (1988) allowed those 55 or older to move any tax savings resulting from the taxable value cap (Proposition 13) if the move is within the home county or other selected counties. Similarly, beginning in 2008 with the passage of an amendment to the “Save Our Homes” program (which passed in 1992 and became effective in 1995), Florida homeowners were able to take some tax benefits with them when they moved.

Table 2: Detroit Property Tax Millage Rates, 2011*

Taxing Authority	Homestead	Non-Homestead
State Education	6.0000	6.0000
City Operating	19.9520	19.9520
City Debt Service	9.5558	9.5558
Library	4.6307	4.6307
School Operating	-	17.8308
School Debt	13.1015	13.1015
County	7.8220	7.8220
Intermediate School Cluster	3.4643	3.4643
Other	0.3146	0.3146
Community College	2.4769	2.4769
Total	67.3178	85.1486

*One mill equals 0.1 percent of taxable value. Source: City of Detroit Executive Budget.

For some homeowners, this high tax burden is alleviated because their *effective* tax rates are reduced as a result of Proposal A and various abatement programs. The *effective* tax rate is therefore a more accurate measure of tax burden than is the statutory tax rate. We define the *Effective Tax Rate* for residential property i using the following equation:

$$[1] \quad \text{Effective Tax Rate}_i = [(TP_i)/(SEV_i)] = f[T_i, r, V_i, C_i, L_i]$$

Equation [1] shows that the *Effective Tax Rate* for property i is determined by the tax payment (TP_i) and the state equalized value per \$1,000 (SEV_i), where TP is equal to the millage rate multiplied by TV, and SEV reflects the actual market value of the property.⁸

Effective tax rates differ considerably across residential properties, depending on whether the property is homestead or non-homestead, whether it qualifies for one of the abatement programs, and the degree to which the property is protected by the taxable value cap. Generally, the effective tax rate depends on the length of time an individual has owned the property (T_i), the rate of inflation multiplier (r), the appreciation (or depreciation) of property value (V_i),⁹ the characteristics of the property (C_i),¹⁰ and the location of the property (L_i).¹¹ These factors can contribute to differences in effective tax rates across properties. Generally, the less a property owner benefits from the taxable value growth cap and various tax abatement programs, the closer the effective rate will be to the full statutory rate.

⁸ According to Michigan assessment guidelines, state equalized value should reflect 50 percent of market value.

⁹ Because of the taxable value cap, effective tax rates fall as the length of homeownership increases when property values and thus SEV are rising faster than the rate of inflation.

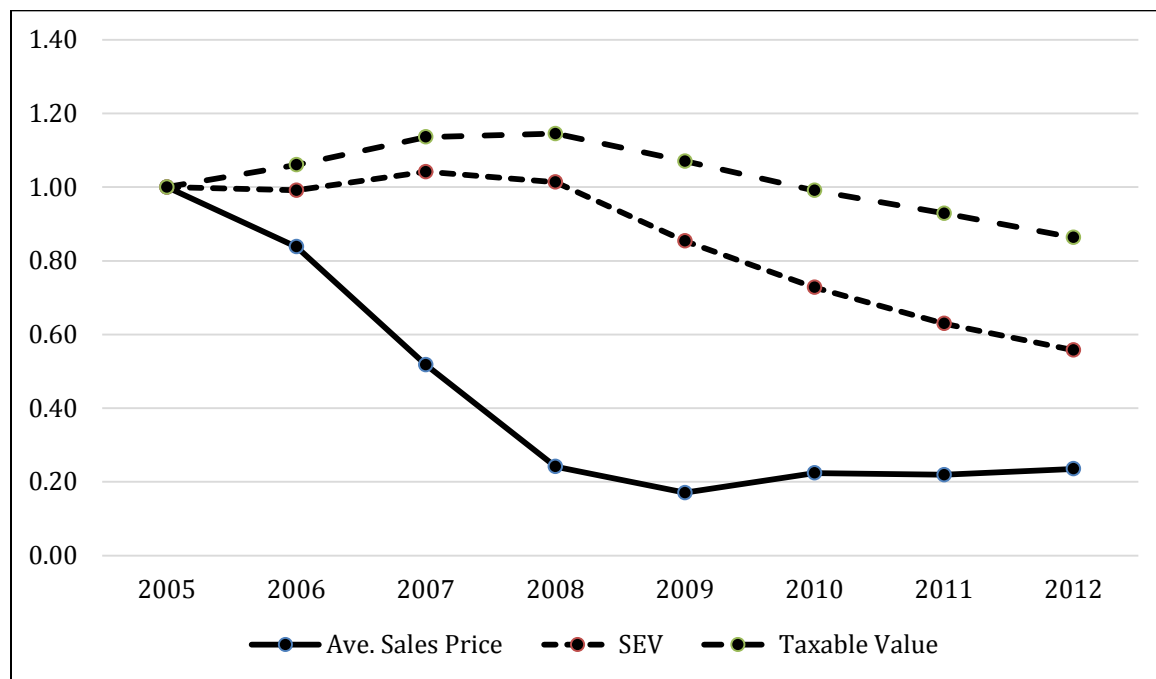
¹⁰ Characteristics such as age of the house, lot size, house size, homestead, etc. are important determinants of the sale price (related to SEV and TV).

¹¹ The location of the property determines whether or not a property owner may benefit from any of the targeted abatement programs. Also, location may influence the growth in state equalized value since properties in more desirable locations may experience larger growth in market values relative to properties in less desirable neighborhoods.

Over time, the taxable value growth cap created large differentials between TV and SEV. In Detroit, the largest differential between citywide TV and SEV since the 1994 imposition of the taxable value growth cap occurred in 2003 when TV was about 65 percent of SEV. In 2006, the difference in SEV and TV began to narrow and TV was 86.5 percent of SEV by 2011. Even though SEV has fallen in recent years, as of 2010 there were still many property owners who enjoyed a tax benefit. About 30 percent of property owners had a TV to SEV gap of 30 percent or more. Another 34 percent enjoy a gap of 1 to 29 percent, and for about 35 percent of property owners there was no gap between TV and SEV.

Figure 1 shows the paths of TV, SEV, and the average sales price of residential properties in Detroit since 2005. As shown in the figure, sales prices fell much more dramatically than SEV, which in turn fell more so than TV (the property value to which the tax rate is applied). Sales prices stabilized in 2009 at about 20 percent of the pre-crash levels, but have not increased in subsequent years. As a result, even after the bursting of the housing market bubble a significant gap between aggregate TV and SEV remains for many homeowners.

Figure 1: Percentage Change in Detroit Residential SEV, TV, and Average Sale Price



Sources: City of Detroit Comprehensive Annual Financial Reports and Michigan Association of Realtors.

Figure 1 gives cause to question assessment practices in Detroit. Statewide assessment guidelines require local units' assessments to reflect market value. However, in the case of Detroit reductions in assessments do not appear to have fully matched the housing market decline. As shown in Hodge, *et al.* (2013b), assessed values of recently sold properties are much higher than sales prices; in 2010 the average sale price of recently sold properties was about \$7,000 whereas average assessed value of these same properties is about \$50,000 (Figure 1). If the City were to assess property in a way that fully reflected recent sales, the benefits of the taxable value cap to long-time homeowners would be eliminated in most cases. However, current assessment practices are such that assessments have not fallen; residents make decisions in the context of the

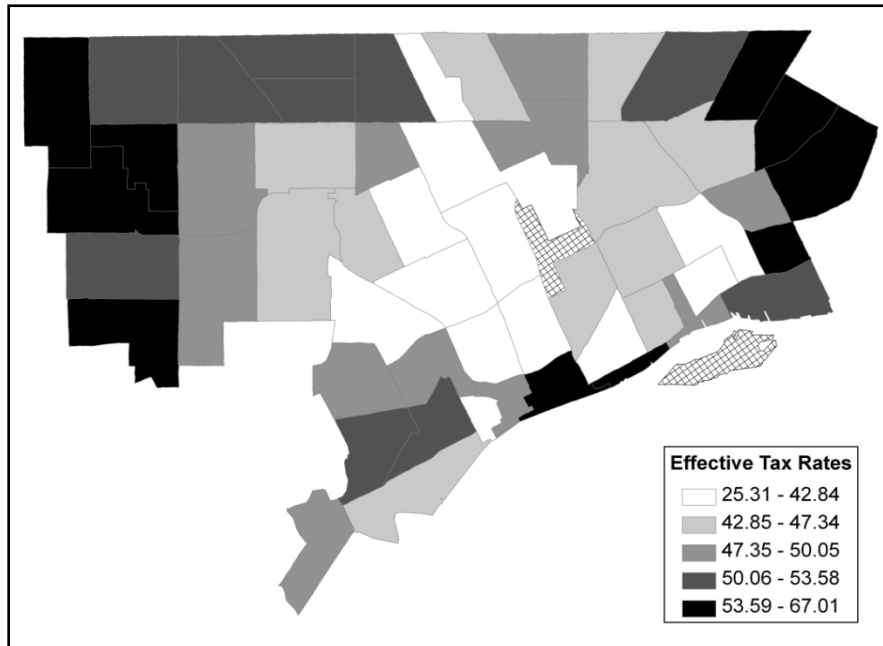
current, inaccurate assessment regime. Thus, even in this faltering housing market many long-time property owners perceive a tax benefit that would be lost if they were to make a decision to move. It should be noted, however, that in 2012 the Michigan State Tax Commission learned of the potential issue with assessments and ordered an external sample reassessment to determine whether a full reassessment of all properties within the City was warranted.¹² The State Tax Commissions investigation is not yet complete. However, the assessment regime was not in question in 2010-11 (the period under consideration), and thus it seems reasonable to think that homeowners based decisions on the assessment practices and the perceived “tax benefits” they received, not on state assessment policy guidelines.

Figures 2 and 3 illustrate the variation in effective tax rates across Detroit. Figure 3 presents average effective tax rates of owner-occupied residential properties at the neighborhood level, and Figure 4 shows the variation of effective tax rates between all taxable properties within a single illustrative Detroit neighborhood.¹³ The high effective tax rates in the extreme west and northeast areas of Detroit are likely the result of a number of factors. The outlying neighborhoods are predominantly single family, newer and generally of higher socio-economic status than inner city areas. Perhaps more importantly, the outlying neighborhoods have experienced more stable populations than other parts of the City; population has increased slightly in the northeast part of the City. Home sales activity in these areas has also been substantially higher than in the inner city and the TV for many of these properties has been reset, resulting in a higher effective tax rate. Together, these maps highlight the substantial variation in effective rates across neighborhoods and between neighbors within a given neighborhood.

¹² The City of Detroit Assessment Office subsequently announced that it would begin the process of reassessing all City properties.

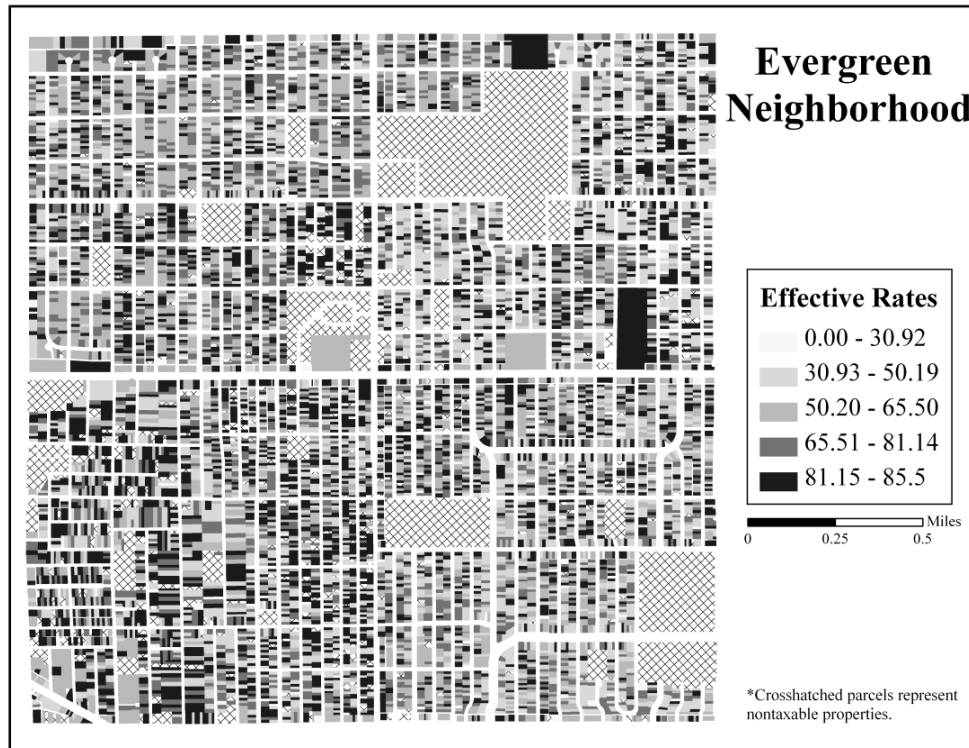
¹³ In Figure 3 crosshatched neighborhoods represent those that do not have any owner-occupied residential properties. Crosshatched parcels in Figure 4 represent nontaxable properties. Figure 4 includes all taxable properties to highlight the wide variation in effective tax rates between neighbors, including non-homestead properties.

Figure 2: Average Effective Tax Rates of Owner-Occupied Residential Properties by Detroit Neighborhood, 2010



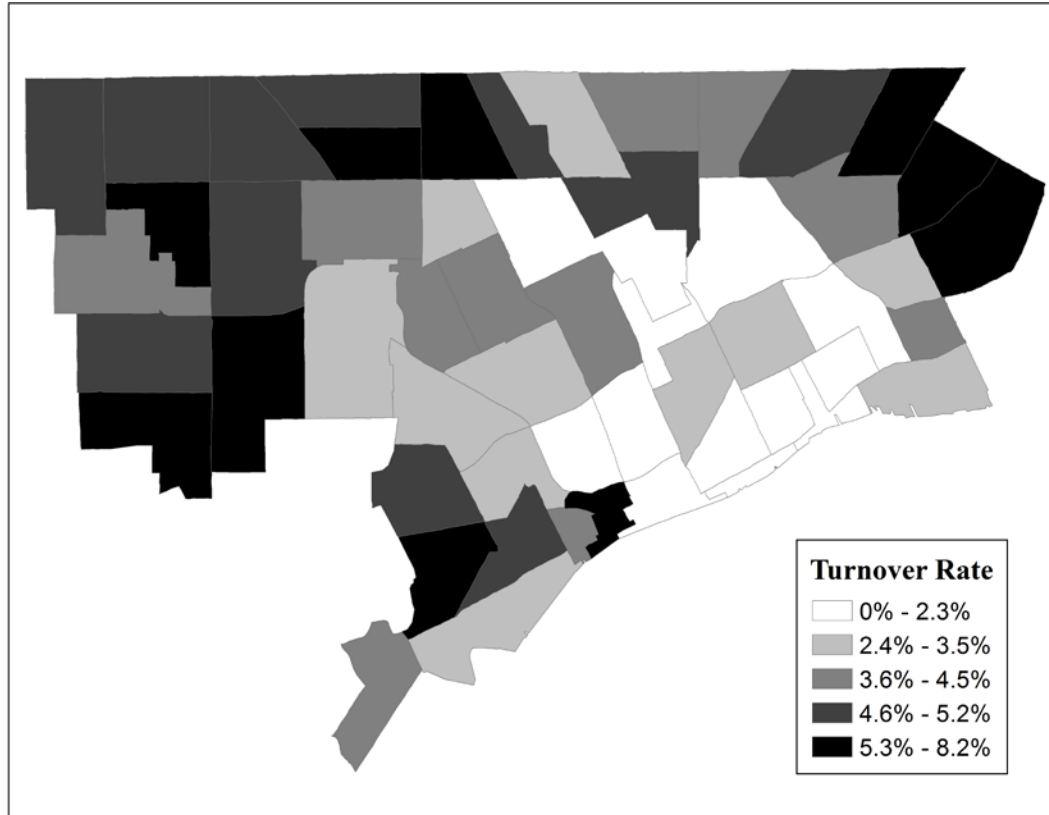
Source: Data provided by the City of Detroit Assessment Division.

Figure 3: Parcel-level Effective Tax Rates between All Taxable Properties, 2010



Source: Parcel-level shapefiles and tax data provided by the City of Detroit Assessment Division.

Figure 4: Neighborhood Level Effective Residential Property Turnover Rate, 2010



With this overview of Michigan property tax environment and how policies play out in practice within Detroit, we now turn to a review of the most relevant literature on assessment growth limits.

3. Literature Review

Much of the early empirical research on property tax limits, including taxable value growth caps, tended to focus on determining the degree to which these emerging fiscal constraints limited property tax revenue growth.¹⁴ More recently, however, researchers have turned their attention to the distributional consequences of taxable value growth limits. We discuss several key articles to demonstrate that there are substantial tax differentials that can emerge from taxable value growth caps, thus demonstrating that there is potential for these differentials to generate housing market distortions. We then turn our attention to research that specifically examines the potential lock-in effect resulting from taxable value growth caps.

¹⁴ See Dye, McGuire and McMillen (2005), Mullins and Joyce (1996). O’Sullivan, Sexton and Sheffrin (1995), and Skidmore (1999) for a review of this literature.

Assessment Growth Limits and Equity

Dye, McMillen, and Merriman (2006) address the implications of a recently imposed assessment growth cap in Cook County, Illinois. They demonstrate that a taxable value growth cap that protects residential owners (as in Cook County) will lead to increased taxes for industrial and commercial property owners. They also show that homeowners with property appreciating at a rate less than the cap will experience higher effective tax rates to make up for those who are protected. Dye and McMillen (2007) extend the work of Dye, McMillen, and Merriman (2006) by developing a more formal theoretical framework to evaluate the effects of assessment caps on property taxes. Two key conclusions from this additional evaluation are that: 1) reassessment upon sale can make it costly for homeowners to move, and may thus affect real estate markets; and 2) assessment limits can lead to higher taxes for some property owners for whom the limit was meant to protect.

Muhammad (2007) evaluates the horizontal and vertical inequities resulting from the District of Columbia's taxable value cap policy, imposed in 2002. District of Columbia's tax cap policy (TCP) imposed a property value assessment growth limit set at 12 percent annually between 2001 and 2005 and 10 percent thereafter. Over the 2001-2007 period, median homestead property values more than tripled in the District of Columbia (from \$128,499 to \$400,050), an average annual increase of 20.8 percent. By 2007, the median property's final taxable value differed from the actual market value by over 60 percent. Muhammad demonstrates the degree of horizontal and vertical inequities resulting from the assessment growth limit. For example, he finds that for homesteads with a value of \$600,000, the effective millage rate can be as high as \$0.79 or as low as \$0.01.

Focusing on Michigan, Skidmore, *et al.* (2010) shows that just prior to the real estate market decline beginning in 2008, the taxable value cap in Michigan reduced effective tax rates statewide by about 18 percent for long-time homeowners relative to new homeowners. Recently, Hodge, *et al.* (2013a) use quantile regression techniques to evaluate the distributional consequences of Michigan's taxable value cap in the City of Detroit. They showed that homeowners who have lived in their homes since 1994 (or earlier) face effective property tax rates that are between 19 and 52 percent lower than property owners who recently purchased their homes.

In 2008, the Lincoln Institute of Land Policy (Haveman and Sexton, 2008) published a comprehensive report on property tax assessment limits and their use across the U.S. states. The report covers the institutional/legal aspects of such limits, the implications for the tax base and local government autonomy, equity issues and the inefficiencies that arise. The report concludes by offering potential alternatives to provide property tax relief to those in need, indicating that property tax assessment limits are "...the least effective, least equitable, and least efficient strategies available for providing tax relief."

The body of research discussed above provides ample evidence of the significant inequities resulting from taxable value caps. Below, we discuss a closely related literature that has examined the effects of assessment growth caps on mobility.

Assessment Growth Limits and Mobility

Nagy (1997), Stohs, Childs, and Stevenson (2001), Wasi, *et al.* (2005), Stansel, Jackson, and Finch (2007), Ferreira (2009), Ferreira, Gyourko, and Tracy (2010) and Ihlanfeldt (2011) evaluate the lock-in effect in various contexts. Nagy (1997), Stohs, Childs, and Stevenson (2001), Ferreira (2009) and Ferreira, Gyourko, and Tracy (2010) study the potential lock-in effect resulting from California's Proposition 13. Stansel, Jackson, and Finch (2007) and Ihlanfeldt (2011) focus on Florida's Save Our Homes program.

Nagy (1997) and Wasi, *et al.* (2005) analyze data on mobility rates before and after the imposition of Proposition 13 in California relative to communities in other states without a taxable value cap. With tax benefits accruing to stationary homeowners, the expectation was that relative mobility rates would decline after Proposition 13. However, the findings of the two studies differed, with Nagy failing to find evidence for a lock-in effect and Wasi, *et al.* supporting its existence. Stohs, Childs, and Stevenson (2001) use a cross-sectional approach to evaluate the lock-in effect. Specifically, they compare home sales rates in California metropolitan areas with metropolitan areas in other states, finding that sales rates are relatively lower in California—a result that is consistent with a lock-in effect. However, in the context of estimating effects using aggregated cross-sectional data, as pointed out by Ihlanfeldt (2011), omitted variable bias is a concern.

Ferreira (2004) also examined residential mobility after Proposition 13, but focused on two amendments allowing transferability of the tax benefits to a new home for those who are 55 or older. In a comparison with two age groups, he found that mobility for those over 55-years of age is about 25 percent higher than the mobility for those 54-years and younger.

There are also two studies that focus on Florida's assessment growth cap. Stansel, Jackson, and Finch (2007) compare average home tenure of full-time homeowners in 2002 and 2006—before and after the implementation of the assessment growth limit. The researchers hypothesized that average home tenure would be longer in 2006 because homeowners would have accumulated tax savings and would be less willing to move. However, their comparisons failed to support this hypothesis. Ihlanfeldt (2011) used parcel-level data from Duval and Miami-Dade counties to examine the probability of home sale before and after the imposition of Amendment One, which enable homestead property owners to apply a portion of the tax savings from the assessment growth cap to a new home. He finds evidence that household mobility increased in the periods following the passage of Amendment One.

The present study adds to the literature in several ways. First, despite the fact that a number of studies demonstrate that the lock-in effect exists, there is still some question regarding the conditions under which a lock-in effect may emerge; our study focuses on faltering real estate market, a context that is quite different than other studies. Second, we examine the issue using parcel-level data in a single city, Detroit, where all property owners interact with the same governmental units. Finally, we examine the lock-in effect on different home value groups and different locations within Detroit.

4. Empirical Analysis

As described in the literature review, effective tax rate differentials resulting from an assessment growth cap may generate inefficiencies; that is, assessment growth caps have the potential to inhibit normal levels of residential market transactions and homeowner mobility. This phenomenon has come to be known as the “lock-in” effect. A homeowner who enjoys a substantial tax benefit may be less likely to sell because the cost of holding the property is low(er) and tax benefits are lost once the property is sold.

The City of Detroit’s Assessment Division provided parcel-level data for this research. The raw data include information for 444,183 real and personal property parcels in 2010, of which we focus on owner-occupied residential properties. However, since our focus is on determining factors that influence a voluntary move, we exclude all property transfers to a financial institution due to mortgage foreclosure or a government entity due to tax foreclosure.¹⁵ In total, there are 103,615 residential owner-occupied (or homestead) properties included in our evaluation. In order to match the previous owners’ effective tax rate with sales activity, we combine the 2010 parcel-level data with 2011 residential property sales data.¹⁶ Summary statistics for all of the variables we consider are provided in Table 3. Definitions for all variables used in the analysis are provided in Appendix 1.

Table 3: Summary Statistics

Variable	Mean	Std. Dev.
<i>Effective Tax Rate (or millage)</i>	49.60	14.43
<i>Sold in 2011 (yes=1, no=0)</i>	0.044	0.204
<i>Living_Area (in square feet)</i>	1,108	390.6
<i>Lot_Size (in square feet)</i>	831.85	193.0
<i>Age of Structure (in decades)</i>	6.706	1.485
<i>Tax Delinquency (yes=1, no=0)</i>	0.353	0.478
<i>Years_Owned</i>	13.07	4.67
# of Observations	103,615	

To examine the average change in length of ownership resulting from the assessment growth cap, a two-step procedure is required. First, we must estimate the change in effective tax rates as a result of the taxable value growth limit. We then estimate the effects of the effective tax rate on the probability of a property being sold. With these two estimates, we can calculate the effect of the taxable value growth limit on the length of ownership.

Recall that the taxable value growth cap may lower effective tax rates the longer a property owner retains ownership. The first step therefore requires us to estimate the effect of years of

¹⁵ To focus our evaluation on the effects of the assessment growth cap, we exclude 328 homestead properties that received some sort of tax abatement.

¹⁶ Recall that houses sold in 2010 do not experience the “pop up” in taxable value until the 2011 tax year. Therefore, using the properties that sold in 2011 with the previously discussed tax data allows us to measure how reduced effective tax rates affect the probability of sale.

ownership on effective tax rates. Consider Table 4, which reports an effective tax rate regression in which years of ownership is the key variable of interest. While we do not discuss these estimates in detail, note that the primary variable *Years_Owned* is negative and statistically significant.¹⁷ That is, the effective tax rate is lower the longer an owner retains the property. For homestead properties owned since 1994 (the date of taxable value growth cap implementation), effective tax rates are about 28 mills (or 42 percent) lower than they would have been otherwise. As discussed earlier, a property owner stands to lose the tax benefit he/she currently enjoys upon sale of a property. According to this first part of our evaluation, there is a substantial incentive to retain ownership for many homeowners.

Table 4. Effective Tax Rate Regression Results

Independent Variable	Homestead
<i>Living_Area (in square feet)</i>	-0.0005*** (0.0001)
<i>Lot_Size (in square feet)</i>	0.0025*** (0.0002)
<i>Age (in decades)</i>	-0.6945*** (0.0415)
<i>Years_Owned</i>	-1.7685*** (0.0069)
<i>Constant</i>	75.448*** (0.6995)
Neighborhood Fixed Effects	Yes
# of Observation	103,615
R-squared	0.414

Notes: Standard errors are in parentheses and all regressions are corrected for heteroskedasticity. Asterisks denote significance at the 1% (***), 5% (**) and 10% (*) levels.

To examine how a change in the effective tax rate affects the probability of selling a property, we estimate the probability of selling a property as a function of effective tax rates while controlling for a number of property and neighborhood characteristics. To inform and guide our empirical strategy we present a simple model put forth by Hanushek and Quigley (1978) and Ihlanfeldt (2011), where the probability of a property selling is equal to the probability that an owner will put his/her property up for sale (P(U)) times the conditional probability that if the property is for sale, a buyer is found (P(B/U)):

$$[2] \quad P(S) = P(U) \cdot P(B/U)$$

The probability of offering a property for sale depends on the loss of utility from being at a suboptimal level of housing consumption (H*) and moving costs (MV).

¹⁷ See Hodge, *et al.* (2013a) for a more detailed analysis and explanation of the determinants of effective tax rates in the Detroit context.

The property owner puts his/her property up for sale when the utility loss from living at a suboptimal level of housing exceeds moving costs:

$$P(U) = 1 \text{ if } U(H^* - H) > MC$$

$$P(U) = 0 \text{ if } U(H^* - H) < MC$$

To determine the effect of the taxable value cap on the probability of moving, we include a range of variables that control for differences in $P(U)$ across property owners, property characteristics and neighborhood characteristics. The tax savings resulting from the taxable value cap are embedded in MC ; moving requires that one give up any tax benefit that has been acquired over time.

We estimate the probability of a property being sold with a standard probit estimation procedure. The core results are presented in Table 5 where, in addition to the effective tax rate, we include as control variables property characteristics, a tax delinquency indicator variable, years of ownership¹⁸, and neighborhood indicator variables.¹⁹ Before considering the variable of interest, the effective tax rate, we first discuss the control variables. Larger homes are more likely to be sold than smaller homes, all else equal. Interestingly, properties that are delinquent on their property taxes are less likely to be sold. One possible reason for this result is that tax delinquency may be correlated with negative equity, which is shown to also create a lock-in effect (Ferreira, *et al.*, 2010). As reported in Alm, *et al.* (2013), tax delinquency in Detroit is the result of a confluence of factors, but is most prevalent among owners of the lowest valued properties: Owners of low valued properties have little to lose from tax foreclosure and potentially much to gain from the foregoing of tax payments because owners can potentially avoid tax foreclosure for a number of years. Importantly, the tax delinquency indicator variable helps to control for negative equity, which may be correlated with the effective tax rate. Finally, the longer a property is owned, the lower the probability of home sale. Controlling for years owned is also very important in order to obtain an unbiased estimate of the effect of the taxable value growth cap has on the probability of home sale.²⁰ While the coefficient estimates on the control variables are of interest, our focus in this paper is on the role the assessment growth cap plays in mobility. We now turn our attention to this question.

Controlling for other factors, we see that the coefficient on effective tax rates is positive and highly significant. That is, a lower effective tax rate reduces the probability of home sale. From these estimates, it appears that the lock-in effect is occurring. The marginal effects generated

¹⁸ Recall that the longer a property owner retains ownership, the lower the effective tax rate. However, years of ownership also serves as a proxy for the owners' general propensity of move (long-time property owners are generally less likely to sell). We therefore include years of ownership as an explanatory variable to control for this important factor.

¹⁹ Figure 5 offers a citywide perspective of the turnover rates, showing substantial differences across space. Thus, we include neighborhood indicator variables to control for these spatial differences.

²⁰ In order to obtain an unbiased estimate of the lock-in effect, we must control for characteristics that make it more or less likely that a given property will be sold; years of ownership, an indicator of property owners' propensity to sell is therefore potentially very important. The estimates in Table 5 confirm the notion that the longer a property owner retains the property, the less likely he/she will sell a property. We note that omitting this variable leads to a larger coefficient on the effective tax rate variable. This result provides some assurance that we are generating an unbiased estimate of the lock-in effect.

from the probit estimation are also presented at the bottom of Table 5. Here the marginal effect of the effective tax rate from the homestead property regression is 0.0003; a one-mill increase (decrease) in the effective tax rate increases (decreases) the average probability of selling a property by about 0.03 percent. Though the magnitude of the coefficient may seem inconsequential upon initial examination, the size of the effect is in fact meaningful. However, several steps are required to assess the magnitude of the effect.

Table 5: Delinquency Probit Estimation Results

Independent Variable	Homestead
<i>Living_Area (in square feet)</i>	0.00006** (0.00002)
<i>Lot_Size (in square feet)</i>	-0.00005 (0.00005)
<i>Age (in decades)</i>	-0.0096 (0.0068)
<i>Tax Delinquency (yes=1, no=0)</i>	-0.1690*** (0.0158)
<i>Effective Tax Rate</i>	0.0038*** (0.0007)
<i>Years_Owned</i>	-0.0270*** (0.0016)
<i>Constant</i>	-1.7860*** (0.1193)
Neighborhood Fixed Effects	Yes
# of Obs.	103,517
Pseudo R-squared	0.0328
Percent Correct Predictions	
Overall	
Sold	
Not Sold	
Marginal Effect on Probability of Sale (dy/dx)	
<i>Effective Tax Rate</i>	0.0003

Notes: Standard errors are in parentheses and all regressions are corrected for heteroskedasticity. Asterisks denote significance at the 1% (***), 5% (**) and 10% (*) levels.

By combining the results from Tables 4 and 5, we can calculate the change in tenure as a result of the assessment growth cap. The probability of selling a property is estimated to decrease by 0.84 percent as a result of the reduced effective tax rate generated from the assessment growth limit ($28 \times 0.0003 = 0.0084$). That is, property owners who have owned their property since 1994 and thus receive an average 28-mill reduction in the effective tax rate due to the taxable value growth cap have a 0.84 percent lower probability of selling their property (i.e. lower turnover rate). We must now compare this reduction with the average turnover rate for homestead

properties in the City of Detroit. Following the method presented in Stohs, Childs, and Stevenson (2001), average tenure length is calculated by taking the reciprocal of the property turnover rate. For example, if the turnover rate in a given year (or percent of homes sold) is 10 percent, then on average a household remains in a home for 10 years (1.00/0.10).

In 2011 the turnover rate for Detroit homestead property (not in tax or mortgage foreclosure) is 4.4 percent. Based on this turnover rate, the average length of tenure is about 22 years.²¹ A 0.84 percent reduction in the probability of home sale means that the turnover rate for these homeowners is reduced to 3.56 percent. This translates into an increase in the average duration of property ownership from 22 years to 28 years (1.00/0.0356) for property owners who have owned their property since 1994. This of, course, is an upper limit on the magnitude of the lock in effect, and so it is also of interest to calculate the average change in tenure length among all property owners, and not just properties owners who have retained ownership since 1994. Across all years of ownership, the average tenure length increases from 22 years to 27 years. This analysis suggests a meaningful increase in the length of property ownership as a result of the assessment growth cap – evidence of a lock-in effect.

The effect of the assessment growth cap on the probability of property sale can also be examined across different property value groups. Table 6 presents the coefficient and marginal effects for the effective tax rate variable across property value quintiles.

Table 6: Delinquency Probit Marginal Effects by Property Value Quintile (SEV)

Quintile	1	2	3	4	5
Probit	-0.0018	0.0026**	0.0085***	0.0107***	0.0102***
dy/dx	-0.0001	0.0002**	0.0007***	0.0010***	0.0010***

Notes: All regressions are corrected for heteroskedasticity. Asterisks denote significance at the 1% (***), 5% (**) and 10% (*) levels.

The results reported in Table 6 show that property owners with higher valued homes (as measured by SEV) are locked into ownership for longer periods than owners with lower valued homes. Specifically, the effective tax rate begins to be important in the second quintile and the magnitude of the coefficient increases with property value.

In addition to evaluating differential effects by property value class, we also consider differential effects across the ten geographic clusters within the city (called Neighborhood Clusters by the Detroit Planning and Development Department²²). As shown in Table 7, we find positive and statistically significant coefficients on the effective tax rate in five of the ten clusters. The largest effect is in Cluster 2. However, the ten clusters are relatively large and diverse, making it somewhat difficult to interpret the estimates in Table 7. Generally, statistically significant results were not found in areas of the city that have been most severely affected by the collapse of the housing market. Clusters 1, 3, 5, and 6 have been subject to extensive foreclosures and

²¹ The rate of non-foreclosed property turnover in 2011 is lower than in previous years and the turnover rate with home foreclosures is 5.16 percent. Note that the calculated tenure length based on the rate of home sales is about nine years longer than the average years of ownership from the summary statistics reported in Table 3.

²² A map of the neighborhood clusters can be found at <http://www.degc.org/images/gallery/Neighborhood.pdf>.

increasing abandonments among single family homes. Cluster 4 has too few sales (and too few homestead properties) to produce significant results. The remaining areas of the city have been somewhat more stable, but all submarkets are to some degree stressed.

Table 7: Delinquency Probit Estimation Results and Marginal Effect, by Cluster

	Cluster1	Cluster2	Cluster3	Cluster4	Cluster5
Probit (Erate)	0.0017	0.0085***	0.0018	0.0033	0.0021
dy/dx (Erate)	0.0001	0.0010	0.0002	0.0001	0.0002
Pseudo R-squared	0.0250	0.0178	0.0344	0.0236	0.0193
# of Obs.	11,455	13,443	8,618	1,555	8,443
# of Sales	0.037	0.053	0.037	0.020	0.045
	Cluster6	Cluster7	Cluster8	Cluster9	Cluster10
Probit (Erate)	0.0013	0.0066***	0.0039*	0.0072***	0.0045*
dy/dx (Erate)	0.0001	0.0006	0.0003	0.0006	0.0004
Pseudo R-squared	0.0076	0.0391	0.0292	0.0323	0.0327
# of Obs.	6,148	16,267	13,598	14,845	9,243
# of Sales	0.034	0.053	0.044	0.039	0.042

Notes: All regressions are corrected for heteroskedasticity. Asterisks denote significance at the 1% (***), 5% (**) and 10% (*) levels.

5. Conclusions

Our general finding of decreased likelihood of property sale as a result of the assessment growth cap mirrors the conclusions of several previous studies. Although our estimated average effect is in a similar range as these other studies, our examination has the advantage of using parcel-level data that include the actual tax benefit that homeowners enjoy as a result of the taxable value cap. This enables us to consider differential effects across property value classes, as well as across space. Measuring the effects at the parcel-level also offers a more precise measure of the impact because the benefit that properties receive from an assessment growth cap varies substantially within a single jurisdiction. Further, we examine the lock-in effect in the context of a declining urban area that is in the midst of a real estate crisis.

In the context of Detroit's current property assessment regime, our examination shows that the taxable value cap increases tenure length from 22 years to about 27 years, on average. However, the estimated tenure length is 28 years for homestead property owners who have owned their property since 1994, the year the taxable value cap was imposed.²³ The effects also differ by property value—no lock-in effect is found in the lowest quintile; but substantial decreases in mobility are evident in the third to fifth property value quintiles. To provide a sense of the differential impacts, consider homestead property owners in fifth property value quintile who have owned their homes since 1994 and enjoy the average reduction in effective tax rates. For this subset of homeowners the estimated length of ownership is 59 years. These results show that the impacts of the taxable value growth cap differ substantially depending on circumstances.

²³ About half of property owners have owned their property since 1994.

Generally, the findings suggest that the taxable value growth cap generates a significant reluctance among some property owners to sell their properties.

As with any empirical analysis, there are some caveats that should be discussed. First, there is considerable evidence that assessed values are substantially higher than current market values. More accurate assessments would eliminate differences between SEV and TV for most properties. The unwillingness on the part of policymakers and assessors to allow assessed values to fall to reflect market conditions is in part, due to incentives created by the taxable value cap. Once SEV and TV are reduced to reflect market conditions, subsequent increases are limited to the rate of inflation (or five percent). Applying subsequent percentage increases to a lower base will mean that property tax revenues will not recover to pre-decline levels when housing prices begin to trend upward; there is therefore a strong incentive on the part of local officials to keep TV and SEV from falling. Second, even though we control for years of ownership, tax delinquency and property/neighborhood characteristics, there is still the possibility of omitted variable bias for our coefficient on effective tax rates. While some caution is warranted in the interpretation of our findings, they offer additional evidence of lock-in effect in the context of a faltering housing market. Further, while Detroit is an exceptional case, this analysis may be of interest to other struggling urban areas around the country. Importantly, with unemployment that is more than 20 percent, the taxable value growth cap may inhibit appropriate moves to obtain employment, thus exacerbating the spatial mismatch/unemployment problem. The efficiency costs of the taxable value growth cap in a city experiencing significant economic challenges are potentially substantial. While there is a temptation to think that reduced mobility might be good in the context of significant population out-migration, in a broader context the taxable value growth cap inhibits moves that would ultimately improve both labor and housing market outcomes.

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Appendix 1
Variable Names and Definitions

Variable Name	Variable Definition
State Equalized Value	State equalized value of a parcel is equal to $(0.5) \times (\text{estimated market value of property})$.
Taxable Value	Taxable value of a property is state equalized value at the time of purchase, but taxable value grows at the annual rate of inflation or 5 percent since the date of purchase, whichever is less. Taxable value is adjusted to state equalized value at the time of sale.
Effective Tax Rate (or effective millage)	$[(\text{Statutory tax rate per 1,000 of taxable value}) \times (\text{taxable value})] / (\text{state equalized value})$.
Tax Delinquent	Indicator variable equal to 1 if the property owner is tax delinquent and 0 otherwise.
Living_Area	Size of residential structure in square feet.
Lot_Size	Size of lot in square feet.
Age	Age of residential structure in ten-year intervals.
Years_Owned	Number of years owned by the current property owner. Years_Owned is capped at 16 years because the taxable value cap was imposed in 1994.