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Anticipated property tax increases and the timing of home sales: Evidence from administrative data

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Abstract

The infrequent reassessment of properties results in a divergence between the assessed values of current owners and prospective purchasers. This divergence is reduced when properties are reassessed, as is the tax "wedge" between current owners and prospective buyers. We examine how a reassessment-induced reduction in this tax wedge affects home sales. Using data from Lexington, KY and our preferred approach, we find that reassessments are associated with an increase in sales of approximately 5%. Using an alternative approach, we find that a 10% increase in taxes due to reassessment increases the probability of a sale by 3%.

Key Takeaways

- Infrequent property reassessments are common with many states not requiring reassessments for periods of several years.
- The infrequency of reassessments may create a divergence in the assessed values between current owners and prospective purchasers, a "tax wedge," particularly in times of high housing appreciation.
- These infrequent reassessments may affect the timing of sales, reducing sales in years prior to reassessment and increasing the likelihood of sales at the time of reassessment.
- Using data on housing sales from Fayette County (Lexington), Kentucky, we find that reassessments are associated with an increase in sales of approximately 5%. Alternatively, a 10% increase in taxes due to reassessment increases the probability of a sale by 3%.

INTRODUCTION

While no tax seems to be popular among Americans, other taxes do not seem to generate as much animosity as the property tax. One explanation noted by Cabral and Hoxby (2015) is that the property tax may be more salient than other taxes as almost 70% of homeowners directly pay their property taxes. This contrasts with income and payroll taxes in which taxpayers have payments withheld and, for the income tax, often receive refunds (Cabral & Hoxby, 2015). While salience may be one reason for the unpopularity of the property tax, another possible reason might be concerns about the subjectivity of the tax base—the assessed value of a house. Differences in assessed property values may not only reflect differences in the market value of the house but also the household's length of ownership.

The unpopularity of the property tax undoubtedly helps explain why property taxes have been subject to so many limits and restrictions on their use. While the best known of these limits are those passed between 1978 and 1981, including Proposition 13 in California and Proposition 2½ in Massachusetts, property tax limits have been in existence for well over 100 years and are found in almost every state.[1] Broadly, there are three forms of limits: limits on the (nominal) tax rate that can be applied, limits on assessment ratios and increases, and limits on proper tax revenues or revenue increases. For example, in California the allowable annual increase in assessments is set at 2% is often well below market appreciation. However, when a house is sold, its assessment is based on current market values. This being the case, a household that has lived in the same home for several years, particularly during periods of high appreciation, can have an assessed value that is significantly below what a new purchaser acquires on the open market.

These differences in assessed values between a homeowner with a long length of ownership and a prospective purchaser can lead to significant differences in tax payments. These wedges may lead to the reluctance of homeowners to sell their currently under-assessed properties and purchase other properties assessed at market value, what is known as the "lock-in effect." Numerous studies have found evidence of lock-in effects (Ferreira, 2010; Hodge, Sands, & Skidmore, 2015; Stansel et al., 2007). In fact, it is not only researchers who recognize these "lock-in" effects—California and Florida, for example, allow for the difference between the assessed and market value to be "portable," that is, homeowners are allowed to apply this difference to the assessment on their new homes.

In this study, we consider another assessment practice, the time between reassessments, that also results in the divergence in property taxes of existing and potential new property owners. To our knowledge, the possibility that infrequent reassessment might similarly result in "lock-in" effects has been ignored in the literature on property taxation. As can be seen in Table 1, 44 states and the District of Columbia have laws governing how often reassessments must occur. While 10 states require annual reassessment, the remaining 34 states have reassessment intervals varying in length from 2 to 10 years with 17 states having intervals of 4 or more years. Two states, Connecticut and Rhode Island, have a 10-year reassessment cycle, and New Jersey only requires reassessment when improvements are made. While the majority of states have a maximum period of time between reassessments (at least every *x* years) some state statutes have a specific length of time or conditions for early reassessment (e.g., Maryland).

As we show, these extended periods between reassessments can lead to significant differences in the assessments faced by current and new homeowners during periods of high appreciation. In contrast to assessment limits, the periodic reassessment of properties means that

[1]While the late 1970s and early 1980s was a period in which several states imposed or revised property tax limits, in fact, Missouri first instituted rate limits on property taxes in 1875. States without any state limits on property taxes include Connecticut, Hawaii, Maine, New Hampshire, South Carolina, Vermont, and Virginia. The District of Columbia has no restrictions on property taxes as well. See Hoyt et al. (2011) for more details on the form and timing of state property tax limits.

TABLE 1 State laws governing frequency of real property assessment.

State	Frequency of assessment	State	Frequency of assessment
Alabama	At least every 3 years	Nebraska	Annually
Alaska	Annually	Nevada[a]	Every 5 years
Arizona	Annually	New Hampshire	No provision
Arkansas[b]	At least every 3 years[b]	New Jersey	When improvements are made
California	Usually whenever a "change of ownership" occurs or new construction is completed	New Mexico	At least every 2 years
Colorado	Every 2 years	New York	No provision
Connecticut	Every 4 years	North Carolina[c]	Every 8 years
Delaware	No provision	North Dakota	Annually
Florida	At least every 5 years	Ohio	At least every 6 years
Georgia	Every 4 years	Oklahoma	At least every 4 years
Hawaii	No provision	Oregon	No provision
Idaho	At least every 5 years	Pennsylvania	Annually
Illinois	Every 4 years. Cook County is assessed triennially	Rhode Island	Every 10 years
Indiana	Every 4 years	South Carolina	Every 5 years
Iowa	Every odd-numbered year	South Dakota	No provision
Kansas	Dependent on county	Tennessee	Every 6 years
Kentucky	At least every 4 years	Texas	At least every 3 years
Louisiana	At least every 4 years	Vermont[d]	Every year
Maine	At least every 4 years	Virginia[e]	Every 2 years
Maryland	Every 3 years	Utah	Every 5 years
Massachusetts	Revalued annually, certified by State every 3 years	Washington	Every year
Michigan	Annually	Wisconsin	Every 5 years
Minnesota	At least every 4 years	Wyoming	Every year
Mississippi	No provision		
Missouri	Every 2 years		
Montana	Annual Assessment Mostly		

Source: Higginbottom, Justin. 2010. "State Provisions for Property Reassessment," Fiscal Fact No. 223, Tax Foundation, Washington, DC and Rafool, Mandy. 2022. "A Guide to Property Taxes: An Overview," NCLS Fiscal Affairs Program. Denver, CO.

[a]All counties are moving to a system of annual reappraisal. All counties reappraise land every year and Clark County reappraises both land and buildings annually.

[b]Arkansas counties that completed reappraisal between 2002 and 2004 have a 5-year reappraisal cycle.

[c]North Carolina counties with population of 75,000 or greater must reassess real property within 3 years if the county's sales assessment ratio is less than 0.85 or greater than 1.5, or if no change, within 8 years of county's last reassessment. All other counties: every 8 years.

[d]In Vermont, state assessors calculate current fair market value for all properties each year, whether or not they have been reassessed locally. When the aggregate assessment of property in any township is less than 80% of the state-level "equalized" assessment," the locality must reassess all of its properties.

[e]Virginia makes an exception for some counties, allowing them to have up to 6 years between reassessments. (Alleghany, Amelia, Amherst, Appomattox, Bath, Brunswick, and Buchanan County to name a few).

the “wedge” in taxes between current and new owners either disappears or is reduced when the property is subject to periodic reassessment independent of a sale.

Unlike 20 other states, the Commonwealth of Kentucky does not have a statewide limit on assessment value growth. Kentucky statute requires that local property value administrators (PVAs) revalue every year properties at *fair cash* (market) *value* each year and *examine* each property no less than every 4 years.[2]

In practice, at least in Lexington, distinct neighborhoods are most frequently examined on a 4-year cycle and it is following this neighborhood assessment (NA) that properties are revalued (reassessed). A household that has lived at a property for 3 years since the last NA may, particularly in times of high housing appreciation, have an assessment significantly below what a new purchaser with an assessment based on current market value. However, in the fourth year from the previous statute-required assessment, the house will be reassessed and the incumbent household will have an assessment more comparable to that of a new owner. Thus, as with restrictions on assessments, the gap between NAs leads to a difference in tax payments between a current and prospective homeowner. Unlike tax differences arising from assessment limits, this difference disappears or is greatly reduced with the next assessment. In this case, the likelihood that a household sells its house depends on: (1) whether an NA occurs in that year and (2) the magnitude of the difference in taxes based on the assessed value before reassessment and the revised amount following it. We test these predictions using administrative data from the *Fayette County Property Valuation Administrator (PVA)*.

Based on these data, we first find that tax payments can change significantly when neighborhoods are reassessed with a mean increase of over $300 ($2020) and, for the homes with the highest assessments, an increase of over $470 per year with reassessment. Using a difference-in-difference (DID) strategy with the NA as the treatment, we find that the probability of a sale occurring in the year of reassessment increases by approximately 4.5% for the sample and over 7% for houses in the 25th–75th percentiles in assessed value. Alternatively, by estimating the change in taxes with reassessment using two-stage least squares, we find a 10% change in property tax payments arising from reassessment increases the likelihood of a sale by approximately 3.7% and by over 7% for the homes in the third quartile of assessed value.

LITERATURE REVIEW

There is a large and varied literature on property taxes and, specifically, on the impacts of property tax limits. Numerous studies examine the political and economic motivation for these regulations. For example, Anderson (2006) argues that while property tax limits may serve as a constraint on local government expenditures, these limits also serve as insurance against unexpected increases in personal property tax liabilities. A related motivation for property tax limits that coincides with many of the limits imposed in the 1970s and early 1980s is as a “defense” against inflation-induced increases in property tax liabilities (Bowman, 2006; Cornia & Walters, 2006) or Leviathan governments seeking to maximize revenue (Cutler et al., 1999). Other studies focused on the impact that property tax limits have on local revenues and expenditures (Bradbury et al., 2001; Lang & Jian, 2004). Another strand of the literature on property taxation and property tax limits focuses on the distributional impacts of these limits (Dye et al., 2006; Hodge, Sands, et al., 2015; Skidmore et al., 2010).

[2]From the Kentucky Revised Statute 132.690 Annual revaluation of real property—Quadrennial physical examination of real property—Methods of examination—Emergency revaluation. (1) (a) Each parcel of taxable real property or interest therein subject to assessment by the property valuation administrator shall be revalued during each year of each term of office by the property valuation administrator at its fair cash value in accordance with standards and procedures prescribed by the department and shall be examined no less than once every 4 years by the property valuation administrator.

While our study is not focusing on the effects of property tax limits on homeowner mobility, it is related to these studies as it explores an institutional aspect of assessment that “locks-in” assessed value for current homeowners. The literature on property taxation and mobility has, for the most part, focused on several “case-study” state-level reforms. Most notably, there are numerous studies on the economic effects of California's Proposition 13. Enacted in 1979, Proposition 13 reduced the property tax rate to 1% of assessed value, and limited increases in assessments to, at most, 2% per year. However, assessments are set to market value at sale, potentially creating a “lock-in” effect, especially for long-tenure owners in rapidly appreciating housing markets. Several other states, including Massachusetts and Florida, have enacted similar limits on assessments.

The focus on the immediate passage of laws also creates potential problems as, in some instances, the effects of these limits may not be seen in the short run. For example, Nagy (1997) finds little lock-in effect from Proposition 13, but Wasi and White (2005) argue that there was little time to find such impacts as Nagy only examines behavior for 3 years after the law was enacted. In other instances, the short-run effects may be larger than the long-run effects due to pent-up demand. Ferreira (2010) finds large increases in mobility for Californians over the age of 55 using the 1990 Census, soon after several amendments allowed older homeowners to transfer their property tax savings to another home in California, but these amendments resulted in much smaller effects in the 2000 Census. Hodge, Skidmore, et al. (2015) examine the impact of taxable value growth caps on mobility using parcel-level data in Detroit, Michigan and find longer durations of property ownership for those who received greater reductions in their effective property tax rate. Focusing on Florida's assessment limits, Ihlanfeldt (2011) finds evidence of a lock-in effect for homeowners in single-family homes. In contrast, Stansel et al. (2007) find no evidence that Florida's cap, which is portable across the state, had an impact on tenure. Stohs et al. (2001) identify the impact of Proposition 13 on homeowner mobility through comparisons of home sales in selected counties in California with selected counties in Illinois and Massachusetts and find fewer housing sales in the California counties. Wasi and White (2005), focus on the impact of Proposition 13 on tenure length of owners, employing Florida and Texas as comparisons and using a “DID” methodology with microdata on households from the 1970 to 2000 Census of Population and Housing. They found that the length of tenure in California increased by 0.66 years or 6% following the passage of Proposition 13.

Many lock-in studies clearly recognize the frailties of strictly relying on time series variation to identify the effects of an introduction or modification of these limits. Although the passage of a law that limits property taxation may certainly affect owner mobility, a host of other factors, including changing employment and housing markets, may also matter. Typically, researchers have examined owners in unaffected markets (e.g., housing markets outside of California in the Proposition 13 context), or owners that are differentially affected by the law (e.g., those with high or low tax savings). Approaches that rely on cross-state control groups often suffer from the problem that different property tax systems can be correlated with other underlying characteristics of the state that also affect household mobility.[3] Moreover, these studies have difficulty controlling for differential trends in housing markets over time as these trends could independently affect mobility and may be correlated with tax savings.[4] Approaches that rely on differential tax savings to identify mobility effects often have difficulty in disentangling the causality issues: appreciating housing markets, longer tenure increases property tax savings, while the empirical approach often estimates the impact of property tax savings on mobility which is highly related to length of owner.

The literature discussed above focuses on the lock-in effect resulting from differences in assessments between current owners and purchasers of a property. That this increase in property

[3]See the discussion in Ferreira (2010).

[4]For example, real housing appreciation in San Francisco exceeded the national average by more than 2 percentage points per year for the years between 1950 and 2000 (Gyourko et al., 2013).

taxes only arises with the change in ownership effectively establishes a real-estate transfer tax. As noted in Slemrod et al. (2017), 35 states and the District of Columbia apply transfer taxes on residential real estate transactions with a mean rate (2012) of 0.58% but in D.C., the focus of their study, the rate ranged from 2.2% to 2.9%. The United States is not the only country that applies these transfer taxes, Fritzsche and Vandrei (2019) examine transfer taxes in Germany, and Eerola et al. (2021) examine them in Finland. Both studies find significant lock-in effects of these transfer taxes and anticipatory changes in the timing of transactions when rates are changed. Zhang and Deng (2023) examine a specific transfer tax in Singapore, a seller stamp duty. Unique to this tax is the duration-dependence of the tax—the longer the property is held, the lower the tax rate that is applied to sale. Not surprisingly, Zhang and Deng find that higher tax rates and longer "lock-in" periods reduce the probability of a sale. Interestingly, they also find that increases in the lock-in period and tax rates lead some homeowners to lease out their properties.

A related literature examines lock-in with respect to housing appreciation and mortgage interest rates (Chan, 2001; Ferreira, 2010; Nakagami & Pereira, 1991; Quigley, 1987; Fonseca & Liu, 2023). Evidence from these and other studies suggests that changes in housing prices and mortgage interest rates might affect household mobility.

Finally, Spreen and Keddington (2023) examine the lock-in effects of short-term (5 years) property tax relief to long-tenured (40 years) senior (age 60 and over) homeowners passed in Maryland in 2016 and adopted by some but not all counties. Using both DID and regression discontinuity strategies, they find no statistically significant evidence that the property tax relief affected eligible senior homeowners' property sales decisions.

Relative to existing work, our study offers several innovations. First, our source of tax assessment variation is transparent and clearly exogenous to the household. Second, we rely on tax assessor data, meaning we measure mobility, tax assessments, and housing characteristics far more precisely than typical household-based surveys. Third, any fears about differential housing market trends affecting mobility are reduced as we are examining mobility within a single housing market with our exogenous variation occurring at the neighborhood level. Finally, as we examine behavior over the period 2002–2020 concerns about overstating the long-run impact of property taxation due to pent-up demand should be greatly reduced.

ASSESSMENT-INDUCED TAX DIFFERENTIALS AND THE DECISION TO SELL

Here, we illustrate how differences in property taxes between existing homeowners and new purchasers can arise and what factors determine the magnitude of these differences. Our parameterization gives some indication of the potential magnitude of how these tax differences may vary over the assessment cycle. As motivation for our empirical work, we provide a simple example of how these tax differences affect the likelihood of a household moving or, equivalently, when there is a sale of property.[5]

Determinants of assessment-based tax differentials

To understand the differences in tax payments between a current and potential new homeowner, consider the example of a homeowner who just had their home reassessed at a value of $500,000, equal to the current market value. Then if the assessment cycle is 4 years and the

[5]As we only consider arms-length sales of owner-occupied houses, a property sale results in a change in residence for both the seller and purchaser.

homeowner stays in the house until the next reassessment, with a 2% property tax rate, her tax payment for each of the next 4 years is $10,000. Now, with an annual appreciation rate of 7.5%, someone purchasing the house the year following the NA would pay and be assessed at the current market price of $537,500, paying annual taxes of $10,750 for the 3 years until the next NA—$750 more per year than the current owner.

As seen in Figure 1a, the difference in annual tax payments between current homeowners and potential purchases continues to grow until the next NA. In this figure, we show this difference in annual tax payments based on the years since assessment for homes at the 25th, 50th, 75th, and 95th percentiles of sale value which, in 2020 (at $2020), are $153,341, $193,888, $367,658, and $466,256. We assume a tax rate of 1.25% with both the appreciation and discount rate set at 3%.[6] Figure 1b reports the differences in the present values of the tax payments. While the greatest annual tax difference is in the third year following assessment, the greatest difference in the present value of taxes is found in the second period.[7]

Assessment-based tax differentials with incomplete reassessment

Kentucky law states that properties are to be assessed at "fair cash value" and, unlike other states, there are no statutory limits on how much assessments can increase. However, the tenure of a property owner can have a significant impact on the assessed value of her property, suggesting that properties are not necessarily assessed at "fair cash value" when an NA is done.

Figure 2 compares the difference in tax payments over multiple assessment cycles for four alternative assessment strategies: annual assessment at market value, annual assessment with an assessment growth limit of 2%, assessment every 4 years at 85% of market value, and assessment every 4 years at full market value. Note that the "wedge" between tax payments for annual reassessment at full market value and those when assessment limits apply only increases over time. However, when reassessment is on a cycle, the wedge increases during the cycle but decreases or disappears every 4 years. Thus, while there is a continuous increase in the tax wedge between current and new homeowners when there is an assessment limit, there is a discrete "jump" in taxes for current homeowners every 4 years when reassessments are on a cycle. It is this discrete jump in taxes for a current homeowner and how it might influence the sale of their home that is the focus of our empirical analysis.

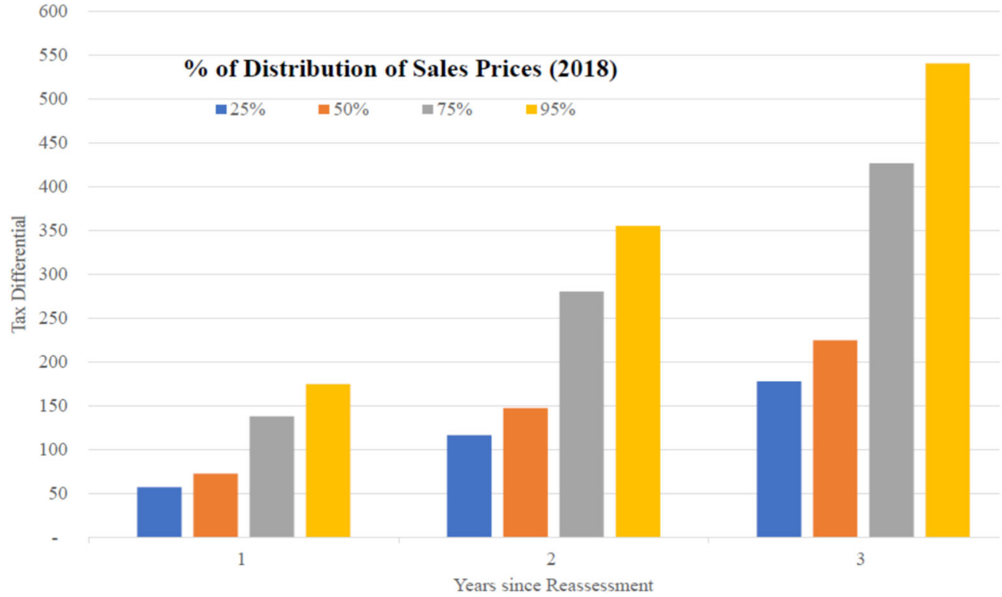
Timing of sales with known versus uncertain reassessment

The example of the property tax differences between existing and new homeowners discussed above presumed, following Kentucky Statute, that an inspection and subsequent reassessment occurs every 4 years. As we shall see later, while this 4-year cycle of neighborhood reassessments seems to have been followed in the years before 2010, reassessments were less frequent and did not follow any obvious pattern after 2010. Of course, that reassessments did not occur on a 4-year cycle, may be partly explained by the limited appreciation of properties during and shortly after the Great Recession. But, as becomes apparent with our calculation of differentials between assessed and market values, the limited appreciation in property values does not fully explain all the apparent deviations from the 4-year cycle.

How, then, might uncertainty in neighborhood reassessments affect the decision of homeowners to sell? To the extent that homeowners make the decision of whether to sell based

[6]The Federal Housing Finance Agency (FHFA) housing price index (HPI) for the Lexington MSA increased by 2.82% from 2002 to 2020.
[7]As seen in the formulae in Table A1, critical to the tax savings received by an existing homeowner is the rate of appreciation in housing prices, the value of the home, the tax rate, and the length of time until the next assessment.

(a)



(b)

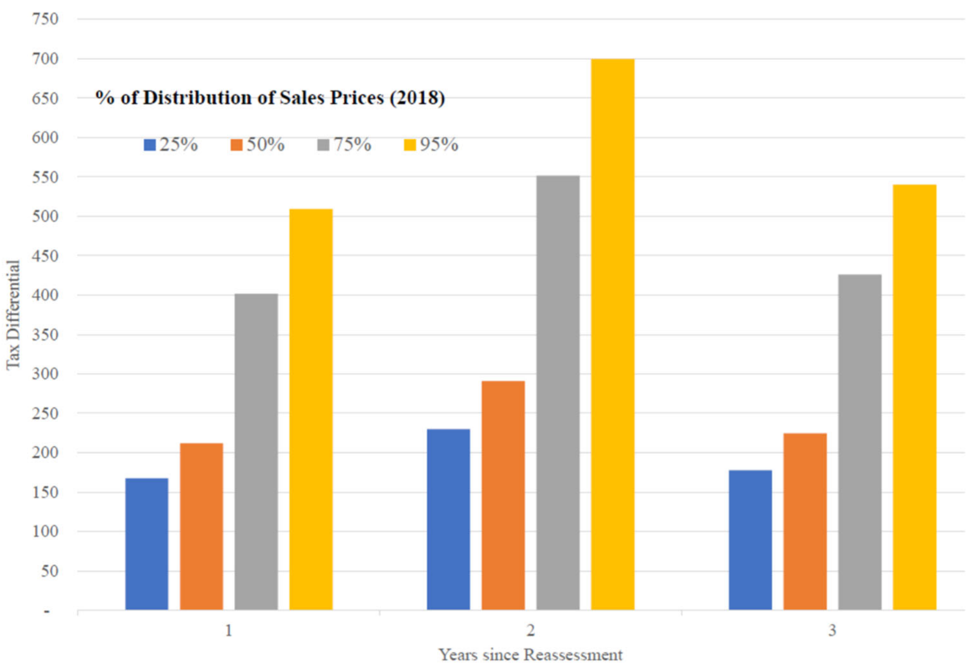


FIGURE 1 Annual and present value differences in taxes during assessment cycle, current versus new owner for different house values (% of distribution).[a] (a) Annual tax differences during assessment cycle for different house values. (b) Present value of taxes during assessment cycle, for different house values. [a]*Source*: Authors calculations. We assume a tax rate of 0.0125, a discount rate of 3.0%, and appreciation rate of 3.0%. The house value for the 25% is 153,341, for the 50% is 193,888, the 75% is 367,658, and the 95% is $466,256 in $2018.

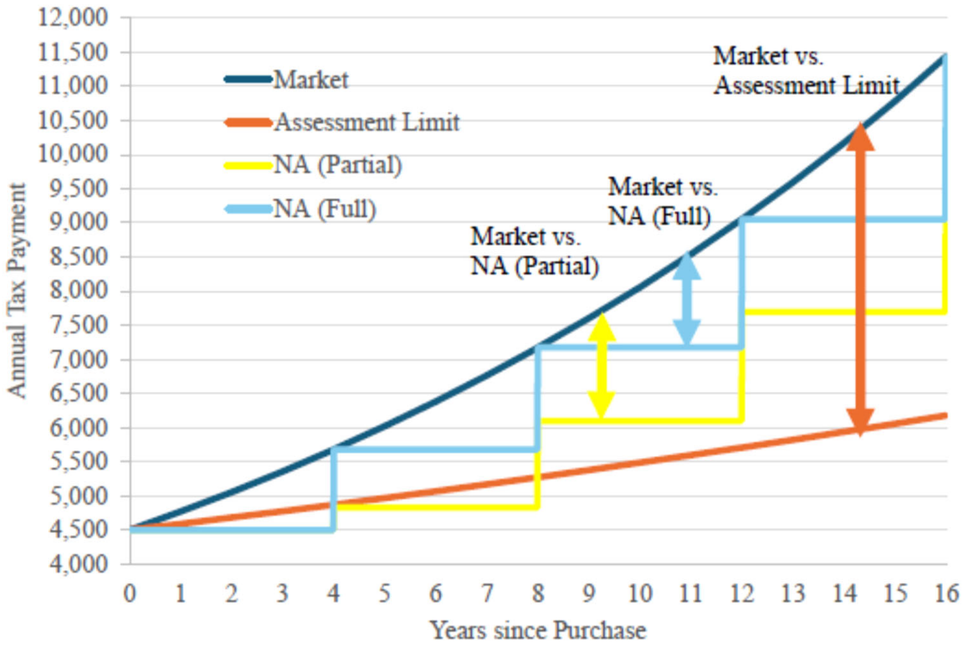


FIGURE 2 Assessment appreciation and tax payments: Assessment limit versus periodic assessment limit versus neighborhood reassessment (full and partial) versus market value. *Source*: Authors calculations. NA is neighborhood assessment. Assessment limit is 2%, the NA with assessment limit is 2% per annum applied every 4 years; Partial NA is at 85%.

on current annual differences in tax payments, the timing of the next neighborhood reassessment is irrelevant. However, if their decision is based on the present value of the current and future tax savings, the timing of the neighborhood reassessment matters.[8]

Regardless of whether an NA is expected or not, the occurrence of the reassessment is likely to result in a distinct and discrete increase in a homeowner's taxes that is likely to persist for several years. The realization that her taxes have increased may change the homeowner's incentive to remain in her current home. The focus of our empirical work is to examine how these NAs affect the probability of a sale.[9]

The decision to move

To illustrate the impacts of property tax assessments on moving, consider a simple model in which a household, at any time t, has its own valuation of its home, $V^o(t)$, and is aware of the market valuation at that time, $V(t)$. There is also a moving cost of $M(t)$. Initially, assume that there is no tax difference between a current and a potential new homeowner with assessed value equal to market value for both. Then the current homeowner will sell if

$$\pi(t) = V(t) - V^0(t) - M(t) > 0. \tag{1}$$

[8]In the case of an uncertain reassessment, the expected present value of tax savings for a current owner is given by $EPV \equiv \sum_{t=0}^{\bar{T}} P(NA(t)) pV^0 \sum_{k=0}^{t-1} \frac{[(1+\rho)^k - 1]}{(1+r)^k}$ where $P(NA(t))$ is the probability of a neighborhood reassessment in year t, p is the tax rate, V^0 is the initial assessment, ρ is the appreciation rate, r is the discount rate, with a reassessment to occur sometime before or at $t = \bar{T}$.

[9]From the Fayette County PVA website (https://fayettepva.com/assessments-appeals/): "Many homeowners will receive an assessment notice that will include a map of recent sales in their immediate neighborhood in April. Neighborhood sales are the primary driver for reassessments." Thus current homeowners will be informed of their (re)assessed value by April of the year of reassessment.

However, because assessed values lag market values, there is differential tax treatment between the current and a new owner and there will be a change in ownership only when

$$\tilde{\pi}(t) = V(t) - V^0(t) - M(t) - \Delta P(t) > 0, \tag{2}$$

the bid of the potential buyer, $V(t)$, exceeds the valuation of the current owner, $V^o(t)$, her moving costs, $M(t)$, and her tax advantage, $\Delta P(t)$. Then introducing a random component into Equation (2) enables us to relate the tax wedge between current and new homeowners to the probability of a current homeowner moving (selling their house)—a link to our estimation. We assume that the valuation of the current owner reflects the market but has an idiosyncratic (randomly distributed) component or $V^0(t) = V(t) - \varepsilon_t$. Then substituting for $V^o(t)$ in Equation (2) we obtain

$$\tilde{\pi}(t) = \varepsilon_t - (M(t) + \Delta P(t)) > 0. \tag{3}$$

It follows from Equation (3) that if $\tilde{\pi}(t) > 0$ or equivalently if $\varepsilon_t > \varepsilon_t^* \equiv M(t) + \Delta P(t)$, the household will move with the probability that it moves at time t given by $P\left(\varepsilon_t > \varepsilon_t^*\right)$. Then, as $\varepsilon_t^* \equiv M(t) + \Delta P(t)$, ε_t^* increases in both the tax and appreciation rates, meaning that the likelihood of a sale is lower between NAs than in the year of a neighborhood reassessment or immediately after.

DATA

Our primary data source is the Property Valuation Administrator (PVA) in Lexington-Fayette County, Kentucky. We obtained these data for virtually every parcel in the county. They are unique in several respects. First, they are unusually detailed. In addition to reporting current tax assessments, parcel identification, street address, house, and lot characteristics, all tax assessments from 2002 onward are available. Legal transactions (such as arms-length sales, quit claim deeds arising from divorce, and foreclosure proceedings), along with relevant dates, parties, and prices, are also recorded. Second, each parcel is classified into one of 344 neighborhoods in Fayette County. As shown below, this is vital to our identification strategy, because parcels are assessed at different times based on their neighborhood. Finally, access to the data is unusually open. The detailed data we utilize are freely available at the website www.fayettepva.com.

Our focus is on single-family homes, and we restrict the sample to only include arms-length transactions. Ultimately, we have a sample of single-family residential homes located in 344 neighborhoods. Figure 3 plots these parcels in Lexington. On the map, the shaded area is the *Urban Service Area* where most of the development of single-family homes occurs and where city water and sewer are provided. Outside the urban service area is the rural service area, without city water, sewer access, and where development is more restricted. Most of this area is agricultural with horse farms constituting a large share of the land. In our analysis, we separately examine urban and rural service areas.

Tax assessment in Lexington and identification strategy

In Lexington, there are seven tax districts for single-family residential homes with modest variation in the tax rates among them—ranging from 1.10% to 1.28% of assessed value in 2020. The variation arises in large part because some neighborhoods rely on private garbage collection, street cleaning, and street light maintenance. Newer neighborhoods cannot opt out of having these services being publicly provided and if a neighborhood switches from private

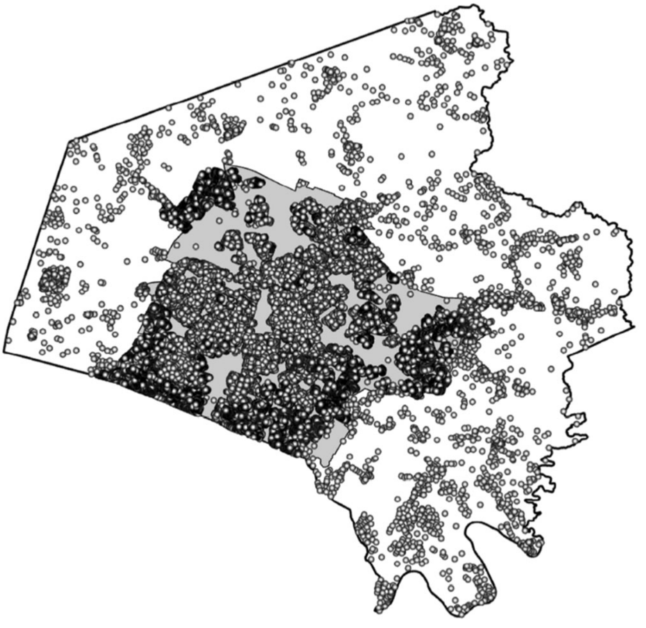


FIGURE 3 Map of house sales in Fayette County, 2002–2020.

services to public services, that switch is irreversible. Of the homes in our sample, almost 70% receive full public services and pay the highest tax rate.

Kentucky law (KRS.132.690) states that each parcel will be assessed annually by the PVA at its fair cash value in accordance with standards prescribed by the Revenue Cabinet. In addition, property will be physically examined no less than once every 4 years by the PVA. In practice, houses in Fayette County are reassessed in the tax year following a sale. Also, NAs are usually updated once every 4 years, though this may not mean that assessments change. If properties in a Lexington neighborhood, in aggregate, have unusually high rates of appreciation or depreciation, then NAs may occur more than once every 4 years though this occurs infrequently.

Table 2 reports the share (percentage) of houses assessed for 24 large neighborhoods from 2003 to 2020, with the cells highlighted in dark yellow denoting neighborhoods with a high percentage (70%+) being reassessed, our criterion for an NA. While approximately one quarter of homes in Fayette County appear to be assessed from 2003 to 2008, from 2009 to 2013, only one neighborhood, Cardinal Hill in 2011, met our criterion of having an NA. That there was very little assessment from 2009 to 2013 is consistent with housing prices not increasing during this period and, in fact, falling for several years, as can be seen in Figure 4a. In 2014, neighborhoods again appeared to be subject to assessments consistent with housing prices rising, as seen in Table 2. In most cases, it is clear which neighborhoods are being reassessed and which neighborhoods have a few properties reassessed because of transactions or structural changes to the property.

Our identification strategy—an important contribution of our paper—is motivated by this table. In older, more established neighborhoods, it is easy to see when wholesale assessments occurred (at least if property values are appreciating). The fact that houses in one neighborhood are assessed in a given year, whereas houses in another nearby neighborhood are not, creates plausibly credible variation in property tax burdens for individual homeowners. This allows us to construct a DID estimator of the impact of assessment on property sales, using the differential timing of assessments across neighborhoods to estimate this effect.

Several comments about our approach are in order. First, we are ultimately inferring that a neighborhood was subject to assessment based on observed changes in assessments in that

TABLE 2 Neighborhood assessment rates, 2003–2020 (percentage of homes assessed).

Neighborhood	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Autumn Ridge 90	12	11	**90**	9	9	8	19	4	9	3	3	5	9	10	**73**	8	5	6
Cardinal Valley	6	**86**	7	6	7	4	3	4	**76**	3	1	4	4	26	5	7	6	6
Century Hills	8	**95**	9	8	8	**75**	5	4	8	2	2	3	5	12	6	6	6	5
Chevy Chase	**98**	13	14	**85**	11	10	8	9	13	5	6	9	8	**82**	12	8	9	10
Deep Spring Part of Dixie Hermitage Hill	6	7	**88**	5	7	5	4	2	6	2	3	5	4	13	6	8	**97**	6
Downtown	35	7	8	8	62	5	3	3	7	2	2	7	7	10	9	7	63	9
Gainesway	7	8	**88**	7	4	7	16	4	7	2	3	6	6	7	8	7	**96**	5
Garden Springs	**92**	6	8	6	**95**	8	6	5	8	2	2	5	6	6	7	**83**	6	7
Gardenside Prospect Hill & Sky Crest	7	**87**	9	6	7	6	5	4	10	2	2	6	6	**77**	9	6	5	5
Highland Lakes 95	12	**70**	9	11	8	10	8	7	11	5	5	10	9	9	**70**	9	7	8
Hollow Creek & Winburn	5	5	**80**	5	4	3	3	1	48	2	1	5	4	3	**70**	5	4	4
Idle Hour	6	7	9	**94**	7	5	5	3	7	3	2	5	6	7	8	**80**	7	7
Lansdowne	5	6	**95**	9	6	6	13	3	6	1	3	**78**	6	14	**83**	10	9	8
Melody Village & River Park	9	6	8	**96**	7	5	3	6	6	38	40	5	4	4	6	6	**92**	5
Pine Meadows	9	6	**96**	8	6	6	16	3	11	2	2	6	9	68	10	4	6	7
Radcliffe	**83**	5	6	7	**94**	6	4	3	7	1	4	**60**	4	10	4	5	**96**	5
Rookwood & Kenwood	6	6	**77**	6	5	5	3	3	3	3	2	4	4	5	**70**	6	6	7
Southland & Hill N' Dale	9	9	**83**	6	7	5	6	6	7	2	2	5	6	**72**	5	6	**95**	8
Southland & Rosemill	**91**	8	8	10	**91**	9	7	5	9	3	3	6	5	7	**81**	8	**94**	9
Squires Woods 96	10	**92**	12	9	23	63	5	8	10	7	2	4	8	4	7	3	4	7
The Meadows	7	7	**78**	8	6	4	7	3	8	2	2	5	5	7	6	7	**80**	8
Thoroughbred	**88**	5	6	6	**94**	5	3	3	8	2	2	**66**	5	4	5	**91**	5	5
Wellington	16	28	7	14	10	**79**	7	6	12	4	4	7	6	66	6	4	6	6

neighborhood. Some neighborhoods were certainly subject to reassessment under Kentucky law, but their assessments were not revised when appreciation was low or even negative. Our procedure will have difficulty in detecting these neighborhoods and assessment years. In Table 2, the years for which the neighborhood was subject to a *binding* NA are highlighted in yellow. Those neighborhoods for which we could identify a 4-year interval between assessments are in bold. An example of a *binding* assessment is found for the "Cardinal Valley" neighborhood—in 2004, it had a wholesale assessment (86% of parcels). However, only a trivial amount of assessment occurred there in 2008. Put differently, our approach detects *binding* NAs, but not *nonbinding* NAs.[10] Second, as mentioned, we define a threshold of 70% in a neighborhood as a binding, scheduled NA.[11] Note that assessments primarily occur for two main reasons: "wholesale" NA and as a result of individual property sales (which is our outcome of interest). The assessment percentage in Table 2 includes both.

While 4 years is a *maximum* interval between assessments, as seen in Table 2, several neighborhoods (those not in bold) were assessed in a 3-year interval or on an interval with a length we cannot identify. This is an issue that we address empirically.

Summary statistics

Table 3 provides summary statistics on sales, assessed values, and tenure length for the sample of single-family dwellings we utilize in our estimation. Table A2 provides additional summary statistics on the characteristics of the dwellings, and other variables employed in our estimation strategy but not our focus. In Table 3, we can see that approximately 2.3% of houses are sold each year. We also consider the distribution of sales conditional on the house being in a neighborhood assessed in that year. Then, from the table, we see that the percentage of houses sold in the year a neighborhood is being assessed is higher than when no NA occurs (sold in current year).

The mean assessed (fair cash) value for our sample of houses was $213,274 ($2020). As much of our empirical analysis employs sub-samples of the properties based on the average assessed value in the neighborhood, we provide additional information about the distribution of assessed values. The mean tenure length was 11.02 years, with approximately 7% of households residing in their house for less than a year and almost 20% in their house for over 18 years.

Housing appreciation and mortgage interest rates

Numerous studies have examined how mortgage interest rates and household appreciation might affect household mobility and lock-in. In Figure 4a, we report the FHFA housing price index for the Lexington metropolitan area. As is evident from the figure, housing prices appreciated from January 2002 to April 2008 by 26%, an annual rate of approximately 4%, then were relatively flat and falling until January 2015. From January 2015 to January 2021 housing prices increased by 34%, an annual rate of 5%. For the entire period, 2002–2020, housing prices increased by an average of 2.82% per year. In Figure 4b, we report the monthly average 30-year fixed mortgage rates for the United States during this period. Rates are variable but generally decrease during this period. While these fluctuations in housing prices and mortgage interest rates may affect mobility, they are not the focus of our study, and we address these concerns in our estimation through time-fixed effects.

[10]We have obtained data from the Fayette PVA from 2004 onward that shows us which neighborhoods were subject to assessment, allowing us to explore the effects of binding versus nonbinding assessments more carefully.

[11]As robustness checks, we considered 60% and 80% as alternative criteria for binding assessments.

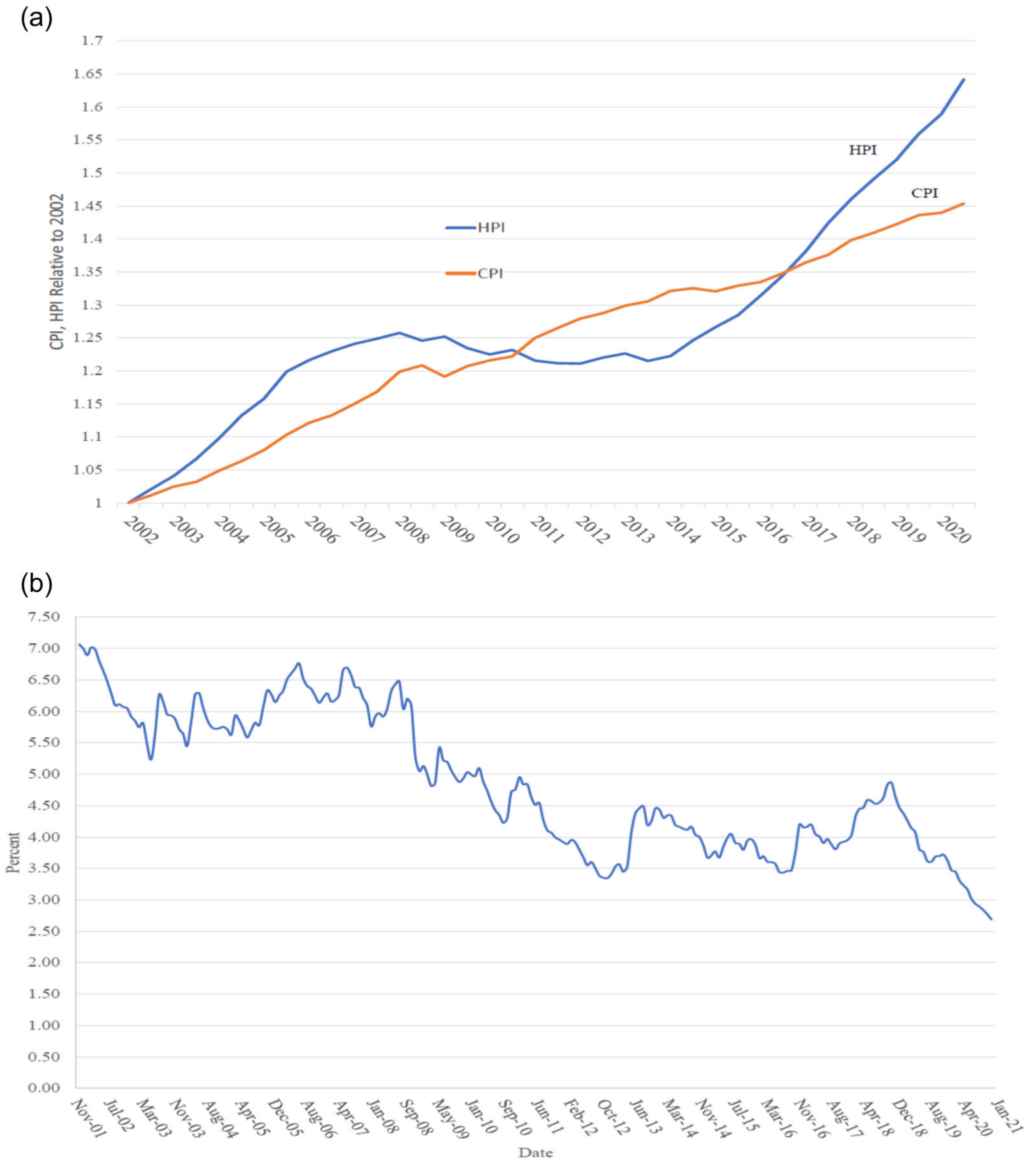


FIGURE 4 (a) Lexington Housing Price Index (FHFA) and urban CPI, (semi-annual) 2002–2020 (relative to 1–2002). *Source*: Federal Research Economic Data (FRED), Economic Research Division, Federal Reserve Bank of St. Louis (https://fred.stlouisfed.org; U.S. Bureau of Labor Statistics (https://www.bls.gov/). (b) 30-Year fixed rate mortgage average in the United States, November 2001 to January 2021. *Source*: Federal Research Economic Data (FRED), Economic Research Division, Federal Reserve Bank of St. Louis (https://fred.stlouisfed.org).

NA timing and tax payments

Figure 5 plots the change in tax payments, by quantile of assessed value and the mean, that arises when properties are reassessed following an NA. As the assessment only changes at time 0, the taxes, in $2020, only vary at the other periods due to changes in the CPI. The figure demonstrates that the mean increase in taxes with reassessment is approximately $320. Not surprisingly, the largest increase in taxes, $471 on average, occurs for the most expensive houses. Figure A1 shows how these changes in tax payments vary for the periods 2002–2008, 2009–2015, and 2016–2020.

Sale price versus assessment appreciation

Figure 6 plots the time series of sale price and assessment (fair cash value), by quantile and the mean ($2020). The mean sale price exceeds the mean assessment in every year except for 2011 and 2012. Sale prices fell more than assessments during the recession (2008–2012) but grew at a faster rate following it.

In Figure 7, we compare the change in tax payments for houses that are reassessed, but not sold, during a neighborhood reassessment to houses that were sold in reassessed neighborhoods in the same year by assessment quantile and mean. The difference in taxes for both groups is based on the assessed value in the year of assessment relative to the preceding year's assessed value. For houses sold during the year, the practice in Lexington is to set the assessed value equal to the sale price. For houses that are not sold, the assessed value only changes if the neighborhood is reassessed or there are structural changes in the property. The mean change in taxes for houses that were not sold but were reassessed was $278 while the mean change for houses that were sold was $345, 125% of the change in taxes from reassessment or $67. The greatest difference in tax payments, in both absolute and percentage terms, is for the highest value homes (4th quantile) with houses that were sold having a tax change of $180 or 145% of those that were reassessed in a neighborhood reassessment. For the lowest quintile, the tax increases for sold houses were 28% higher than those reassessed without sale while houses sold in the second and third quintiles were 18% higher. Figure A2 provides these tax differences for each of the periods 2002–2008, 2009–2015, and 2016–2020.

EMPIRICAL FRAMEWORK AND IDENTIFICATION STRATEGY

There are a few well-recognized empirical problems in the lock-in literature that make it challenging to estimate the causal effect of property taxes on mobility. As Shan (2010) notes, property taxes are likely to be endogenous to moving decisions, and net property tax burdens are certainly measured with error. Owners who pay high property taxes (and consume higher levels of services) may have different mobility rates than owners who pay low property taxes. For example, homeowners with children may choose to live in areas with high property tax levels if those taxes are used to fund public schools, and these families are also likely to have lower mobility rates than other households.[12] The goal of most researchers has been to find an exogenous source of variation that affects the net property tax burden but is otherwise uncorrelated with latent mobility. In our case, the fact that most parcels are assessed every 4 years, and on a staggered basis, provides exogenous variation in both gross and net tax burdens.

Assessment

As discussed, the extent of "lock-in" depends on the extent of the expected increase in assessed value and, therefore, property taxes due to automatic assessment. As also discussed, if households with longer tenure lengths might be assessed at levels below market value, the tax wedge between current and new owners should increase with tenure increasing "lock-in." To determine the extent to which both tenure and automatic assessment affect assessed property value we estimate a regression of the form

$$LN\left(V^{A}_{\mathrm{int}}\right) = \gamma_0 + \gamma_1 NA_{nt} + \gamma_2 Tenure_{\mathrm{int}} + \gamma_4 \ln\overline{(HPI)}_t + \gamma_4 Y_{nt}^{NA_{-1}} + \mu_{in} + \pi_t + \varepsilon_{\mathrm{int}}, \tag{4}$$

[12]Shan (2010) finds smaller OLS estimates than IV estimates due to omitted variable bias.

TABLE 3 Summary statistics on sales, value, and length of ownership.

Sample	Segment of distribution of assessed values[a]					
Variable	Full Mean	5%–95%	5%–25%	25%–50%	50%–75%	75%–95%
Sold in current year (%)	2.3%	2.4%	1.8%	2.6%	2.7%	2.4%
Sale year conditional on neighborhood assessment						
Sold in year of assessment (%)	2.8%	2.9%	2.1%	3.3%	3.2%	2.5%
Year before assessment (%)	2.9%	2.9%	2.1%	3.1%	3.4%	3.0%
2 Years before assessment (%)	3.0%	3.1%	2.3%	3.4%	3.4%	2.9%
Year following assessment (%)	2.5%	2.6%	2.0%	2.8%	2.9%	2.4%
Assessed value						
Assessed value (mean, $2020)	$213,274	$191,483	$106,726	$144,904	$199,340	$323,010
Tenure						
Years (mean)	11.2	11.2	12.6	11.5	10.6	10.6
1 Year or less (%)	6.9%	6.8%	7.2%	6.6%	6.9%	6.5%
2–4 Years (%)	15.6%	15.5%	14.4%	14.9%	16.5%	16.0%
5–8 Years (%)	22.3%	22.3%	19.8%	21.9%	23.6%	23.4%
9–17 Years (%)	36.4%	36.6%	33.4%	37.0%	37.1%	38.1%
18 or more years (%)	18.8%	18.9%	25.3%	19.7%	15.9%	16.0%
Parcels	113,089					
Years	19 (2002–2020)					
Observations	1,486,544					

[a]The distribution is based on the assessed value of the property when it is first observed—2002 or later. Some parcels enter the sample after 2002 and some leave it before 2020.

where V^A_{int} is assessed property value of parcel (house), i in neighborhood n in year t, NA_{nt} is a dummy variable equal to 1 if a neighborhood was assessed in year t, $Tenure_{it}$ is the length of time the current homeowner has been in the home, $\ln(\bar{HPI})_t$ is the average HPI for Lexington from year $t-4$ to year t, and $Y^{NA_{-1}}_{nt}$ is years since last reassessment. The terms μ_{in} is a dummy variable (fixed effect) for the parcel and π_t is a time-fixed effect with ε_{int} the error term. The employment of a parcel fixed effect combined with the invariance in housing attributes obviates the need to include housing characteristics in this and our other regressions, but does limit our sample to properties that are sold at least twice during the period of our sample, 2002–2020.

NA and mobility

To determine the relationship between the probability of a home selling and whether the NA occurred in the same year we estimate the model,

$$Sale_{\text{int}} = \beta_0 + \beta_1 NA_{nt} + \mu_{it} + \pi_t + \varepsilon_{\text{int}}, \tag{5}$$

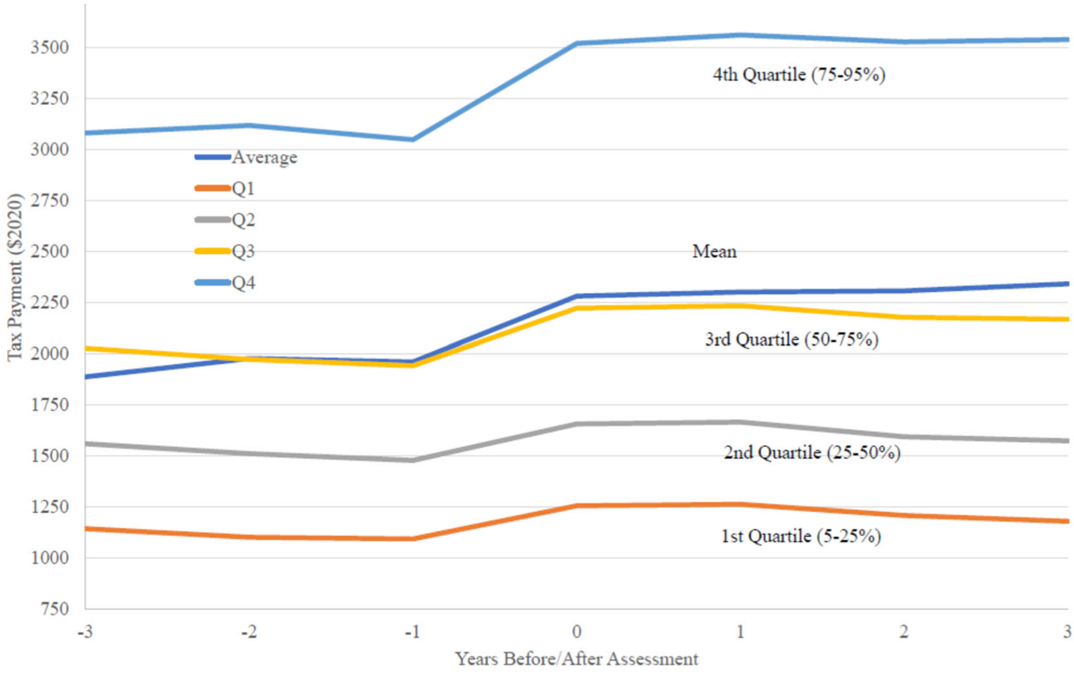


FIGURE 5 Neighborhood assessment timing and tax payments ($2020), 2002–2020. *Source*: Authors' calculations. Based on any assessment that occurs for reasons other than a transaction or change in reported property characteristics.

where $Sale_{int}$ equals 1 if a home sold in year t with the other terms as defined for Equation (4). While we can interpret Equation (5) as a DID model with the NA being the treatment, there are few distinctions with the standard model. First, unlike the standard model we do not have a term *NA*Post*, analogous to the term *Treat*Post* in the standard *DID* as in our case, the treatment, a discrete revision of the assessment, is expected to primarily affect sales in the year of the reassessment and not in the following years. Second, as all neighborhoods are reassessed at different times, we do not have a "control" that has never been treated, raising concerns about how to interpret our *DID* estimates (Goodman-Bacon, 2021). Finally, like many studies, we employ two-way fixed effects (neighborhood and time) with the underlying assumption that the effect of the NA is constant over time (de Chaisemartin & D'Haultfœuille, 2020). In Table A3, we report the results of estimates that relax some of the standard assumptions of a *DID*.

As an alternative, we also estimate an equation of the form.

$$Sale_{\text{int}} = \beta_0 + \beta_1 A_{nt}^{20-40} + \beta_2 A_{nt}^{40-60} + \beta_3 A_{nt}^{60-80} + \beta_4 A_{nt}^{80+} + \mu_{in} + \pi_t + \varepsilon_{\text{int}}, \tag{5'}$$

where A_{nt}^{x-y} equals 1 if the percent of houses assessed in neighborhood n in year t is between x and y.

Tax change and probability of sale

Our final set of estimates involves a two-stage procedure to first estimate the change in taxes from the previous year (ΔT_{int}) associated with an NA (NA_{nt}), accounting for whether the property was reassessed by NA or sale. In our second stage, we estimate the probability of a sale as a function of the change in tax as predicted from the first stage. The first stage is

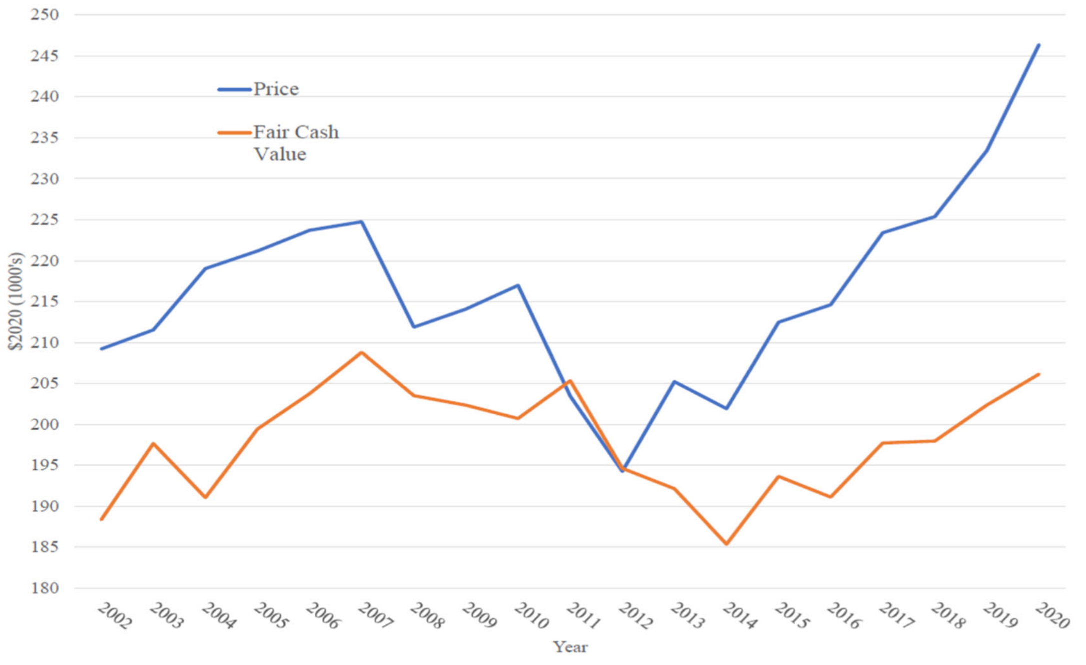


FIGURE 6 Mean sale price versus mean assessment, 2002–2020. *Source*: Authors' calculations.

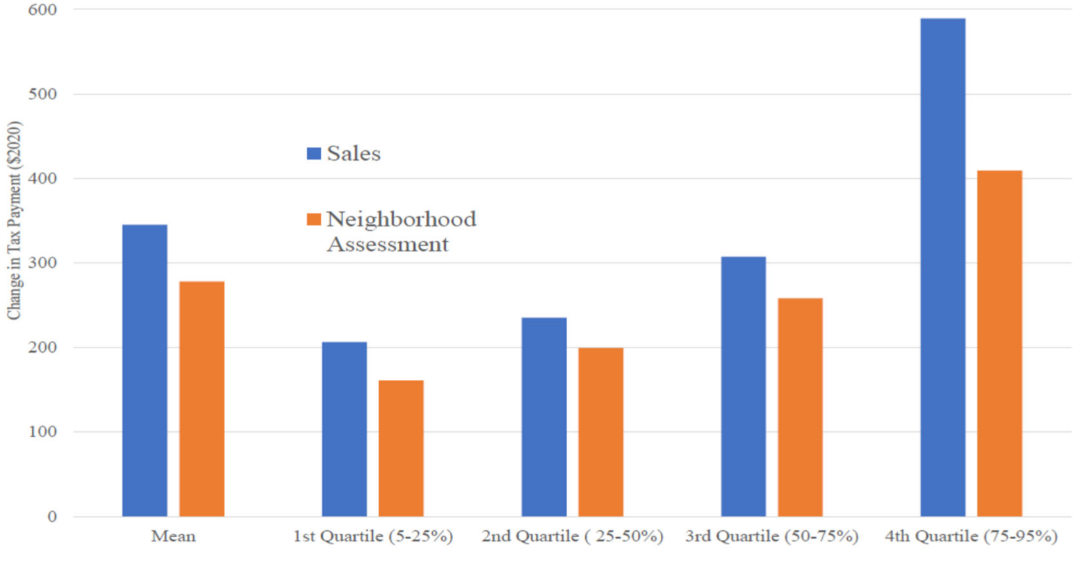


FIGURE 7 Change in tax payment from sale versus nonsale with neighbor assessment, by assessment quartile, 2002–2020.[a] [a]Authors calculation. The tax difference is based on the difference in the assessment in current year and the previous year. A neighbor assessment is defined as occurring when over 70% of houses are reassessed absent any transaction or change in structure. The change in tax are only for sales that occur in the neighbors in the year the neighborhood is reassessed.

$$\ln(\Delta T)_{\text{int}} = \delta_0 + \delta_1 NA_t + \varphi_{in} + \tau_t + \varepsilon_{\text{int}}, \tag{6a}$$

where φ_{in}, τ_t, and ε_{int} are the parcel fixed effect, the time fixed effect, and the error term. The second stage is

$$Sale_{\text{int}} = \lambda_0 + \lambda_1 \ln\,(\hat{\Delta T})_{\text{int}} + \chi_{in} + \pi_t + \omega_{\text{int}}, \tag{6b}$$

where $\ln\,(\hat{\Delta T})_{\text{int}}$ is the predicted change in taxes from the first stage and χ_{in}, π_t, and ω_{int} are the analogs to φ_{in}, τ_t, and ε_{int} in Equation (6a).

RESULTS

In all tables, we report the results obtain from estimating using the full sample, as well as the results using a trimmed sample of houses that are in 5%–95% range of assessed values and using the four quartiles of assessed value.[13]

Tenure and assessment

Table 4 reports our estimates of Equation (4), the relationship between the log of assessed (fair cash) value and NA as well as the *HPI*, years since the last assessment, and homeowner tenure length. As seen in the table, the coefficient on NA ranges between 0.0745 to 0.0937 across our subsamples which reflects an average increase in assessed value of 7.45%–9.37%. The coefficient on *L(HPI)* ranges from 0.345 for the highest-value houses to 0.960 for houses in the lowest quartile. As we include *HPI* as a log then the coefficient on *L(HPI)* is the elasticity of assessed value with respect to *HPI*. Changes in *HPI* are almost fully capitalized into assessed values for houses in the lowest quartile but only about a third of the increase in *HPI* is reflected in higher assessments for the highest quartile of houses. Somewhat surprisingly, the time since the last assessment lowers the assessment, perhaps reflecting delays in assessments for neighborhoods or times with less appreciation. Finally, as we might expect, homeowner tenure length reduces the assessed value with homeowners having the average tenure of 11 years having assessments of approximately 2.7% lower than new owners.

Assessment and mobility

In Table 5a, we report estimates of Equation (5), the relationship between a sale of a property and an NA. Interpretation is perhaps simplest by considering the row NA/Constant, the coefficient on NA divided by the constant. This coefficient multiplied by 100 gives the estimated percentage change in the probability of sale resulting from an NA. This is depicted in Figure 8a as well. Relative to those homes not facing an NA, the probability of a sale increases by about 4% for the full sample, with the greatest increases of over 7% for houses in the second and third quartiles. Sales in the first quartile decrease in a year with an NA by over 7% while there is no significant effect on sales in the highest quartile.

In Table 5b and Figure 8b, we report the results when we include multiple categories for the percentage of homes reassessed in neighborhood. For the full sample and the sample of the

[13]For houses that were in the sample in 2002, there assessed value (in \$2020) would depend in which quartile they belong. Regardless of changes in how their relative value might change over time they remain in the same quartile. Houses that enter the sample later are categorized based on how they rank relative to the houses in 2002 based on their \$2020 value.

TABLE 4 Assessed (fair cash) value and neighborhood assessment (NA).

All years, dependent variable = log of fair cash value	(1)	(2)	(3)	(4)	(5)	(6)
Sample	**Full**	**5%–95%**	**5%–25%**	**25%–50%**	**50%–75%**	**75%–95%**
NA[a]	0.0832***	0.0834***	0.0886***	0.0937***	0.0897***	0.0745***
	(0.00694)	(0.00711)	(0.0133)	(0.00778)	(0.00641)	(0.00802)
L(HPI)[b]	0.627***	0.636***	0.960***	0.626***	0.551***	0.345***
	(0.0461)	(0.0464)	(0.137)	(0.0430)	(0.0391)	(0.0483)
Years since last assessment	−0.00544***	−0.00539***	−0.00652***	−0.00652***	−0.00529***	−0.00511***
	(0.000929)	(0.000947)	(0.00220)	(0.000940)	(0.000744)	(0.00123)
Tenure	−0.00251***	−0.00246***	−0.00163***	−0.00219***	−0.00376***	−0.00371***
	(0.000347)	(0.000342)	(0.000508)	(0.000365)	(0.000604)	(0.000579)
Constant	−10.87***	−10.56***	11.79*	−9.484***	−19.71***	−27.77***
	(3.139)	(3.217)	(6.925)	(3.428)	(2.305)	(3.106)
Parcel fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	No	No	No	No	No	No
Linear trend	Yes	Yes	Yes	Yes	Yes	Yes
Observations	343,133	321,961	56,966	111,415	91,438	62,142
R^2	0.286	0.306	0.150	0.371	0.429	0.393
Parcels	31,728	29,490	5598	9627	8720	5545

Note: Clustered (neighborhood) standard errors in parentheses.

[a]NA = 1 if 70% or more of homes reassessed.

[b]LN(HPI) is the log of the 5-year average ($t-4$ to t) for the Lexington FHFA housing price index.

***$p < 0.01$.; *$p < 0.1$.

5%–95% assessed values, only assessment rates above 60% have a significant effect on sales. Interestingly, there is a higher likelihood of sale for assessment rates in the 60%–80% range than when rates exceed 80%. However, this relationship varies dramatically among the quartiles—there are no significant effects in the lowest or highest quartiles, consistent with what we found with the single measure of NA. However, for the second quartile, the percentage increase in sales is high and statistically significant for all categories above 40% with the largest increase in sales for assessment rates in the 40%–60% range and descending as rates increase. For the third quartile, only for rates of assessment above 80% was there a statistically significant increase in sales.

The effect of NAs in different periods

As is clear from Figure 6, the changes in both housing prices and assessed values varied dramatically over this period. Reflecting these differences in both appreciation in prices and assessed values over the period, in Table 6, we report estimates of Equation (5) for three distinct time periods: 2002–2008, 2009–2015, and 2016–2020. For the years 2002–2008, the NA had a statistically significant effect on sales for the full sample and for the second and third quartiles. Looking at the row NA/constant, we see that for these two quartiles, the probability of sale increased by almost 10% when an NA occurred.

TABLE 5 Probability of sale versus neighborhood assessment (NA).

(a) NA or not						
All years, dependent variable = 1 if parcel sold in arm's length transaction, 0 otherwise						
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Sample	**Full**	**5%–95%**	**5%–25%**	**25%–50%**	**50%–75%**	**75%–95%**
NA[a]	0.00145***	0.00166***	−0.00165	0.00274***	0.00321**	0.000324
	(0.000627)	(0.000664)	(0.00101)	(0.00130)	(0.00112)	(0.00152)
Constant	0.0348**	0.0355**	0.0231**	0.0376**	0.0416**	0.0381**
	(0.000816)	(0.000868)	(0.00141)	(0.00139)	(0.00205)	(0.00185)
Parcel fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
NA/constant	0.0416***	0.0467***	−0.0716	0.0729***	0.0771**	0.0085
	(0.0180)	(0.0185)	(0.0448)	(0.0343)	(0.0267)	(0.0397)
Observations	1,488,595	1,334,031	287,007	379,686	370,035	297,303
R^2	0.002	0.002	0.002	0.003	0.002	0.002
Parcels	84,139	74,636	15,940	20,401	20,815	17,480

(b) Varying extent of NA						
Dependent variable = 1 if parcel sold in arm's length transaction, 0 otherwise						
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Sample	**Full**	**5%–95%**	**5%–25%**	**25%–50%**	**50%–75%**	**75%–95%**
20%–40% Assesssed[b]	−0.000258	−0.000488	0.000987	0.00112	−0.00308	−0.00120
	(0.00105)	(0.00113)	(0.00131)	(0.00232)	(0.00242)	(0.00205)
40%–60% Assessed[b]	0.000817	7.39e−05	−0.000643	0.00543***	−0.00283	−0.00146
	(0.00106)	(0.00113)	(0.00144)	(0.00268)	(0.00241)	(0.00223)
60%–80% Assessed[b]	0.00207***	0.00207***	−0.000180	0.00444***	0.00158	0.00176
	(0.000834)	(0.000846)	(0.00108)	(0.00182)	(0.00150)	(0.00172)
80%+ Assessed[b]	0.00168***	0.00179***	−0.00155	0.00324***	0.00277***	0.000335
	(0.000807)	(0.000842)	(0.00117)	(0.00163)	(0.00139)	(0.00176)
Constant	0.0348**	0.0355**	0.0231**	0.0376**	0.0416**	0.0381**
	(0.000816)	(0.000868)	(0.00141)	(0.00139)	(0.00205)	(0.00185)
Parcel fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,488,595	1,334,031	287,007	379,686	370,035	297,303
R^2	0.002	0.002	0.002	0.003	0.002	0.002
Parcels	84,139	74,636	15,940	20,401	20,815	17,480

Note: Clustered (neighborhood) standard errors in parentheses.

[a]NA = 1 if if at least 70% of homes in neighborhood assessed.

[b]Value of 1 if percentage of homes in the neighborhood that are reassessed is in this range.

***$p < 0.01$.; **$p < 0.05$.

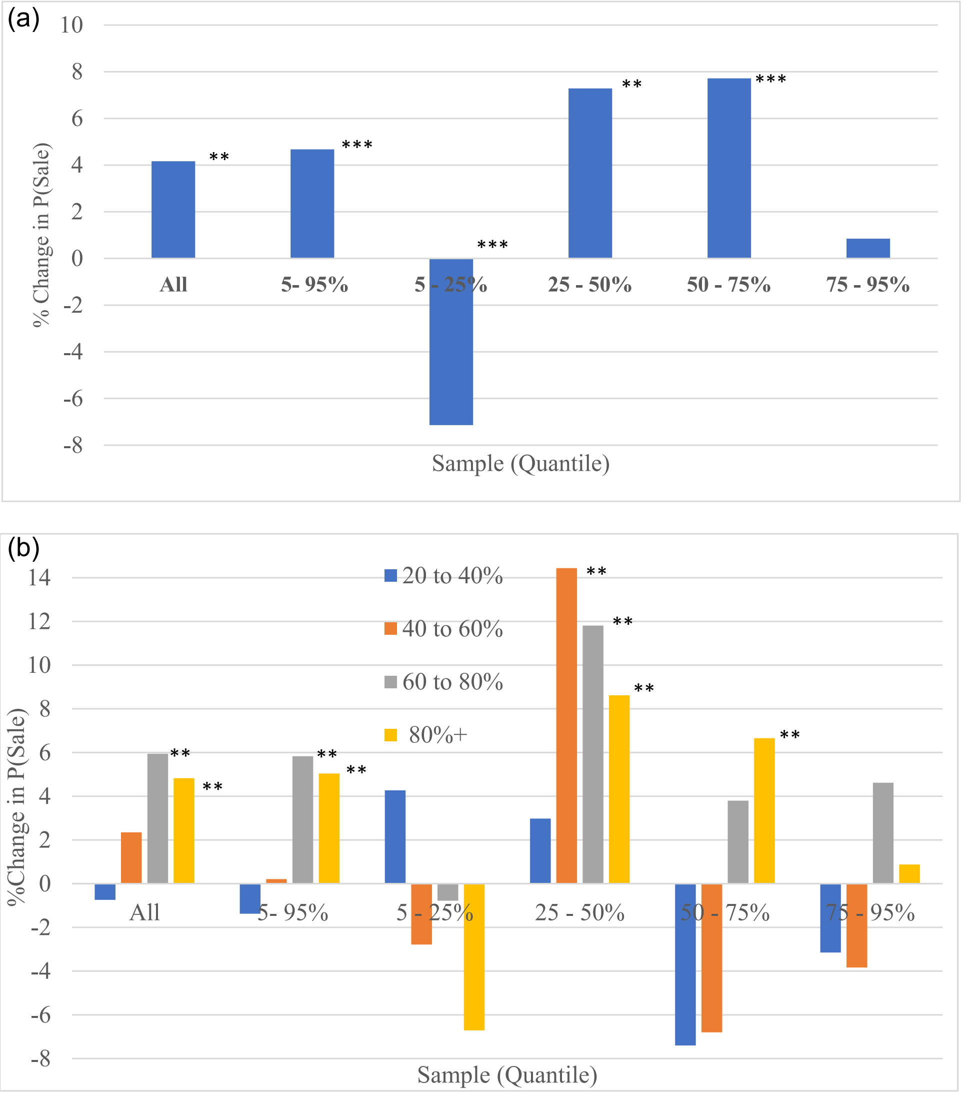


FIGURE 8 Estimated change in probability of sale (%) with neighborhood assessment (NA). (a) Change with NA.[a] ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$. [a]NA = 1 if 70% or more houses are reassessed. (b) Change by percentage of homes assessed. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

A very different story emerges during the 2009–2015 period. In this case, the coefficient on the NA in the second and third quantiles is negative—the probability of a sale is reduced with NA. While seeming inconsistent with our results for the samples from 2002 to 2008 and for all years, assessed values decreased from 2011 to 2014, reducing the incentive to sell. Finally, from 2016 to 2020, the only statistically significant coefficient on NA is for the second quartile and it is negative.

Tax payments and the probability of sale

In Table 7, we report our estimate of Equation (6), the relationship between the change in taxes with reassessment and the probability of a sale. In Table 7a, we report the first stage results, an estimate of the relationship between NA in year t and the (log) tax change from year $t-1$ to year t. As seen in the

TABLE 6 Probability of sale versus neighborhood assessment (NA), alternative time periods.

Dependent variable = 1 if parcel sold in arm's length transaction, 0 otherwise						
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Sample	**Full**	**5%–95%**	**5%–25%**	**25%–50%**	**50%–75%**	**75%–95%**
(a) 2002–2008						
NA	0.00227***	0.00227**	0.000639	0.00352*	0.00381**	0.000309
	(0.000867)	(0.000915)	(0.00160)	(0.00190)	(0.00165)	(0.00192)
Constant	0.0337***	0.0344***	0.0229***	0.0375***	0.0400***	0.0361***
	(0.000696)	(0.000729)	(0.00140)	(0.00122)	(0.00171)	(0.00166)
Parcel fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
NA/constant	0.0674***	0.0658**	0.0278	0.939*	0.0952**	0.0086
	(0.0258)	(0.0266)	(0.0696)	(0.0508)	(0.0417)	(0.0531)
Observations	508,578	460,707	102,952	137,688	124,149	95,918
R^2	0.001	0.001	0.001	0.001	0.001	0.001
Parcels	77,699	70,098	14,825	20,003	19,608	15,662
(b) 2009–2015						
NA	−0.00226	−0.00207	0.000930	−0.00995***	−0.00583*	0.000438
	(0.00208)	(0.00240)	(0.00361)	(0.00297)	(0.00336)	(0.00513)
Constant	0.0156***	0.0163***	0.0110***	0.0169***	0.0195***	0.0164***
	(0.000480)	(0.000510)	(0.000804)	(0.000797)	(0.000998)	(0.00103)
Parcel fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
NA/constant	−0.1451	−0.1271	0.0844	−0.5888***	−0.2982*	0.0268
	(0.1336)	(0.1476)	(0.3270)	(0.17775)	(0.1721)	(0.3131)
Observations	569,415	507,397	107,150	141,059	142,951	116,237
R^2	0.001	0.001	0.001	0.001	0.002	0.001
Parcels	82,800	73,374	15,683	20,236	20,617	16,838
(c) 2016–2020						
NA	−0.000222	0.000144	−0.00406***	0.000709	0.00196	−0.000428
	(0.000825)	(0.000807)	(0.00149)	(0.00160)	(0.00158)	(0.00202)
Constant	0.0262***	0.0273***	0.0186***	0.0265***	0.0334***	0.0288***
	(0.000556)	(0.000581)	(0.000972)	(0.00111)	(0.00112)	(0.00108)
Parcel fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
NA/constant	−0.0085	0.0053	−0.2182***	0.0268	0.0586	−0.0149

TABLE 6 (Continued)

Dependent variable = 1 if parcel sold in arm's length transaction, 0 otherwise						
	(1)	(2)	(3)	(4)	(5)	(6)
Sample	**Full**	**5%–95%**	**5%–25%**	**25%–50%**	**50%–75%**	**75%–95%**
	(0.0315)	(0.2956)	(0.0822)	(0.0603)	(0.0477)	(0.0702)
Observations	410,602	365,927	76,905	100,939	102,935	85,148
R^2	0.000	0.000	0.000	0.000	0.001	0.000
Parcels	83,408	73,887	15,540	20,273	20,701	17,373

Note: NA = 1 if at least 70% of homes in neighborhood assessed. Clustered (neighborhood) standard errors in parentheses.
***$p < 0.01$.; **$p < 0.05$.; *$p < 0.1$.

TABLE 7 Probability of sale on change in taxes.

(a) First stage: change in taxes on neighborhood assessment (NA)						
Dependent variable ΔT = LN(1 year tax change)						
	(1)	(2)	(3)	(4)	(5)	(6)
Sample	**Full**	**5%–95%**	**5%–25%**	**25%–50%**	**50%–75%**	**75%–95%**
NA[a]	0.114***	0.113***	0.121***	0.115***	0.109***	0.108***
	(0.00346)	(0.00290)	(0.00749)	(0.00311)	(0.00344)	(0.00511)
Constant	−0.00280	−0.00560	0.00145	−0.00705*	−0.0102***	−0.00571
	(0.00384)	(0.00345)	(0.00850)	(0.00395)	(0.00274)	(0.00399)
Parcel fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,335,506	1,198,087	256,486	340,258	333,458	267,885
R^2	0.129	0.185	0.108	0.282	0.248	0.218
Parcels	83,785	74,231	15,788	20,345	20,769	17,329
(b) Second stage: probability of sale on change in taxes						
	(1)	(2)	(3)	(4)	(5)	(6)
Sample	**Full**	**5%–95%**	**5%–25%**	**25%–50%**	**50%–75%**	**75%–95%**
LN(ΔTax)[b]	0.0103*	0.0123**	−0.0165**	0.0196*	0.0276***	−0.00117
	(0.00537)	(0.00566)	(0.00817)	(0.0102)	(0.0105)	(0.0139)
Constant	0.0351***	0.0364***	0.0260***	0.0406***	0.0406***	0.0358***
	(0.000854)	(0.000908)	(0.00172)	(0.00167)	(0.00152)	(0.00162)
Parcel fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,335,506	1,198,087	256,486	340,258	333,458	267,885
Number of parcels	83,785	74,231	15,788	20,345	20,769	17,329

Note: Clustered (neighborhood) standard errors in parentheses.
[a]NA = 1 if 70+% of homes are reassessed.
[b]LN(ΔTax) is the predicted change in taxes from the first stage.
***$p < 0.01$.; **$p < 0.05$.; *$p < 0.1$.

TABLE 8 Probability of sale with neighborhood assessment (NA), alternative cutoffs.

(a) NA with 60%+ of homes are assessed

All years, dependent variable = 1 if parcel sold in arm's length transaction, 0 otherwise

Sample	**(1) Full**	**(2) 5%–95%**	**(3) 5%–25%**	**(4) 25%–50%**	**(5) 50%–75%**	**(6) 75%–95%**
NA	0.00186***	0.00193***	−0.000812	0.00365***	0.00234**	0.00118
	(0.000557)	(0.000578)	(0.000826)	(0.00116)	(0.000990)	(0.00133)
Constant	0.0348***	0.0355***	0.0231***	0.0377***	0.0416***	0.0381***
	(0.000816)	(0.000868)	(0.00141)	(0.00139)	(0.00205)	(0.00185)
Parcel fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,488,595	1,334,031	287,007	379,686	370,035	297,303
R^2	0.002	0.002	0.002	0.003	0.002	0.002
Parcels	84,139	74,636	15,940	20,401	20,815	17,480

(b) NA with 80%+ of homes assessed

All years, dependent variable = 1 if parcel sold in arm's length transaction, 0 otherwise

Sample	**(1) Full**	**(2) 5%–95%**	**(3) 5%–25%**	**(4) 25%–50%**	**(5) 50%–75%**	**(6) 75%–95%**
NA	0.00155*	0.00167**	−0.00154	0.00297*	0.00274**	0.000243
	(0.000813)	(0.000847)	(0.00117)	(0.00165)	(0.00139)	(0.00174)
Constant	0.0348***	0.0355***	0.0231***	0.0376***	0.0416***	0.0381***
	(0.000815)	(0.000867)	(0.00141)	(0.00139)	(0.00205)	(0.00185)
Parcel fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,488,595	1,334,031	287,007	379,686	370,035	297,303
R^2	0.002	0.002	0.002	0.003	0.002	0.002
Parcels	84,139	74,636	15,940	20,401	20,815	17,480

Note: NA = 1 if at least 60% of homes in the neighborhood are assessed. Clustered (neighborhood) standard errors in parentheses. ***$p < 0.01$.; **$p < 0.05$.; *$p < 0.1$.

table, an NA increases taxes by approximately 11%. Then, using the predicted value for $LN(\Delta T)$ in the second stage (Table 7b), we estimate the relationship of $LN(\Delta T)$ with the probability of a sale. The results are qualitatively consistent with the results we found for the relationship between having an NA and the probability of a sale—an increase in the tax payment increases the likelihood of a sale in the full sample and in all but the first and fourth quartile. Interpreting the coefficient on the tax change by dividing by the constant suggests that a 10% increase in the tax payment increases the probability of a sale by approximately 3% and for the second and third quartiles increases it by 4.8% and 6.8%, respectively.

Robustness checks

We undertake several robustness checks reported in Tables 8–10. First, we consider alternative cutoffs, in terms of percentage of homes assessed in a neighborhood for the neighborhood to

TABLE 9 Probability of sale with neighborhood assessment (NA) on probability of sale, inside versus outside urban service boundary (USB).

(a) Inside USB

All years, dependent variable = 1 if parcel sold in arm's length transaction, 0 otherwise

Sample	(1) Full	(2) 5%–95%	(3) 5%–25%	(4) 25%–50%	(5) 50%–75%	(6) 75%–95%
NA[a]	0.00139**	0.00164**	−0.00167	0.00274**	0.00318***	0.000249
	(0.000644)	(0.000677)	(0.00102)	(0.00131)	(0.00114)	(0.00161)
Constant	0.0352***	0.0359***	0.0231***	0.0378***	0.0423***	0.0392***
	(0.000835)	(0.000886)	(0.00143)	(0.00140)	(0.00210)	(0.00194)
Parcel fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,445,245	1,303,911	283,251	376,409	361,841	282,410
R^2	0.002	0.002	0.002	0.003	0.002	0.002
Parcels	81,571	72,930	15,725	20,214	20,361	16,630

(b) Outside USB

Sample	(1) Full	(2) 5%–95%	(3) 5%–25%	(4) 25%–50%	(5) 50%–75%	(6) 75%–95%
NA[a]	0.00310	0.00140	−0.0284	−0.000282	0.00236	0.00115
	(0.00217)	(0.00253)	(0.0188)	(0.00533)	(0.00664)	(0.00411)
Constant	0.0203***	0.0188***	0.0209**	0.0243**	0.0144**	0.0193***
	(0.00277)	(0.00305)	(0.00746)	(0.00834)	(0.00563)	(0.00432)
Parcel fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	43,350	30,120	3756	3277	8194	14,893
R^2	0.001	0.002	0.007	0.008	0.003	0.003
Parcels	2568	1706	215	187	454	850

Note: Clustered (neighborhood) standard errors in parentheses.

[a]NA = 1 if at least 70% of homes in the neighborhood are assessed.

***$p < 0.01$.; **$p < 0.05$.

be considered as assessed. We report the results for two alternatives: an NA occurring when 60% or more homes are assessed or when 80% or more are assessed. Results for a sample of all years (2002–2020) are reported in Table 8. As can be seen by comparing the results in the table to those in Table 5, the coefficients are generally similar in magnitude and statistical significance.

Our next robustness check was examining how changes in the sample, specifically dividing the sample based on whether neighborhoods and homes were in or out of the urban service boundary (USB), affected our results. The results for the sample in the USB (Table 9a) are almost identical to those reported for the entire sample (Table 5a). In contrast, the coefficients on NA are not statistically significant for the sample outside of the USB, where neighborhoods are newer and more of the housing is associated with agricultural enterprises.

Finally, rather than examining the relationship between NAs and arm's length sales, we examine the relationship of NAs with other changes in ownership. These changes often include changes in family status such as marriage, divorce, or death of an owner. Because family status

TABLE 10 Probability of change of ownership other than arm's length sale with neighborhood assessment (NA).

All years, dependent variable = change of ownership, no arm's length sale						
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Sample	**Full**	**5%–95%**	**5%–25%**	**25%–50%**	**50%–75%**	**75%–95%**
NA	0.000368	0.000394	0.00106	0.000117	0.000314	0.000393
	(0.000366)	(0.000375)	(0.000931)	(0.000482)	(0.000641)	(0.000655)
Constant	0.00433***	0.00407***	0.00498***	0.00445***	0.00392***	0.00355***
	(0.000307)	(0.000305)	(0.000602)	(0.000496)	(0.000430)	(0.000486)
Parcel fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,488,595	1,334,031	287,007	379,686	370,035	297,303
R^2	0.001	0.001	0.001	0.001	0.001	0.000
Parcels	84,139	74,636	15,940	20,401	20,815	17,480

Note: NA = 1 if at least 70% of homes in the neighborhood are assessed. Clustered (neighborhood) standard errors in parentheses.
***$p < 0.01$.

changes are likely to dominate any efforts at tax planning and are often unavoidable, a significant effect of NA on these changes in ownership might cast doubt on the validity of our primary findings. The results, reported in Table 10, show no evidence of any relationship between NA and nonsale ownership changes. This is consistent with our expectations and does not conflict with our main findings.

CONCLUSION

We find that the infrequent reassessment of properties in the face of housing price appreciation can lead to significant tax differentials between properties with reassessment potentially increasing property tax payments by several hundred dollars per annum. We find that the practice of infrequent NAs or upon sales appears to affect household mobility with statistically significant increases in mobility when a home is reassessed. As an alternative interpretation, infrequent assessments reduce mobility in the years when current owners are not facing an NA as they are receiving a tax advantage relative to purchasers of their properties.

Our results suggest that mobility, measured as the sale of a property, is significantly different in the year in which an NA occurs. While these results suggest that mobility is affected by discrete, automatic assessments, it is not obvious whether it leads to households postponing moving to capture another year of lower tax obligations or deciding to move earlier to avoid the higher tax payment because of the assessment. Theoretically, both cases are possible. Regardless, while long-term mobility might be unaffected by the length of the interval between assessments, our evidence suggests short-term mobility rates are affected.

To the extent infrequent assessments result in differences in tax liabilities for existing and new owners that influence who lives in a home, there may be “mismatch” in who is residing in the home. This mismatch, arising because decisions about where to live are not determined by households' valuations of the home independent of their tax obligations, carries an associated welfare cost.

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APPENDIX A

See Tables A1–A3 and Figures A1 and A2.

TABLE A1 Differences in present value of taxes, current versus new owner by years since assessment.

Years since neighborhood assessment	Existing	Sale year T^A	$T^A + 1$	$T^A + 2$	$T^A + 3$	Annual difference (most recent purchase)
0	pV^o	pV^o				0
1	pV^o	pV^o	$p(1 + \rho)V^o$			$p\rho V^o$
2	pV^o	pV^o	$p(1 + \rho)V^o$	$p(1 + \rho)^2V^o$		$p[(1 + \rho)^2 - 1]V^o$
3	pV^o	pV^o	$p(1 + \rho)V^o$	$p(1 + \rho)^3V^o$	$p(1 + \rho)^3V^o$	$p[(1 + \rho)^3 - 1]V^o$
4	$p(1 + \rho)^4V^o$	$p(1 + \rho)^4V^o$	$p(1 + \rho)^4V^o$	$p(1 + \rho)^4V^o$	$p(1 + \rho)^4V^o$	0
Present value of tax differential		0	$\sum_{j=0}^{2} pV0\frac{[(1+\rho)-1]}{(1+r)^j}$	$\sum_{j=0}^{1} pV0\frac{[(1+\rho)^2-1]}{(1+r)^j}$	$pV^o[(1 + \rho)^3 - 1]$	

Present value of tax differential: general for sale t years after assessment (T^A)

$\sum_{j=0}^{t} pV0\frac{[(1+\rho)^t-1]}{(1+r)^j}$

The tax rate is denoted by p, the discount rate by ρ, and the initial value by V°.

TABLE A2 Summary statistics on housing characteristics.

	Segment of distribution of assessed values[a]					
Sample	**Full**	**5%–95%**	**5%–25%**	**25% –50%**	**50% –75%**	**75% –95%**
Variable	**Mean**					
Square feet, residence	1820	1735	1215	1383	1814	2588
Square feet, lot	33,134	16,602	9672	10,528	15,599	32,298
Year built	1974.2	1975.6	1962.1	1973.6	1981.0	1984.3
Exterior wall, brick (%)	45.3%	45.6%	55.4%	46.6%	35.3%	47.8%
Exterior wall, masonry and frame (%)	35.2%	37.5%	11.4%	35.9%	52.9%	45.5%
Exterior wall, aluminum/vinyl (%)	11.0%	10.4%	18.7%	11.7%	8.2%	3.7%
Exterior wall, other (%)	8.5%	6.5%	14.5%	5.9%	3.6%	3.0%
Basement (%)	43%	42.4%	21.4%	38.6%	43%	66.7%
Garage (%)	68.8%	69.5%	45.4%	64.9%	77.5%	88.6%
Split level (%)	12.6%	12.4%	12.4%	12.0%	12.4%	12.8%
Pool (%)	1.9%	1.6%	0.2%	0.8%	2.0%	3.3%
Bedrooms (#)	3.4	3.3	3.0	3.1	3.3	3.8
Full baths (#)	1.8	1.7	1.2	1.6	1.9	2.3
Half baths (#)	0.4	0.4	0.2	0.3	0.5	0.8
Fireplaces (#)	0.8	0.8	0.3	0.6	0.9	1.2
Parcels	113,089					
Years	19 (2002–2020)					
Observations	1,486,544					

[a]The distribution is based on the assessed value of the property when it was first observed—2002 or later. Some parcels enter the sample after 2002 and some leave it before 2020.

TABLE A3 Estimation of *P*(sales) with heterogeneous treatment effects.

(a) Results for all years

All years, dependent variable = 1 if parcel sold in arm's length transaction, 0 otherwise						
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Sample	**Full**	**5%–95%**	**5%–25%**	**25%–50%**	**50%–75%**	**75%–95%**
Neighborhood assessment (NA)[a]	0.00003	0.0003	0.0012	0.0034	−0.0002	−0.0038
	(0.0011)	(0.0012)	(0.0022)	(0.0025)	(0.0023)	(0.0025)
Observations	496,539	374,918	89,184	82,911	104,811	89,441

(b) Results for 2002–2008

	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Sample	**Full**	**5%–95%**	**5%–25%**	**25%–50%**	**50%–75%**	**75%–95%**
NA	0.00016	0.0004	0.0015	0.0035	0.0006	−0.00508*
	(0.0014)	(0.0015)	(0.0024)	(0.0028)	(0.0030)	(0.0029)
Observations	254,356	224,072	55,221	62,270	60,242	46,339

(c) Results for 2009–2015

Sample	**(1) Full**	**(2) 5%–95%**	**(3) 5%–25%**	**(4) 25%–50%**	**(5) 50%–75%**	**(6) 75%–95%**
NA	0.00001	0.0002	0.0041***	−0.00798***	−0.0025***	0.0035
	(0.0027)	(0.0028)	(0.0019)	(0.0024)	(0.0012)	(0.0048)
Observations	482,750	357,803	60,136	80,132	100,901	81,970

(d) Results for 2016–2020

Sample	**(1) Full**	**(2) 5%–95%**	**(3) 5%–25%**	**(4) 25%–50%**	**(5) 50%–75%**	**(6) 75%–95%**
NA	0.00168	0.0018	−0.0026	0.00576***	0.0024	0.0005
	(0.0012)	(0.0013)	(0.0023)	(0.0026)	(0.0025)	(0.0027)
Observations	216,322	192,661	40,613	52,177	52,985	46,886

Note: Clustered (neighborhood) standard errors in parentheses. Estimated using Stata package: did_multiplegt (StataCorp., 2023).

1. Estimated using Stata package: did_multiplegt.

[a]NA = 1 if 70% or more homes in the neighborhood are assessed.

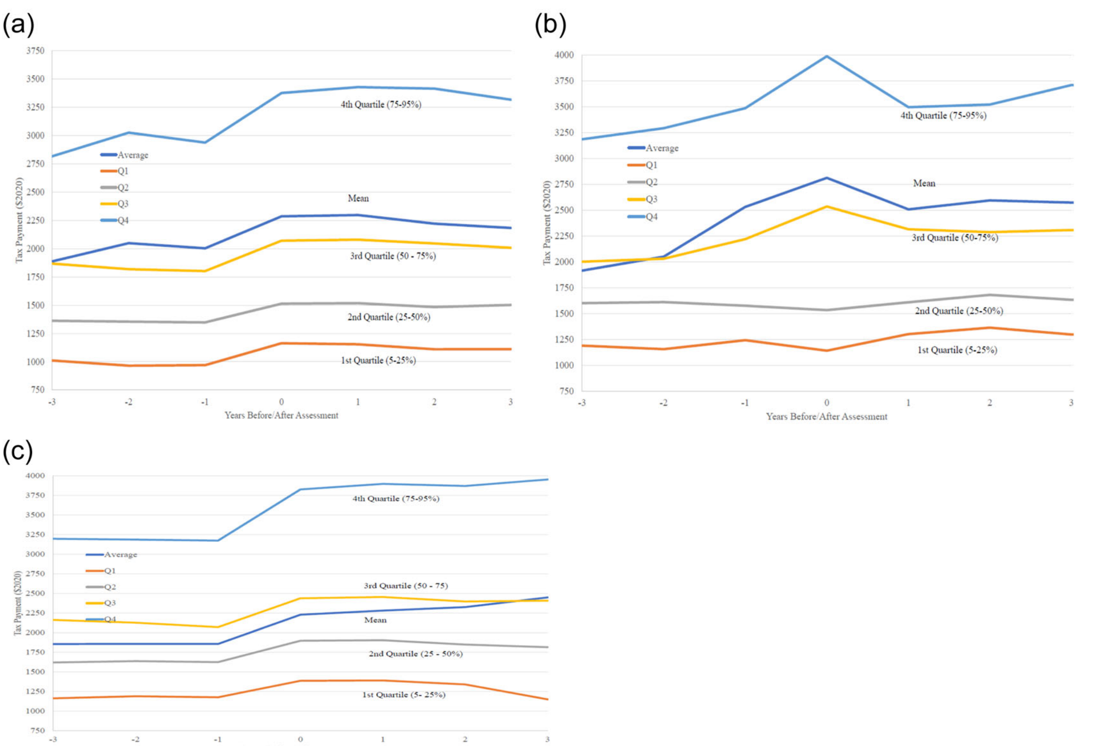

FIGURE A1 Neighborhood assessment timing and tax payments ($2020), various periods. (a) 2002–2008. (b) 2009–2015. (c) 2016–2020. *Source*: Authors' calculations. Based on any assessment that occurs for reasons other than a transaction or change in reported property characteristics.

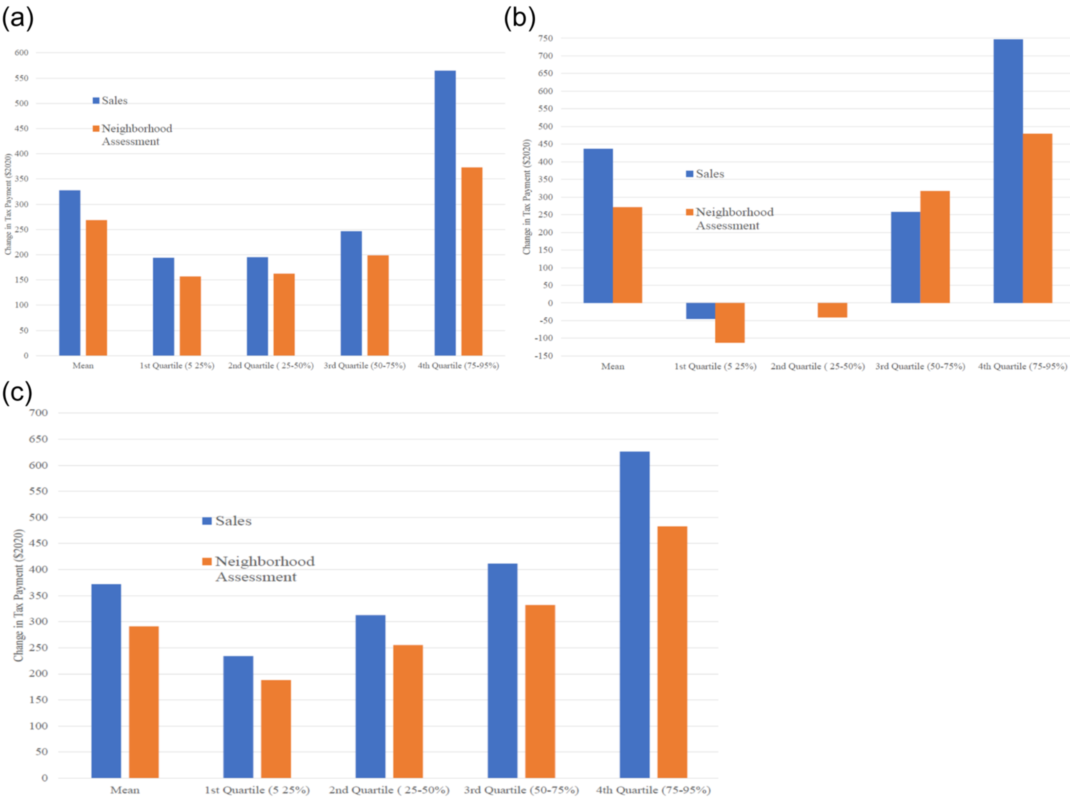

FIGURE A2 Change in tax payment from sale versus nonsale with neighbor assessment, by assessment quartile, various periods.[a] (a) 2002–2008. (b) 2009– 2015. (c) 2016–2020. [a]Authors calculation. The tax difference is based on the difference in the assessment in current year and the previous year. A neighbor assessment is defined as occurring when over 70% of houses are reassessed absent any transaction or change in structure. The change in tax is only for sales that occur in the neighbors in the year the neighborhood is reassessed.