Abstract—Michigan’s implementation of assessment limits gives rise to a wide variation in taxable basis across comparable homes. Exploiting the fact that the resulting differences in property tax liability are temporarily inherited by new homebuyers, I estimate the degree of capitalization of these largely idiosyncratic tax differences to evaluate whether homebuyers understand the tax implications of their home purchases. Consistent with anecdotal evidence but in stark contrast to the traditional view of rational consumer behavior, I find that homebuyers are woefully inattentive to the temporary nature of their initial tax obligations, resulting in an overpayment of nearly $10,000 for the average home.

I. Introduction

Property tax payments account for approximately 12% of annual home ownership costs among mortgage-holding U.S. households and 28% among households without mortgages. Standard economic theory consequently suggests that consideration of the property tax system should figure prominently in the purchasing decisions of homebuyers, especially in markets where there exists significant cross-sectional or intertemporal variation in property tax liabilities, and these taxes should be appropriately capitalized into home prices in proportion to the relative elasticities of housing supply and demand.

However, if consumers are susceptible to various cognitive biases, as a growing literature at the intersection of psychology and economics suggests, then prospective homebuyers may make mistakes in bidding for homes, and the design of state property tax systems may have important implications for real estate pricing and consumer welfare. As noted in DellaVigna (2009) departures from perfect rationality may be particularly pronounced or resistant to correction via market forces for complex and infrequent decisions (home purchases being a leading example), but even in relatively familiar settings, recent evidence suggests that modest changes in the availability of information may have profound effects on agents’ actions. Chetty, Looney, and Kroft (2009) and Finkelstein (2009) show, for example, that consumer behavior is heavily influenced by manipulating the visibility, or salience, of sales and excise taxes or tolls without changing true after-tax prices.

If consumer behavior can be heavily influenced by the salience of relatively familiar taxes where individual decisions involve low stakes, how do homebuyers respond to unfamiliar details of financially burdensome property taxes in the context of a multifaceted home purchase decision? To date, there exists little evidence to evaluate whether the standard assumption of rational behavior remains reasonable for large stakes, none of which pertains to property taxation. The purpose of this paper is to examine homebuyers’ ability to anticipate the property tax implications of their purchases in an environment characterized by wide cross-sectional variation in initial tax obligations due to underlying variation in sellers’ tax bases. Simply put, do homebuyers behave in a well-informed manner, or are responses to property taxation susceptible to inattention?

In order to address this question, I exploit a set of distinct features of the Michigan property tax system that gives rise to temporary idiosyncratic differences in property tax obligations accruing to new homebuyers and estimate the degree to which these initial tax obligations are capitalized into sale prices while controlling for future tax obligations and a wide array of additional property characteristics. Modeled after California’s Proposition 13 (1978), Michigan’s system of acquisition-value-based assessment limits adopted under Proposal A (1994) can give rise to taxable values (i.e., the tax base, henceforth denoted TV) against which property taxes are levied that lie far below the local authority’s assessment.

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1 These figures mask wide heterogeneity across states, from lows of 4% and 8% across mortgage- and non-mortgage-holding households in Alabama and Louisiana, respectively, to highs of 23% and 58% in New Jersey (U.S. Census Bureau, 2010).

2 In practice, the degree of property tax capitalization may be influenced in subtle ways beyond supply and demand elasticities based on capital and household mobility. See Yinger et al. (1988) for a discussion.

3 Formally, Chetty et al. (2009) define tax salience as the “visibility of the tax-inclusive price” (p. 1146) wherein taxes can be thought of as a type of “shrouded attribute” in the terminology of Gabaix and Laibson (2006). Goldin (2015) similarly defines tax salience as “the prominence of a taxed good’s tax-inclusive price” (p. 2), modeled as consumers’ responsiveness to the tax amount relative to their responsiveness to changes in the pretax price. A fully salient tax is thus a tax that is included directly in posted prices, whereas a fully shrouded tax is defined implicitly by the absence of any behavioral response.

4 Notable exceptions, albeit unrelated to taxation, include Madrian and Shea (2001), Genesove and Mayer (2001), Campbell (2006), and Bucks and Pence (2008). Chetty and Saez (2013), and Feldman, Katriučik, and Kawano (2015) pertain to the comprehension of relatively large tax credits. In each of the cases considered, deviations from perfect rationality may conceivably generate substantial financial losses.
of current market value as a result of capping the rate of annual TV growth in years in which no change of ownership has occurred. Consequently, properties of equal assessed value may face substantially different taxable values after a period of substantial housing price appreciation. This practice is by no means unique, and carries certain well-known further implications: that new homeowners may face considerably higher tax obligations than their predecessors due to TV uncapping, thereby discouraging existing homeowners from selling their homes (i.e., the lock-in effect). However, Michigan’s Proposal A has the additional feature that TVs are reset only on January 1. As a result, buyers temporarily inherit sellers’ tax obligations, thereby conferring on most new homebuyers a form of temporary tax savings in the year of purchase followed by a permanent step up in tax liability. Identification of homebuyers’ comprehension of the property tax system thus revolves around households’ recognition of this intertemporal discontinuity in property tax bases and obligations, as reflected in the capitalization of these temporary tax savings whose magnitude can vary across properties for no other reason than the seller’s duration of ownership.

Methodologically, the approach pursued in this paper builds on an extensive literature on property tax capitalization, avoiding by its quasi-experimental intrajurisdictional nature two of the main econometric problems common to the literature since Oates (1969): that the degree of capitalization of entire streams of future tax obligations cannot be separately identified from the discount rate and that cross-jurisdictional variation in tax liabilities is correlated with potentially unobservable variation in public service provision. Taking advantage of the mechanical relationship between the number of years elapsed since a property was last acquired and the size of the temporarily inherited tax savings, IV methods are well suited to addressing remaining endogeneity concerns.

Applying this empirical strategy to sales and assessment data for the city of Ann Arbor, Michigan, for the period 1997 to 2007, I find that homebuyers dramatically overcompensate sellers of homes with relatively low tax obligations (conditional on observables), as if such obligations would persist indefinitely beyond the first period of ownership without TV uncapping. Under the preferred specification, a $1 increase in temporary tax savings (i.e., a reduction in first-period tax obligations) for the average property implies an almost $29 increase in sale price, equivalent to the present value of a fully or near fully capitalized infinite stream of $1 in annual tax savings discounted at a real interest rate of approximately 3%. Homebuyers thereby fail to recognize a central feature of the property tax system to which they are subject, with the resulting consequence being an average overpayment of roughly $10,000 during the sample period, equal to approximately 5% of the median sale price.

This finding is consistent with several pieces of anecdotal evidence in a setting characterized by ample scope for confusion or outright ignorance of the implications of Michigan’s property tax and assessment system, evidence to which I return in later discussion. In short, sellers, real estate agents, and mortgage lenders—due to either financial incentives or regulation—are all complicit in reinforcing the view that homebuyers will face the same property tax obligations as the previous owners, contrary to actual practice. Markets may thereby fail to dispel, or even exploit, cognitively biased behavior within a segment of the market (Russell & Thaler, 1985). As real estate professionals and local officials widely acknowledge, this has led to widespread confusion among new homebuyers. Overcapitalization of temporary tax savings thus appears to result from a fundamental lack of accurate and transparent forward-looking information on which homebuyers ought to base their expectations of future property tax obligations. Lending credence to this view is the further finding that greater educational attainment (a proxy for financial or tax sophistication) at the Census tract level is associated with a 27% reduction in the rate of overcapitalization and that overcapitalization seems to disappear altogether for a subset of homes sold through a real estate broker that unilaterally adopted a formal property tax disclosure statement to alert prospective clients to the tax implications of TV uncapping.

Many scholars, including Congdon, Kling, and Mul lainathan (2009), Schenk (2011), Gamage and Shanske (2011), and Goldin (2015), have argued that the government should optimally exploit taxpayer inattention by minimizing the salience of certain tax policy features in order to mitigate efficiency losses associated with behavioral responses to taxation. In the present context, homebuyers’ apparent ignorance of TV uncapping implies an underreaction to the true after-tax price of home purchases, thereby suggesting damped welfare effects relative to alternative implementations of assessment limits. In particular, by inducing homebuyers to mistakenly compensate sellers on the basis of their existing property tax obligations, Michigan sellers are essentially able to walk away with their capped TVs such that the lock-in effect may be largely eliminated.

As generally acknowledged by the proponents of optimal tax salience, however, weighing against any efficiency gains from a reduction in the distortionary effects of taxation are possible welfare losses due to taxpayers’ optimization errors. This is true whether taxpayers’ underreaction is due

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5 For a comprehensive review of the many econometric challenges confronting the property tax capitalization literature and the many empirical strategies employed to surmount these, see Yinger et al. (1988) or Ross and Yinger (1999).

6 Several studies have sought to quantify the extent to which homeowners may be induced to remain in their homes for fear of losing the tax savings associated with avoiding or deferring TV uncapping. See, for example, Quigley (1987); O’Sullivan, Sexton, and Sheffrin (1995b); Wasi and White (2005); Ferreira (2010); or Hilsenfeldt (2011). The direction of the welfare consequences of homeowner lock-in nevertheless remains a matter of debate. In the U.S. Supreme Court’s Nordlinger v. Hahn (1992) ruling upholding the constitutionality of Proposition 13, the majority opinion reversed the usual efficiency argument against acquisition-value assessments by arguing that a mobility tax might be socially desirable if it served to promote neighborhood stability (O’Sullivan, Sexton, & Sheffrin, 1995a).
to an inability or unwillingness to think through the consequences of TV uncapping—whose exact property tax effects are less than fully salient—or whether homebuyers naively believe that they know their correct tax liability and ignore TV uncapping. While it is outside the scope of this paper to precisely quantify these offsetting welfare consequences, it should be clear that homebuyer errors with respect to the Michigan property tax system are far from trivial—in proportion to the magnitude of the investment involved—and are at stark odds with the standard theory of consumer behavior. This paper should hence be viewed as the first study to document the existence of serious optimization errors with respect to a ubiquitous and financially consequential tax and should provide further impetus to consider the role of taxpayer inattention in the formulation of tax policy.

II. Property Taxation

Sixteen years after passage of California’s Proposition 13, Michigan similarly abandoned market-value-based property assessments in favor of a system of acquisition-value-based assessments to restrain property tax revenue growth and volatility. Under Michigan’s Proposal A, local governments have thus been required since 1994 to perform annual property reassessments to determine current market values using a combination of statistical techniques, replacement cost calculations, and discretionary analyses, the final estimates of which are translated into state equalized values (SEV; i.e., 50% of assessed market value). The SEV then determines the TV of a property in its first year of ownership, after which the TV is constrained to grow at a capped rate equal to the lesser of CPI inflation or 5% and may never exceed the level of the SEV. Tax obligations hence remain tied to the assessed value that prevailed at the time of a property’s acquisition, with resets due to TV uncapping occurring on January 1 following an arm’s-length transaction.

This system implies that whenever housing appreciation outstrips the rate of ordinary inflation, as was the case for most of the period following implementation of Proposal A until the housing market downturn of the mid- to late 2000s, TV uncapping following a change of ownership could trigger a large increase in property tax liability. As shown in figure 1, Ann Arbor homes purchased in 2003 were thus hit by an average increase in future property tax obligations, popularly referred to as the “pop-up” tax, in excess of 55%, or approximately $1,500. Underlying the trend across sale years in the magnitude of these tax increases lies substantial variation at the property level, which itself depends on (a) the value of the property when it previously sold (thereby establishing the seller’s base-period TV), (b) the number of years elapsed since the last change of ownership (or the adoption of Proposal A, whichever was more recent), and (c) the difference between annual CPI and housing price inflation over these intervening years. Observationally equivalent properties may hence face different tax liabilities (and subsequent changes following sale) as a function of when each property last changed hands.

As a result of Michigan’s practice of implementing property reassessments only on January 1, new homebuyers temporarily avert the pop-up tax to varying degrees according to the timing of their purchase. Relative to a system in which uncapping was immediately or retroactively applied to the date of sale, as in California, Michigan homebuyers thus receive a temporary tax reduction in their year of purchase. The resulting pro-rata capped TV benefits are measured as \( d \times (SEV_0 - TV_0) \), where \( d \) denotes the fraction of the year remaining at the time of sale, \( \tau \) denotes the statutory property tax (millage) rate, and \( SEV_0 - TV_0 \) captures the difference between the counterfactual uncapped TV (i.e., current market value, \( SEV_0 \)) and the capped TV inherited from the seller. Taxes averted in this manner among homes sold in Ann Arbor peaked in 2005 at an amount equal to approximately $700, or 0.25% of the average purchase price. Ten percent of buyers captured virtually no capped TV benefit, while another 10% captured benefits in excess of 0.5% of the sale price. Tax savings near or above 1% of the sale price were available to 1% of home buyers. As the next section describes, the analysis in this paper relies fundamentally on this variation in capped TV benefits across comparable sales.

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7 The fact that homebuyers are presented with potentially misleading or incomplete information should not absolve perfectly rational agents from consulting available resources (subject to cost-benefit considerations), even if the underlying behavioral motivations in the two cases may differ.

8 The use of statistical methods for the purpose of estimating property values implies that even where sale prices are directly observed, assessed market values need not be equal to these except by coincidence or at the assessor’s discretion. While California routinely adopts recent sale prices as its measure of market value, this represents a rare exception in Michigan, the assessors’ intent being to smooth out the idiosyncratic component of buyer and seller matches.

9 See appendix A.1 for a longer description of Michigan’s property tax system.
III. Capitalization Theory and Estimation

A. Standard Model

The standard model of property tax capitalization requires slight modifications to accommodate Michigan’s discontinuous tax treatment around January 1 for properties sold in the previous year. Starting from the basic model, if real per period rental services, $R$, are constant over the lifetime of a house and capture all housing amenities and public services, while $T$ denotes the corresponding real tax payment, then the price of the house will be

$$P = \sum_{n=0}^{N-1} \frac{R - T}{(1 + r)^n},$$

where $N$ is the home’s expected lifetime and $r$ is the real interest rate.10

Property taxes ought to be fully capitalized in this simple framework. Nevertheless, several explanations for less than complete property tax capitalization have been proposed. First, mobility of capital implies that the supply of housing, unlike land, need not be fixed. Second, current tax obligations may not be expected to persist indefinitely. Third, the deductibility of state and local taxes among itemizing taxpayers at the federal level reduces the out-of-pocket cost of property tax payments below the measured level (and, moreover, varies across taxpayers as a function of income),11 and, fourth, property taxes may act as a user fee, whereby differing levels of taxation may yield differing levels of public services. Most relevant for this paper is that homebuyers may have imperfect information about the property tax system and thereby form incorrect expectations about their future $T$.

Allowing for under- or overcapitalization while assuming $N \approx \infty$12 and $T = \tau TV$ as would be true under market value-based assessments, equation (1) may be rewritten as

$$P = \frac{1 + r}{r} R - \beta \frac{1 + r}{\tau TV},$$

where $\beta$ represents the degree of capitalization in the standard empirical analysis.

As the breadth of the literature on property tax capitalization illustrates, estimation of $\beta$ involves important econometric challenges. First, the degree of property tax capitalization cannot be separately identified from the discount rate, and as such, assumptions about the value of $r$ may significantly influence results. Even more serious is the set of endogeneity issues that arise in estimating models derived from this standard framework. These fall into two general categories: the simultaneous determination of sales prices and TVs (and hence, tax payments) through the assessment process and the endogenous selection of statutory tax rates as a function of demand for local public goods and the size of the aggregate tax base. Underlying both sets of issues are unobserved (to the econometrician) determinants of housing prices and assessed values, including assessment-relevant house and market characteristics or unobserved variation in public service provision.

B. Augmented Model

Given that the Michigan property tax system can give rise to differing tax obligations in the year that a property is sold strictly on the basis of the seller’s length of ownership (and yield identical streams of tax liabilities thereafter), it is possible to examine—within a single jurisdiction—the extent to which the temporary tax savings arising during a homeowner’s first partial year of ownership are capitalized into sale prices without resting such estimates on entire streams of subsequent years’ tax payments or rates of time discounting. Neither the determination of an appropriate discount rate nor the existence of unobserved variation in public service provision (as would be true in a cross-jurisdictional study)13 precludes consistent estimation of the degree of property tax capitalization for the initial period, while the exogenous predetermination of $TV_0$ (conditional on observables) rules out simultaneity of tax obligations and sale prices in homebuyers’ first partial year of ownership.

A few modifications to the standard model of property tax capitalization in equation (1) highlight these virtues of the Michigan property tax system for estimation purposes. From the perspective of a well-informed buyer, the inherited capped TV and lower associated tax liability apply only to the fraction of the calendar year remaining beyond the date of sale, $d \in [0, 1]$. After the fraction of year $d$ has elapsed, TV uncapping implies that all subsequent tax obligations are based on assessed values (SEV) for the first full calendar year following sale. In addition, assessment limits are irrelevant unless the rate of appreciation of rental services differs from the rate of CPI inflation. This difference in growth rates is denoted by $h$, while the rate of CPI inflation is $\pi$. Hence, the nominal present value of rental services grows by $(1 + h)(1 + \pi)$ each year (discounted by the nominal interest rate), while tax liability is restricted to grow by only $(1 + \pi)$ per year beginning the year after uncapping.14 The market price

10 For a more complete presentation of the standard model of property tax capitalization along with an extensive review of its application in a wide range of empirical settings, see Yinger et al. (1988) or Ross and Yinger (1999).

11 See de Bartolomé and Rosenthal (1999) for a treatment of this possibility.

12 Given rates of actual housing depreciation, this represents a reasonable approximation (Yinger et al., 1988).

13 Homebuyers still appear to care about within-district quality differences among public schools, as reflected in real estate marketing practices. This motivates the inclusion of school catchment area fixed effects below.

14 For simplicity, this model ignores future property turnover, which will tend to raise expected future tax obligations due to TV uncapping. This is equivalent to assuming that $h = 0$ in the long run (i.e., between transactions), consistent with the experience in Michigan of the first fifteen to twenty years since Proposal A was enacted.
of a property sold in period 0 should therefore be

\[
P_0 = \sum_{n=0}^{N-1} R_0 (1 + h)^n + d\tau(SEV_1 - TV_0) - \tau SEV_1 
\]

\[
- \sum_{n=1}^{N-1} \frac{1}{(1+r)^n} \left(\tau SEV_1\right) \left[1 - d + d(1 + \pi)^{-1}\right].
\]

Rearranging terms and taking \( N \approx \infty \),

\[
P_0 = R_0 \left(1 + \frac{r}{r - h}\right) + d\tau(SEV_1 - TV_0) 
- \frac{\tau SEV_1}{r} \left[1 - d + d(1 + \pi)^{-1} + r\right].
\] (3)

When CPI inflation is low, the last term in equation (3) in brackets is approximately \((1 + r)\), thereby leaving an expression consisting of the inherited capped TV tax savings, \(d\tau(SEV_1 - TV_0)\), whose effect on sale prices is the object of interest, as well as the flow of housing amenities, the real interest rate, the rate of housing appreciation net of ordinary inflation, and the present value of future tax obligations. Notably, \(SEV_1\) is itself a function of \(r, h, \tau,\) and \(R_0\) and is likely influenced at least to a degree by \(P_0\)—these latter two dependencies serving as the primary motivation for IV estimation in the following analysis—whereas \(TV_0\) is only a function of the sellers’ initial postpurchase SEV, their tenure in the home, and \(h\).

Allowing for departures from full property tax capitalization, this implies

\[
P_0 = R_0 \left(1 + \frac{r}{r - h}\right) + \alpha d\tau(SEV_1 - TV_0) - \gamma \frac{1 + r}{r} \tau SEV_1,
\] (4)

where \(\alpha\) and \(\gamma\) capture the degree of capitalization of capped TV benefits and future tax obligations, respectively. By measuring the impact of an increase in temporary tax savings (i.e., reduction in seller tax obligations) in the present period only, \(\alpha\) may be estimated without making assumptions regarding the discount rate.\(^{15}\)

15 Equivalently, equation (4) may instead be written as the stream of tax obligations corresponding to the seller’s taxable basis, plus the amount by which TV uncapping raises future tax obligations, adjusted for the initial “discount” in the first partial year of ownership:

\[
P_0 = R_0 \left(1 + \frac{r}{r - h}\right) - \beta \left(1 + \frac{r}{r} \tau TV_0 + \alpha d\tau(SEV_1 - TV_0) 
- \alpha \frac{1 + r}{r} \tau SEV_1 - TV_0\right).
\] (5)

If buyers are poorly informed with respect to the details and implications of Proposal A and ignore TV uncapping \((\alpha_1 = \alpha_2 = 0)\) equation (5) collapses to a modest respecification of equation (2). Conceptually, equations (4) and (5) address homeowner comprehension of the Michigan property tax system in complementary ways, but estimation of equation (5) sacrifices a key attribute of the IV identification strategy and yields uniformly imprecise statistical results (not shown).

C. Empirical Model and Econometric Considerations

Equation (4) forms the basis of the empirical analysis under the presumption that homebuyers behave in a rational and well-informed manner while allowing for detection of deviations from such behavior, especially ignorance of TV uncapping, through measurement of the independent effect of SEV on sale prices.\(^{16}\) Assuming \(R_0\) to be a linear function of time-invariant housing characteristics, denoted by the vector \(X_n\), the estimating equation for measuring capitalization of the inherited tax savings for house \(i\) in year \(n\) in this setting is

\[
P_{in} = \kappa + \alpha d\tau_i(SEV_{i,n+1} - TV_{in}) + \theta\tau_i SEV_{i,n+1} 
+ \delta X_i + \nu X_n + \epsilon_{in},
\] (6)

where \(X_n\) represents a vector of year and seasonal effects. Capitalization of future tax obligations is captured by \(\theta = \gamma(1 + r)/r\), which depends on the assumed interest rate.

Despite Michigan’s attributes as a natural setting for studying within-jurisdiction property tax capitalization, certain econometric concerns associated with equation (6) nonetheless remain. First, there may exist a mechanical relationship between sale prices and capped TV benefits whereby more valuable homes experience larger dollar-valued tax savings with each passing year of capped TV growth. This is addressed by respecifying all implicated terms in logs.\(^{17}\) Second, postsale assessed values \((SEV_{n+1})\) are likely to incorporate information about observed sale prices despite the application of statistically based assessment techniques. This is especially true given that new property owners have the option to appeal their assessments. Presale SEV \((SEV_{n})\) represents an assessment of true market value stripped of any such information and therefore provides a close proxy deprived of simultaneity concerns. However, even presale SEV may be correlated with omitted house or market characteristics. This problem is mitigated by including an array of housing controls along with school and neighborhood-year pair fixed effects, but the application of comparable sales analyses in arriving at SEV may still present an omitted variables concern.

An additional issue is that the statutory property tax rate depends on whether a home has been granted a primary residence (homestead) exemption.\(^{18}\) Without complete information on residency status of sellers and buyers, I apply the approximately 24% lower homestead rate to all properties. Consequently, the capped TV benefit term will be

16 The tax effect attributed to SEV, and therefore actual future tax obligations, should be negligible if homebuyers are ignorant of the Michigan property tax system but exert a strong negative effect on sale prices otherwise.

17 This excludes just under 20% of observations from the sample due to having 0 capped TV benefits.

18 Homestead status is granted to qualifying primary residences. By Michigan law, local property tax rates may be up to 1.8 percentage points higher for non-homestead properties.
systematically understated for secondary residences. On the other hand, taxpayers’ relevant effective property tax rates may differ from $\tau$ as a result of the federal income tax deductibility of state and local taxes, with lower effective tax rates accruing to home owners with higher marginal income tax rates (including, presumably, most owners of vacation homes and landlords), thereby implying a potentially offsetting source of measurement error. Finally, the fraction of the year, $d$, over which any capped TV benefit is inherited may be endogenously determined. This is especially problematic if market participants recognize that larger capped TV benefits may be realized by delaying transactions from one year into the next, thereby leading to a possible spurious positive correlation between pro-rata inherited tax savings and sale prices. Working in the opposite direction is the fact that in an era of rising house prices, nominal sale prices will generally be lower at the beginning of a calendar year than at the end, all else equal. This is only partly accounted for by the use of controls for month of sale due to the nonlinearity of seasonal demand (see appendix A.2).

The remedy for these remaining endogeneity issues lies in the use of IV methods. The implementation of acquisition-value assessment limits offers a natural exclusion restriction for the capped TV benefit in the form of the number of years that the cap has been in place (i.e., the number of years that a property has been owned without change of hands after the enactment of Proposal A). A plausible instrument for future tax liability, meanwhile, is the level of SEV that prevailed in the year that a property was previously purchased rescaled by intervening growth in citywide assessed values. This measure of “predicted” SEV is intended to be stripped of the influence of sale price realizations, assessment shocks, or comparable sales analyses that may otherwise be correlated with the sale price.

The validity of the first exclusion restriction rests on years of ownership having no direct effect on sale price independent of its influence on the magnitude of the capped TV benefit. A legitimate concern in this context is that years of ownership may also reflect the extent to which a home is out-of-date if homeowners are more likely to update or renovate their homes closer to their time of purchase (the “run-down” effect). If tenure of ownership instead serves as a signal of homes with highly desirable or unique features (e.g., architectural details, quality of materials, suitability for raising children, neighborhood stability) or if long-term property owners are more likely to care about general maintenance, then the associated effect on sale price may be confounded with that of the tax effect and lead to overstatement of the latter (the “peaches” effect). In addition, length of ownership may itself respond to limitations on TV growth due to the lock-in effect.

These concerns are addressed to the extent possible through the inclusion of appropriate controls, including neighborhood-year and school fixed effects and the number of years since additions or other major renovations were last performed. Reduced-form results and results using an alternative instrument even more closely related to the mechanical calculation of capped TV benefits are described in appendix A.4.

By construction of these instruments, the proposed IV strategies do not account for differences in pro-rata capped TV benefits arising from within-year timing of sales, and thus variation in $d$ is discarded as a source of identification in the main analysis. This is desirable to the extent that a portion of this variation may be endogenous. Absent information on household characteristics (e.g., number of school-aged children), which might yield a valid instrument for $d$ whereby the timing of closing within year is affected in a manner unrelated to tax incentives, $d$ is preserved in the empirical specifications for consistency of exposition. As shown in a later indirect test, capitalization rates of full-year tax savings are largely insensitive to transaction timing between the beginning and end of the year, such that homebuyers appear to ignore $d$.

IV. Data

The primary data source consists of a panel of assessed and taxable values for Ann Arbor, Michigan, for the period 1997 to 2007 along with complete property sales data back to 1984. These files cover all properties in Ann Arbor, a city of approximately 115,000 residents in the southeastern portion of the state. The data include all of the necessary information for calculating statutory tax liabilities (assuming all properties to be primary residences), as well as information on date of last sale, last sale price, and a rich set of parcel and house characteristics, including square footage, number of bedrooms, full and half bathrooms, and year built. Crucially, the data are identified by street address such that parcels can be mapped to one of 50 different neighborhoods (as defined by the Assessor’s Office), 38 Census tracts, 18 elementary school catchment areas, 5 middle schools, and 3 high schools. Excluded from the analysis are tax-exempt, commercial, industrial, and unimproved residential property; transactions between related parties; high-frequency sales indicative of foreclosures or employer-subsidized relocations; and transactions exceeding $500,000. The remaining

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19 Roughly 76% of residential property in Ann Arbor qualifies for the exemption, and few properties transit permanently between homestead and non-homestead status.

20 Bradley (forthcoming) provides evidence of this type of behavior for a small number of property transactions within a narrow window around January 1.
Table 1.—Mean Property Characteristics by Ratio of Full-Year Capped TV Benefits to SEV, Ann Arbor

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<td>$d\tau(SEV - TV)$</td>
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Significant at **10%**, ***5%**, and ***1%** (for t-test of equal means assuming unequal variances).

The main analysis is qualitatively unchanged in the full sample. Nevertheless, this restriction plays a more important role in the tests involving listing service data as a way of screening entries for which prices, SEV, and TV were mistyped or recorded using inconsistent scaling and is applied everywhere for consistency.

sample consists of just over 19,000 residential sale observations. Of these, approximately 3,700 observations represent repeat sales for which complete prior-sale assessment information is available (i.e., where the previous sale occurred in 1997 or later) as required for the IV estimation. This selection process will tend to exclude properties associated with either very small capped TV benefits (i.e., those sold shortly after Proposal A was implemented) or very large capped TV benefits (e.g., those sold only once near the end of the sample period).

A second complementary data source featuring an even richer array of property and transaction characteristics is drawn from the Ann Arbor Area Board of Realtors multiple listing service (MLS) database for the period 2005 to 2010 and is used in estimating certain alternative specifications, one of whose virtues is to fully encompass the market downturn (and, hence, the disappearance of capped TV benefits). Geospatial mapping of sold properties in the MLS sample is hindered by the inconsistent formatting of address entries. Nevertheless, mapping followed by matching to the Ann Arbor assessment rolls (to obtain historical assessment entries) and exclusion of outlying or misrecorded transactions on a similar basis as described above yields an initial sample of just over 1,800 transactions. Use of these data is deferred until the latter portion of section V.

Summary statistics for the complete sample of mapped sales are given in table 1 and provide a comparison of the average characteristics of homes with relatively high and low full-year capped TV benefits as a proportion of pre-sale assessed values. Among all homes sold in the same year, those with a high ratio of full-year capped TV benefits to SEV relative to the median reap predictably larger pro-rata tax savings, on average, than those below the median. This is due entirely to lower TVs relative to SEV in the former group. More generally, the two groups of homes differ in a statistically significant manner in every dimension except the average timing of sales, $d$. Homes with relatively high capped TV benefits are on average almost fifteen years older, smaller, and less recently renovated than those with relatively high TVs; and correspondingly, they sell for less. These systematic differences highlight the importance of controlling for all of these property characteristics in the analysis that follows.

V. Results

A. Main Results

Causal identification of the true degree of capitalization of capped TV benefits requires estimation of equation (6) using an IV approach and the full complement of housing and market characteristics likely used by both homebuyers and assessors in their determination of market value. As a preliminary step, table 2 presents the ordinary least squares (OLS) results from estimating two versions of the general hedonic regression specification, which differ only in their inclusion of a regressor capturing future tax liability. Each specification includes controls for home and garage square footage; number of bedrooms and full and half bathrooms; age and age squared of the physical structure; age of renovations (i.e., the number of years elapsed since a property experienced fractional uncapping or, in the absence of such evidence, the number of years since the last sale), and a measure of the previous sale price rescaled by regional HPI appreciation over the intervening period (used to control for remaining unobserved determinants of property value and the seller’s initial post-purchase TV). In addition, macroeconomic trends affecting the evolution of the Ann Arbor housing market, including nominal inflation rates, are also controlled for using sale year dummies, while sale month indicators account for seasonal effects. School fixed effects control for time-invariant public amenities and other location-specific determinants of housing values, while neighborhood-year pair fixed effects allow for further variation in related determinants over time (e.g., to avoid confounding effects of gentrification patterns) and imply that identification rests narrowly on within-neighborhood-year, within-school variation in capped TV benefits and transaction prices. Standard errors are clustered by neighborhood.

As shown, the basic specification ignoring future tax liability (denoted as specification (1) of table 2) and the full preferred specification (specification (2)) yield predictably very different tax effects, thereby highlighting the extent of endogeneity bias associated with the introduction of the second tax term, $\tau SEV$. In particular, future tax liability is associated with a significant positive effect on sale prices, such that SEV appears to convey additional price-relevant
information beyond what the controls are able to explain, and this effect dominates any negative tax effects. Moreover, the separate inclusion of τSEV appears to rob the capped TV benefit of its expected positive effect on prices. These patterns emphasize the importance of devoting adequate consideration to the aforementioned sources of bias.

Table 3 presents results from two-stage least squares estimation of specifications 1 and 2, using years of ownership as the primary instrument for both specifications: Pre-sale SEV from the previous sale rescaled by intervening average assessed value growth (controlling for the previous transaction price) is used as an additional instrument to further account for the endogeneity of the future tax liability term in the full capitalization model. Both instruments perform reasonably well in the first stage (right-most three columns), as illustrated by the sign, magnitude, and precision of their estimated effects, especially in their ability to explain variation in the endogenous capped TV benefit. Instrument relevance is attenuated with respect to the future tax liability term; nevertheless, tests of instrument weakness for the individual instruments readily reject at conventional thresholds, while statistics for the joint test (specification 2) fall at or very narrowly below the relevant critical value.  

As shown in the first two columns of table 3, capitalization of inherited tax savings under either specification is considerably increased relative to the corresponding OLS estimates. A 10% increase in the pro-rata capped TV benefit is thus associated with an increase in sale price of 0.9% to 1.2%. For the average home over the sample period, this translates into capitalization of first-period tax savings of 2,900% to 3,700%. Moreover, unlike under OLS, future tax liability has no statistically significant effect on sale prices in the full model. Hence, it appears that homebuyers’ only tax-related concern—mistakenly—is with respect to the level of the capped TV and, implicitly, sellers’ current tax liability.

If homebuyers were attentive to their true pro-rata tax savings, full-year savings should be capitalized at a relatively higher rate for transactions falling at the beginning of the calendar year (I BoY = 1) than at the end, in proportion to the difference in average tax savings implied by differences in d. A further test of overcapitalization hence consists of comparing capitalization rates of full-year capped TV tax savings around January 1, with a ±1-month “doughnut hole” carved out to avoid including possible strategically delayed transactions.25

Table 2.—Capitalization of Capped TV Tax Savings, OLS Results

<table>
<thead>
<tr>
<th>Y = logP</th>
<th>(1)</th>
<th>(2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>log dt(SEV − TV)</td>
<td>0.015**</td>
<td>−0.012***</td>
</tr>
<tr>
<td>(0.006)</td>
<td>(0.004)</td>
<td></td>
</tr>
<tr>
<td>log τSEV</td>
<td>−0.006</td>
<td>0.628***</td>
</tr>
<tr>
<td>(0.070)</td>
<td>(0.036)</td>
<td></td>
</tr>
<tr>
<td>log P_BoY × ΔHPI</td>
<td>0.296***</td>
<td>0.206***</td>
</tr>
<tr>
<td>(0.036)</td>
<td>(0.036)</td>
<td></td>
</tr>
<tr>
<td>Residence square feet (×10^3)</td>
<td>0.229***</td>
<td>0.053**</td>
</tr>
<tr>
<td>(0.024)</td>
<td>(0.022)</td>
<td></td>
</tr>
<tr>
<td>Garage square feet (×10^3)</td>
<td>0.238***</td>
<td>0.039</td>
</tr>
<tr>
<td>(0.040)</td>
<td>(0.030)</td>
<td></td>
</tr>
<tr>
<td>Number of bedrooms</td>
<td>0.017</td>
<td>0.007</td>
</tr>
<tr>
<td>(0.009)</td>
<td>(0.006)</td>
<td></td>
</tr>
<tr>
<td>Number of baths (full)</td>
<td>0.026**</td>
<td>0.003</td>
</tr>
<tr>
<td>(0.009)</td>
<td>(0.009)</td>
<td></td>
</tr>
<tr>
<td>Number of baths (half)</td>
<td>0.037**</td>
<td>−0.005</td>
</tr>
<tr>
<td>(0.010)</td>
<td>(0.007)</td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>−0.001</td>
<td>0.01</td>
</tr>
<tr>
<td>(0.001)</td>
<td>(0.001)</td>
<td></td>
</tr>
<tr>
<td>Age^2</td>
<td>0.000</td>
<td>0.00</td>
</tr>
<tr>
<td>(0.000)</td>
<td>(0.000)</td>
<td></td>
</tr>
<tr>
<td>Renovation age</td>
<td>−0.001</td>
<td>0.006***</td>
</tr>
<tr>
<td>(0.002)</td>
<td>(0.002)</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>5,239</td>
<td>3,722</td>
</tr>
<tr>
<td>Adjusted R^2</td>
<td>0.816</td>
<td>0.876</td>
</tr>
</tbody>
</table>

Significant at *10%, **5%, and ***1%. Standard errors (in parentheses) are clustered at the neighborhood level. Month, school, and neighborhood-year fixed effects are included in all specifications.

B. Evaluation of Instrumental Variables

The sign of the bias associated with OLS capitalization estimates of capped TV benefits is theoretically ambiguous. Even if homebuyers ignore variation in d for the purpose of valuing d τ(SEV − TV), d might still reflect within-year

25 Complete regression results for this and all subsequent specifications are available from the author on request.

26 In practice, including December and January transactions yields very similar results to those below, consistent with the small proportion of sales appearing to have been timed for the purpose of delaying TV uncapping in Bradley (forthcoming).
housing price trends. Under rising housing prices, smaller values of \( d \) should consistently imply higher prices—which, if unaccounted for, as under OLS—would be attributed to smaller pro-rata capped TV benefits.\(^{27}\)

It is also worth noting that IV first-stage identification arises from the subset of homes for which renovation age and to the end of the same calendar year (\( d = 0 \)) is associated with a greater than \$10,000 increase in average sale price (results not shown). This is consistent with average annual housing price appreciation having exceeded 3.7\% over the entire sample period.

\( ^{27} \) In models estimated in levels with a separate control for \( d \) (disregarding possible simultaneity), shifting a sale from the beginning of the year (\( d = 1 \))
years owned differ and may help explain the implicit negative bias in the OLS capitalization estimates. The use of years owned as an instrument helps to distinguish two sources of variation in capped TV benefits: (1) the accumulation of lower relative tax obligations due to assessment limits and (2) the depreciation of particular housing amenities that may go unnoticed by assessors over time. Under OLS, a strong positive correlation between the size of the capped TV benefit and the number of years elapsed since renovations were last performed works against finding a large positive effect of the capped TV benefit or large negative effect of renovation age on sale price. Once years owned is separately accounted for, however, renovation age is allowed to play its intended role by signaling the degree to which a home is up-to-date.

As discussed in section III, yet another explanation for the larger IV estimates of capitalization of first-period tax savings could be that years of ownership actually exert a positive influence on sale prices independent of their effect on the size of capped TV benefits, in violation of instrument exogeneity (i.e., the peaches effect dominates any offsetting run-down effect in a manner not fully accounted for by renovation age). Notwithstanding existing studies of investment in home improvements, which tend to imply precisely the reverse, this possibility warrants serious consideration. Reduced-form regression results contrasting the influence of years of ownership on sale prices for properties with positive versus zero capped TV benefits provide some assurance that this is not a concern (appendix A.4). Whereas years of ownership has a significant positive effect on sale prices among properties for which there exist positive capped TV benefits ($SEV > TV$), no such effect arises when capped TV benefits are 0 ($SEV = TV$). Controlling for renovation age, tenure hence appears to influence sale prices only insofar as there exist associated tax savings.

As a further robustness check, I also consider an alternative instrument based on the differential between average assessed value growth and nominal price growth over the intersale period interacted with the measure of presale SEV that prevailed at the time of the seller’s purchase. Full results are available in appendix A.4. Despite the degree of overcapitalization of the capped TV benefit being nearly halved in the full specification (to over 1,600%, with evidence of instrument weakness), the ultimate message remains qualitatively unchanged: first-period tax savings are significantly overvalued in a manner that cannot be reconciled with rational or well-informed behavior on the part of Ann Arbor home buyers. Whether full-year capped TV benefits are capitalized 1,600% or 2,900% (i.e. 47% or 85% capitalization of an infinite stream of annually recurring first-period benefits at a 3% real interest rate), this can only represent a costly error from the perspective of new home buyers. In particular, homebuyers must believe that holding $tSEV$ constant, a decrease in $tTV$ will persist indefinitely; in other words, seller tax obligations will carry over to the new homeowners and remain permanently unchanged.

C. Institutional Details and Other Supporting Evidence

Extensive anecdotal evidence supports this interpretation of homebuyer behavior, which is made all the more credible given institutional details surrounding the homebuying process. Foremost among these institutional features is the federal requirement that mortgage lenders base their estimates of future tax obligations on the seller’s last twelve months of tax payments for the purposes of determining maximum mortgage escrow account contributions, as outlined in the Real Estate Settlement Procedures Act of 1974 (RESPA) (C.F.R. §3500.17(c)(7))—a practice that extends to the provision of all property tax disclosures. Thus, while mortgage lenders’ incentives with regard to accurate property tax disclosure are a priori ambiguous—trading off the opportunity to issue larger loans against a heightened potential for mortgage default—lenders are bound to provide only backward-looking information on those forms intended to inform buyers about their precise closing costs and ongoing homeownership costs, thereby obfuscating the occurrence of TV uncapping. Current seller tax liabilities, which also figure prominently on real estate sales listings, are hence emphasized throughout the homebuying process as the main piece of tax-relevant information. So long as property taxes are capitalized into home values, neither sellers nor real

28 Consistent with the intuition for the run-down effect, Sweeney (1974) demonstrates theoretically that longer-owned homes ought to have higher initial quality and lower final quality than comparable homes with shorter expected tenure. Both Mendelsohn (1977) and Montgomery (1992) find a declining probability of renovations with home owner tenure and, in the case of the latter, a significant reduction in improvement expenses. Gyourko and Saiz (2004) find a positive effect of tenure on renovation expenses where tenure, however, refers to the age of the home.

29 These figures are also consistent with 100% capitalization assuming interest rates of 6.7% versus 3.6%, respectively. Without a strong consensus in the literature as to whether the “correct” degree of capitalization (Yinger et al., 1988; Ross & Yinger, 1999) or even the appropriate discount rate, there exists a wide range of plausible combinations of interest rates and capitalization percentages that nevertheless lead to the same conclusion.

30 The sole source of discretion available to Michigan lenders in terms of calculating buyers’ monthly payments is in determining the appropriate local tax rate as a function of expected residency status (personal communication from Bill Holmes, president and cofounder, Ann Arbor Mortgage Company). Cabral and Hoxby (2013) present survey evidence indicating that homeowners whose tax payments are made through escrow accounts are more likely to misgauge the magnitude of their annual tax obligations and thereby argue that the use of tax escrow leads to diminished property tax salience. Mortgage escrow requirements may thus doubly mislead new homebuyers: first, by concealing the occurrence of TV uncapping and then by bundling monthly property tax payments alongside mortgage principal, interest, and insurance payments.

31 The availability of greater credit ought not, by itself, increase willingness to pay if homebuyers are attentive to their true future tax obligations. This is distinct from the situation considered by Best and Kleven (forthcoming) wherein transfer taxes may reduce the amount that downpayment-constrained homebuyers are able to bid below their reservation price.

32 Michigan MLS listings also provide information on seller’s assessed value, but using this information to formulate accurate predictions of future tax liabilities requires careful understanding of the tax system.
estate agents for either party will have any financial incentive to draw buyers’ attention to impending increases in tax obligations.

According to the City of Ann Arbor Assessor’s Office, this misguided focus on seller tax liabilities has resulted in a large volume of complaints involving new homeowners who had experienced significant jumps in tax liability due to TV uncapping.33 Cognizance among real estate professionals of widespread confusion regarding the tax implications of acquisition-value assessments (and, presumably, of the associated potential for conflicts of interest) prompted the largest real estate agency in Ann Arbor to provide written notices to all prospective homebuyers describing the Michigan property tax system, with special emphasis given to the likelihood of a jump in tax liability following purchase.34

Although the data do not permit an examination of precisely what role such an informational effort in Ann Arbor may have played in raising awareness of TV uncapping, a few related tests are nevertheless feasible. First, as shown in table 5, greater educational attainment, even at an aggregate level, appears to have a nontrivial countervailing effect. In table 5, greater educational attainment, even at an aggregate level, appears to have a nontrivial countervailing effect.

**Table 5.—Capitalization of Capped TV Tax Savings, IV Results: The Role of Census Tract-Level Educational Attainment and Immigration**

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$E[\log dt(\text{SEV} - \text{TV})</td>
<td>0.131***</td>
<td>0.100***</td>
</tr>
<tr>
<td>$E[\log \text{SEV}</td>
<td>(0.020)</td>
<td>(0.024)</td>
</tr>
<tr>
<td>$-</td>
<td>0.243</td>
<td>0.224</td>
</tr>
<tr>
<td>$E[\log dt(\text{SEV} - \text{TV}) \times I[\text{High Education}]</td>
<td>-0.038***</td>
<td>-0.027***</td>
</tr>
<tr>
<td>$I[\text{High Education}]</td>
<td>(0.016)</td>
<td>(0.016)</td>
</tr>
<tr>
<td>$I[\text{High Foreign-born}]</td>
<td>0.014</td>
<td>0.011</td>
</tr>
<tr>
<td>$I[\text{High Education}]</td>
<td>(0.016)</td>
<td>(0.016)</td>
</tr>
<tr>
<td>$I[\text{High Foreign-born}]</td>
<td>0.198***</td>
<td>0.123</td>
</tr>
<tr>
<td>$-</td>
<td>0.086</td>
<td>0.089</td>
</tr>
<tr>
<td>$N</td>
<td>5,239</td>
<td>3,722</td>
</tr>
<tr>
<td>Adjusted $R^2$</td>
<td>0.496</td>
<td>0.610</td>
</tr>
<tr>
<td>Kleibergen-Paap rk Wald $F$-statistic</td>
<td>58.9</td>
<td>1.9</td>
</tr>
</tbody>
</table>

Significant at **10%, ***5%, and ****1%. Standard errors (in parentheses) are clustered at the neighborhood level. All specifications include the full set of controls from table 3, plus month, school, and neighborhood-year fixed effects (not shown). All $E[Z]$ terms denote predicted values from first-stage regressions of the endogenous regressors on the vector of instruments, Z.

33 Personal communication from Mike Courtney, chief appraiser, City of Ann Arbor Assessor’s Office.

34 In New Mexico, a state whose property tax system most closely resembles Michigan’s in terms of its implementation, real estate professionals have been legally required since 2009 to complete an elaborate property tax disclosure to deal with homebuyer confusion regarding the tax implications of TV uncapping: “The legislature finds that property tax levies on a residential property for the current year can be a misleading guide to property tax levies in the years following the sale of that property and that a prospective buyer needs information regarding the property tax obligation in the year following the property’s sale to properly judge the affordability of a contemplated purchase” (N.M. Stat §47-13-4(a)).

35 IV first-stage results for all robustness checks and extensions are available from the author on request.

36 U.S. News and World Reports ranked Ann Arbor as the second most highly educated city in the United States based on the 2009 American Community Survey (Kurtzleben, 2011).

37 Based on average capped TV benefits and sale prices over this time period, a 0.065% increase in transaction prices resulting from a 1% increase in capped TV benefits corresponds to a 2.550% capitalization rate.
in its listings, in either setting list prices or negotiating contract terms.\footnote{38} Controlling for the average market share (measured by 2005–2010 sales volume) of the listing broker, these estimates suggest that capitalization of capped TV benefits was significantly reduced or even eliminated for those properties listed by the disclosing broker. Naturally, these point estimates should be interpreted with some caution given that “assignment” to properties listed by the disclosing broker is treated as exogenous in this framework, whereas selection surely plays an important role, as the significant positive effect of the baseline \(I[\text{Disclosure}]\) indicator term makes clear.\footnote{39} Based on the point estimates alone, near-zero capitalization among properties listed by the disclosing broker could alternatively arise if the disclosure statement instead induced home buyers to erroneously assume immediate uncapping.\footnote{40} A 95\% confidence interval around the sum of the coefficients on \(log d \tau(\text{SEV} - TV)\) and \(log d \tau(\text{SEV} - TV) \times I[\text{Disclosure}]\) spans a wide range, such that it remains impossible to refute (net) overcapitalization of temporary tax savings. Still, the direction of the disclosure interaction effect is consistent with dampening homebuyers’ tendency to overvalue temporary capped TV tax savings, as though the provision of general information about the details of the tax system was sufficient to raise taxpayers’ awareness of TV uncapping. Insofar as tax salience and ignorance represent distinct phenomena (rather than the latter emerging as the consequence of an opaque tax system), this last finding may suggest that ignorance plays a more important role.

The fourth column of table 6 provides a tentative test of the role of experience in modulating buyers’ attentiveness to deferred tax increases due to TV uncapping. Property owners are identified on the basis of their first and last names and mailing addresses as either movers or investors at the time of their second purchases. Collectively, these transactions are denoted as involving experienced buyers (\(I[\text{Experience}]\)) and are allowed to exhibit differential capitalization of capped TV tax savings. Experience measured in this way does not appear to yield any statistically significant difference in tax capitalization, such that experience does not appear to prevent overcapitalization of temporary tax savings. Interpreting this result again warrants caution, however, as highlighted by the low-instrument \(F\)-statistic and the fact that “inexperienced” buyers (91\% of the sample) surely include a nontrivial number of movers or investors who cannot be identified in the data,\footnote{41} thereby biasing the estimated effect of experience toward 0. Even so, experience in the housing market is necessarily limited compared to that for purchases of more ordinary and familiar consumer goods (as in Chetty et al., 2009), such that a failure of experience to mitigate the consequences of limited attention may be unsurprising (DellaVigna, 2009).

\section*{D. Alternative Interpretations}

Despite the breadth of supporting evidence, consideration of alternative explanations for such striking deviations from well-informed consumer behavior is warranted. The three most compelling such explanations are that (a) overcapitalization may merely reflect an artifact of the speculative excesses in the housing market over the time period examined, (b) properties may have been systematically under-assessed between transactions due to a lack of incentives to the contrary and assessors were reluctant to offset these underassessments when establishing post-sale SEV for fear of triggering costly appeals, and (c) deeply cash-constrained home buyers may have been prepared to pay a sizable premium for homes with temporarily low property tax obligations so as to incur reduced closing costs and cash outlays in the first months of ownership. As discussed in detail in appendix A.6, however, none of these explanations survives careful scrutiny. Crucially, neither liquidity constraints, nor systematic and persistent underassessments, nor speculative excesses can explain the statistical irrelevance of future tax obligations in the analysis. It follows that the interpretation

\begin{table}[h]
\centering
\caption{Capitalization of Capped TV Tax Savings, MLS Data Extensions: The Role of Broker Disclosure and Buyer Experience}
\begin{tabular}{lcccc}
\hline
\multicolumn{1}{c}{Y = log P} & OLS & IV & IV & IV \\
\hline
E[log d\tau(\text{SEV} - TV)/Z] & -0.012 & 0.065** & 0.105*** & 0.049** \\
(0.010) & (0.021) & (0.039) & (0.023) \ 
E[log tSEV[Z]] & 0.237*** & 0.154 & -0.105 & 0.096 \\
(0.055) & (0.130) & (0.154) & (0.212) \ 
E[log d\tau(\text{SEV} - TV) \times I[\text{Disclosure}]/Z] & - & - & -0.118** & - \\
E[log d\tau(\text{SEV} - TV) \times I[\text{Experience}]/Z] & - & - & - & 0.330 \\
I[\text{Disclosure}] & - & (0.060) & - & - \\
I[\text{Experience}] & - & (0.318) & - & - \\
\hline
N & 967 & 967 & 639 & 967 \\
R\textsuperscript{2} & 0.838 & 0.494 & 0.316 & 0.217 \\
Kleibergen-Paap rk F-statistic & 6.5 & 4.0 & 0.5 & 0.5 \\
\hline
\end{tabular}
\footnotesize{Significant at \(10\%\), \(1\%\), and \(\%\). Standard errors (in parentheses) are clustered at the neighborhood level. All specifications include the full set of controls from table 3 plus month, school, and neighborhood-year fixed effects. Additional controls (available only in the MLS data) include indicators for the presence of a finished basement, pool, and central air-conditioning; the number of fireplaces; and broker market share (not shown). All \(E[I]\) terms denote predicted values from first-stage regressions of the endogenous regressors on the vector of instruments, Z.}
\end{table}
of the overcapitalization result that is consistent with the full range of evidence, statistical and anecdotal, is that of ill-informed homebuyers valuing homes on the basis of seller tax obligations while ignoring impending changes in future tax obligations due to TV uncapping.

VI. Conclusion

The evidence presented in this paper thus suggests that homebuyers are, on average, grossly mistaken about the implications of the Michigan property tax system and fail to obtain sufficient information to make financially sound decisions with regard to the tax consequences of homeownership, even with many thousands of dollars potentially at stake. In a setting free of some of the most serious econometric challenges to the estimation of property tax capitalization, homebuyers are shown to be willing to pay up to $29 for every $1 of temporary tax savings resulting from their inheritance of sellers’ capped tax obligations in their first partial year of ownership. Assuming a 3% real interest rate, this is equivalent to valuing such savings as if they were to persist forever into the indefinite future, contrary to the actual practice of TV uncapping under Michigan’s acquisition-value based assessment limits. Accounting for the proportion of highly educated homeowners within a Census tract to capture heterogeneity in financial sophistication yields modestly muted rates of overcapitalization, consistent with information and inherent attentiveness playing a pivotal role in explaining this phenomenon. Even larger reductions in overcapitalization arise in relation to properties listed through a real estate broker that voluntarily adopted a special property tax disclosure statement to alert prospective buyers to the implications of TV uncapping, similar to a state-mandated tax disclosure statement implemented in New Mexico in 2009 for the express purpose of mitigating confusion in this area.

This stark departure from well-informed rational consumer behavior surely reflects in large part the unique nature of housing as a good with which consumers have limited experience and where information costs are high, thereby providing fertile ground for cognitive biases to cloud households’ consumption decisions. It might thus come as little surprise that homebuyers may make inattentive, ill-informed decisions, perhaps especially in this particular context given the set of institutional reasons for thinking that prospective homebuyers might easily be deceived into focusing solely on seller tax liabilities without recognizing the occurrence and resulting consequences of TV uncapping.

Such significant overcapitalization of temporary tax savings represents an especially striking example of cognitively biased behavior given the large sums of money involved—one of the most important such examples documented to date, particularly in the realm of taxation. Whereas Chetty et al. (2009) and Finkelstein (2009) deal with frequent, relatively small transactions, the causes and consequences of inattention in this context are perhaps most similar to evidence of households’ failure to refinance their mortgage loans in an optimal manner (Campbell, 2006) or grasp the terms of their adjustable-rate mortgages (Bucks & Pence, 2008). In those cases, as here, “investment mistakes” (Campbell, 2006) imply substantial losses for homebuyers due to overpayment for housing, especially among less sophisticated or less financially literate borrowers. Evidence that property tax disclosures may mitigate inattention to TV uncapping, meanwhile, echoes the findings in Chetty and Saez (2013) pertaining to the effects of tax preparers’ provision of advice on taxpayers’ ability to optimize over their reported earnings with respect to the EITC.

A back-of-the-envelope calculation suggests that by ignoring their impending increases in taxable basis due to TV uncapping, Ann Arbor homebuyers would have collectively overpaid roughly $30 million in 2005 alone. In a less highly educated Michigan community, the frequency and magnitude of homebuyer error could well be even larger, although this may be tempered by the fact that Ann Arbor’s relatively highly educated residents are also likely to be more transient and therefore perhaps less innately familiar with the state’s tax system. Regardless, competitive bidding for homes implies that only some ill-informed bidders are necessary to drive the overcapitalization result, such that the Ann Arbor experience is unlikely to differ widely from that in other Michigan jurisdictions.

Beyond the behavioral explanations for such confusion, an interesting remaining question is why policymakers and state and local authorities have not been more successful in dispelling misconceptions about the Michigan property tax system in the many years since Proposal A was enacted by making the pop-up tax more salient, especially since one of the primary intentions of assessment limits was to protect homeowners from property tax uncertainty. Ultimately, the aspect of Proposal A most responsible for obscuring the tax implications of acquisition-value assessment limits appears to be the delay in TV uncapping until January 1. Despite the precedent established by California in its use of supplemental assessments to achieve immediate uncapping under Proposition 13, Michigan policymakers opted to forgo tax revenue from a source that would have required no new information reporting in a system already characterized by the use of a real estate transfer tax. Ease of administration hence provides weak justification, at best, for delaying TV

42 More broadly, the same implication holds after allowing for the range of estimates falling within the 95% confidence interval, coupled with uncertainty over the true discount rate or the underlying capitalization rate. For any plausible combination of these, the central point remains that temporary tax savings are capitalized at a multiple of their true value.

43 Neither Campbell (2006) nor Bucks and Pence (2008) translate their estimates into explicit welfare costs. Nevertheless, both can be read to imply costs equivalent to at least a 1 percentage point increase in the mortgage interest rate for a subset of the population. For a $200,000 home, with an 80% loan-to-value mortgage, this corresponds to excess interest payments of approximately $35,000 over the course of a thirty-year loan, roughly triple the average overpayment over a similar period due to overcapitalization of temporary tax savings.

44 Regrettably, no other assessment limit state possesses the necessary combination of policy features to allow for a direct test of this conjecture, most important being the existence of annual market value reassessments.
uncapping; instead, a plausible explanation for this decision is that policymakers did not want to discourage home ownership by immediately hitting new home buyers with large tax increases.\(^{45}\)

An important implication of homebuyers compensating sellers as if their temporary capped TV benefits were permanent is that concerns over the lock-in effect of acquisition-value-based assessment limits are substantially mitigated or even eliminated. Deviation from the policy framework of Proposition 13 may hence have been desirable from the perspective of mitigating efficiency losses due to reduced homeowner mobility. However, weighing against any such welfare improvements are potentially consequential welfare losses associated with homebuyers’ inattention and their resulting choices over suboptimally high housing consumption levels—only a portion of which will be recouped through transfers to sellers due to diminishing marginal utility and transaction costs. Homebuyers have thus borne an increasing share of property tax increases due to TV uncapping, consistent with the prediction in Chetty et al. (2009) of diminished tax incidence on sellers in markets where consumer inattention reduces the tax-inclusive price elasticity of demand. While calculation of these offsetting welfare consequences is beyond the scope of this paper, the evidence presented here should reinforce the emerging view that governments ought to seriously consider the possibility of taxpayer inattention as an integral component of tax policy design so as to minimize undesirable distortions, while simultaneously being wary of fostering large optimization errors and effecting potentially unintended transfers.

\(^{45}\) Continued concern for this issue among state policymakers led to an attempt in March 2007 to provide a boost to the Michigan housing market by enacting an eighteen-month moratorium on the pop-up tax. The bill ultimately failed to pass the Michigan Senate, and the concern largely evaporated with the further collapse of the housing market (and therefore the importance of the pop-up tax) soon after.

**REFERENCES**


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