The Effect of Property Taxes on Location Decisions:
Evidence From the Market for Second Homes

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Abstract

While there exists a large empirical literature on the capitalization of property taxes into home prices, very little work has been done to identify the effect of differences in property taxes on location choices. Further, what empirical work has been done typical suffers from identification problems due to aggregation bias, tax endogeneity, and confounding influences from the link between tax rates and the provision of public goods that are funded by these tax rates. In this paper, we identify the effect of differential school tax rates on location choices in the second home market. We are able to overcome the typical identification problems by: 1) focusing on purchasers of second homes who arguably receive no benefits from school expenditures in their second home locations; 2) using a unique tax data base with a high degree of spatial resolution; and, 3) identifying the effects of differential tax rates using an exogenous change in the distribution of school tax rates in Michigan that arose as a result of the passage of 'Proposal A' in 1994. Our results provide some of the clearest evidence to date that net jurisdictional mobility depends both on tax differentials and housing supply elasticity.

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Table of Contents

The Effect of Property Taxes on Location Decisions: Evidence From the Market for Second Homes

1 Introduction

Both theoretical and empirical economists have written extensively on the link between property taxes and housing prices. However, little has been written on the related issue of the link between property taxes and community choice. This is especially true in terms of empirical evidence regarding the role of pure-tax effects on location choice. One likely reason for this lack of empirical evidence is the difficulty of separating out tax effects from the intimately linked effect of the public goods the taxes provide. This identification problem is further exacerbated by limited availability of property tax data with a high degree of spatial resolution.

In this paper, we break the link between school tax levels and public good provision by focusing on the second home market in the state of Michigan – arguing that consumers of second homes do not benefit from expenditures on public schooling in their second home community. Further, by combining spatially identified jurisdiction-level tax data with an exogenous change in the distribution of property tax levels that occurred in response to Michigan's adoption of "Proposal A", we overcome many of the empirical issues that have confronted previous attempts to isolate the effect of tax rates on location choice. Our empirical results provide some of the strongest evidence to date on the responsiveness of home purchasers to differences in property tax rates conditional on housing supply elasticity.

2 Background

Since Tiebout's (1956) seminal work on competition between local jurisdictions, public economists have argued that individuals vote with their feet and locate to jurisdictions which provide their favored tax/public goods pair. On the tax side, theoretical work has focused on the way in which the Tiebout mechanism causes changes in the tax rates to be capitalized into housing prices. Hamilton (1975), Henderson (1980) and Henderson (1985) argue that capitalization will not occur if there is a perfectly elastic supply of housing. As households migrate into a jurisdiction, an entrepreneur supplies them with a new housing stock, leaving the current housing prices unchanged. This free building of structures does not cause capitalization in the existing stock since the increased demand is reflected solely in new buildings. On the other side of the debate, Yinger (1982), Yinger (1995), Wheaton (1993), Hoyt (1999), and Epple (1981), argue that capitalization will occur, as long as the housing supply function is upward sloping [1].

Empirical work has also largely focused on capitalization instead of mobility. Some of the earliest work on the capitalization effect was undertaken by Orr (1968) and Oates (1969). Oar's analysis supported the hypothesis of no capitalization, while Oates found a capitalization effect. More recently, Brasington (2002) estimated the housing price hedonic for both the interior and edge of an urban area and found that supply elasticity and public good expenditures capitalization are inversely related. While the magnitude of public goods capitalization is an ongoing debate its

[1] See Brasington (2002) for an in depth discussion and empirical test of the inverse relationship between capitalization and housing supply elasticity.

inverse relationship with supply elasticity is, for the most part, accepted.[2] From the perspective of tax-induced migration, this finding suggests that when supply is inelastic migratory responses will be muted by tax change driven price adjustments. Conversely, when supply is elastic (such as in exurban areas) prices will be less sensitive to tax changes and thus will not have a dampening effect on migratory responses.

Direct estimation of the tax effect on mobility suffers from several identification issues. First, a key problem is separately identifying the effect of tax differentials from the effect of the differences in public goods provision associated with these tax differentials. This identification problem is made more difficult when, as is typical, aggregate data is used. Even when the sample is split along observables such as race and income in an attempt to proxy for different demands for taxes and public goods it is likely that collinearity between fiscal and public goods combined with unobserved heterogeneity in tastes for these community attributes will tend to bias estimates of the impact of fiscal characteristics towards zero.[3] In more recent work, Farnham and Sevak (2006) use a novel approach to this particular problem. They argue, based upon a life-cycle model of mobility, that the migration of 'empty-nesters' will be sensitive to differences in school taxes, but not to the public goods (public schooling) that these taxes provide. They find evidence that these 'empty nesters' are sensitive to differences in school tax and expenditure patterns in states where these differences are not muted by state-level equalization plans. A second identification issue is data driven. Because there is no nationwide data on property taxes, imprecise proxies such as property tax revenues per capita are typically used. Additionally, these measures are typically aggregated to the state or county level.[4] One would expect the measurement error imparted by these approximations to bias mobility effects toward zero. Additionally, the impact of housing supply elasticity on tax-induced migration is obfuscated by this large spatial aggregation.

A final identification issue that has received less attention in the literature is the potential endogeneity of tax levels. For example, Anderson (2006) provides empirical evidence that expenditure levels are endogenously determined by the presence of a vacation home tax base. In his study of the vacation home market in Minnesota, he finds that a one-percent increase in the size of the second home tax base resulting from an exogenous change in assessment ratios leads to an expected .36% increase in per capita public goods spending. Because our analysis focuses explicitly on the market for second homes, we need to control for this potential endogeneity.

It is not clear that the endogeneity concern is limited to these specific cases. For example, consider the work by Farnham and Sevak (2006) on 'empty-nesters'. If unobserved location attributes attract the 'empty-nest' tax base, then, given the assumption regarding the tastes of these households for lower tax rates one would expect to see lower tax rates in these areas - driven by the voting behavior of the 'empty-nest' tax base itself. Given this mechanism, it would appear

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[2]The literature on capitalization is extensive and an excellent survey on both the theoretical arguments and empirical results is found in Ross and Yinger (1999)

[3] Examples of this type of analysis include Cebula (1974) Cebula (2002), K. Conway and Houtenville (1998), K. Conway and Houtenville (2001), and K. Conway and Houtenville (2003).

[4] See for instance: Conway and Houtenville (1998, 2001, 2003), Dresher (1994), and Duncombe et al. (2003).

the ‘empty-nesters’ prefer locations with a lower tax rate, when in fact it is the effect of amenities that is the driving force in mobility which is then determining the tax rate.[5] This result is found in recent work by Conway and Rork (2006), where the authors show that elderly migration patterns are not driven by the presence of EIG (Estate, Inheritance, or Gift) taxes but rather that the causation does, in fact, run in reverse.

Our analysis overcomes these identification issues by focusing on the impact of local property tax changes in Michigan between 1993 and 1995 on the distribution of second homes in the state. These tax changes arose as a result of ‘Proposal A’, a state-wide overhaul of the school funding mechanism which was passed by Michigan voters in 1994. Proposal A lowered resident property tax rates at the expense of the vacation home market[6]. The law had three main components. First, in order to facilitate revenue equalization, a significant portion of school funding was shifted away from local property taxes to a statewide sales tax. Secondly, a statewide 6 mill property tax was levied and redistributed by the state. Finally a homestead property tax exemption was implemented that allowed local taxing authorities, in this case school districts, to provide tax relief of 18 mills ($18 for every $1,000 of taxable value) for an individual’s primary residence. This policy change made it possible for local school districts to shift a greater portion of their local property tax burden onto the owners of vacation homes. While there was almost no meaningful variation in the jurisdiction’s choice of tax differential[7] there was marked variation in the tax changes experienced by second homeowners in different locations. The important effect of this policy was that, once we control for the initial distribution of housing types and school tax levels, the change in tax rates can be treated as an exogenous “natural experiment” - thus solving any potential endogeneity problem associated with the link between second home populations and tax rates. Further, as was the case with the analysis of Farnham and Sevak (2006), the population of interest can be reasonably assumed to be indifferent to the distribution of school expenditures. We therefore needn’t worry about the confounding interactions of tax rates and public goods provision.

Finally, we have constructed a tax data set with a very high level of spatial resolution (identifying tax rates down to each individual taxing jurisdiction). This high resolution data overcomes two traditional obstacles – state level aggregation bias and the inability to control for differences in migratory responses associated with different supply elasticities.

3 Data

Our study area is the entire state of Michigan. The data for our analysis fall in to three main categories. First, we identify a set of spatially delineated communities that form the basis of our analysis and use Census data to identify the number of second homes in each of these communities for the years 1990 and 2000. Additionally, to control for potential differences in housing supply across these communities, we use the Census delineation as Urban vs. Non-urban under the assumption that supply elasticities will be higher in the less developed non-urban communities. Second, a spatially delineated tax rate dataset which identifies taxes for each level of

[5] Because the vacation home population does not have a vote in the jurisdiction where the vacation home is located, this particular source of endogeneity is not a concern in our analysis.

[6] Courant, Gramlich, and Loeb (1995) provides a detailed analysis of this law, especially its implications for school finance.

[7] The State of Michigan forced most local school districts to move to the 18 mill differential.

local government is constructed for the years 1993 thru 2000. This spatial tax rate data is then used to compute the tax levels for each of our communities. Finally, for each of the communities, variables are constructed to control for additional determinants of second home demand.

3.1 Communities and the Prevalence of Second Homes

Our measure of the prevalence of second homes comes from the 1990 and 2000 Decennial Censuses identified at the Tract Level. Unfortunately, Census Tract boundaries often change from Census to Census. As a result, it is not possible to use Census Tract boundaries to directly delineate communities when evaluating the change in the number of second homes between 1990 and 2000. To overcome this problem, we identify sets of 1990 and 2000 tracts that when aggregated together share a common boundary across both Censuses. In the remainder of the paper, we refer to these aggregated groups of tracts as 'aggroups'. The State of Michigan is covered by 1830 aggroups. These are aggregated from 2533 and 2721 tracts in the 1990 and 2000 Census, respectively.

Given our aggroup definitions, we next construct a measure of both the number of second homes and the density of second homes in each aggroup. This is done as follows. First, for both 1990 and 2000 Decennial Censuses, we take the reported number of second homes in each tract and sum across all tracts in a given aggroup. Next, the by-aggroup vacation home counts are divided by the area of each aggroup - yielding a measure of the density of second homes in each aggroup (Second Homes/Km ^{2}). An additional complication is the presence of large areas of publicly owned land in Michigan. By definition, these areas have been removed from potential development. To provide a more appropriate measure of the level of second home development in each aggroup, we use a GIS dataset (described below) on the location of publicly owned lands acquired from the Michigan Department of Geographic Information to exclude these publicly owned lands when calculating the area of each aggroup. Similarly, GIS water boundary data is used to exclude lakes and rivers when calculating the area of each aggroup. Panel 1 of Figure 1 displays the 1990 vacation home densities and Panel 2 of the figure displays the change in density from 1990 to 2000.

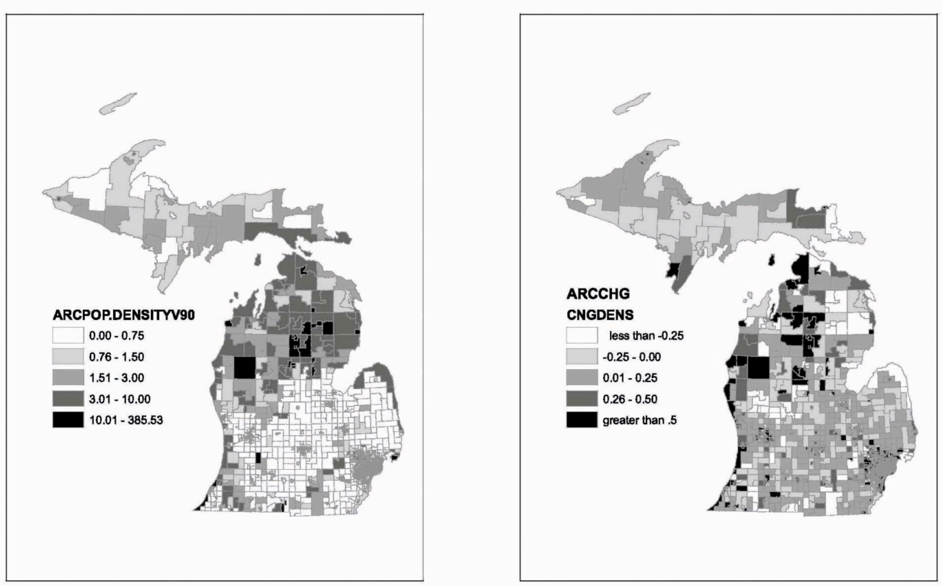


Figure 1: 1990 Vacation Home Density and 1990 to 2000 Change in Density

Finally, in order to control for differing housing supply elasticities across aggroups, we create a dummy variable for urban areas - aggroups where greater than 90% of the component tract areas are classified as urban in the 1990 Decennial Census. There are three specific reasons for using an urban dummy variable. First, the population densities tend to be higher in urban areas than rural areas. Secondly, the presence of more severe zoning restrictions in urban areas may also cause housing supply to be less elastic than in rural areas. Finally, a very dense location (within or outside of a city) may be driven by unobservable community characteristics such as amenities. For these reasons, the urban designation is preferred to simply controlling for population densities as a control for housing supply elasticity.

3.2 Tax Rates

School district tax rates for each school taxing jurisdiction for the years 1993 thru 2000 were obtained from the Michigan State Tax Commission and the Department of Treasury Office of Revenue and Tax Analysis. One limit of our data is that while second home counts are available for 1990 and 2000, the tax change that we are interested in occurred between 1993 and 1995 (the two year lag reflects the fact that it took two years for these adjustments to be completed). Figure 2 displays the distribution of these tax changes. Potential issues arise due to the limitations associated with the decennial nature of the Census. While using 2000 second home counts is consistent with an expected lag in the adjustment of second home populations to changes in the tax rates, biases could be introduced by including changes in second home counts that occur between 1990 and 1993. Two specific concerns exist. First, assuming taxes were constant between 1990 and 1993, inclusion of the changes that occur over this time frame will introduce measurement error in our dependent variable which may weaken the precision of our estimates.[8] Of greater concern is the possibility that tax changes occurred between 1990 and 1993 that are correlated with the 1993-1995 changes - thus, biasing our estimates. Table 1 presents the correlation between tax rates for adjacent years from 1990 to 2000. Because we have been unable to locate school district level data for the years 1990-1992, county aggregates are used for the first three year pairs. District level correlations are presented for the remaining year pairs. These correlations clearly show that tax rates are stable prior to the 1993-1995 period when the Proposal A driven tax changes occurred. A final concern is that changes in second home counts are being driven by tax changes that may have occurred after the 93-95 changes. Again, the data suggest that tax rates were stable following the Proposal A adjustments. Below, we test for the sensitivity of our results by examining 1995-2000 tax changes. This analysis suggests that post 1995 changes are not driving our empirical results.

[8] In our analysis this concern is partially alleviated by the inclusion of 1993 school tax rates as a control variable.

Figure 2: Distribution of 93-95 School Tax Changes

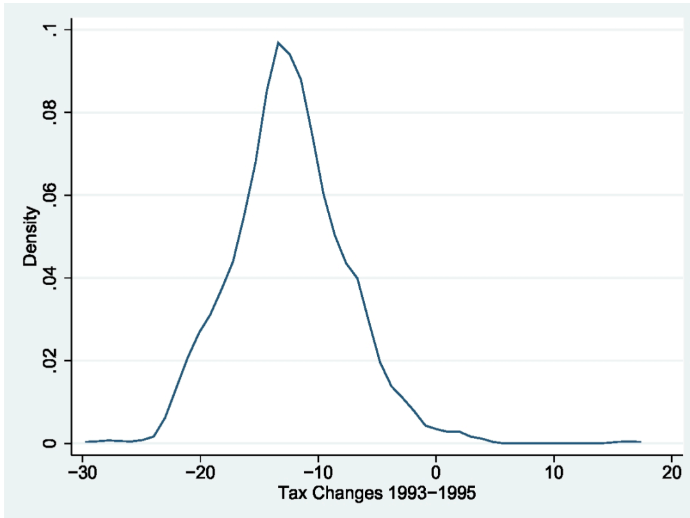


Table 1: School Millage Rate Correlations 1990-2000

Years	90-91	91-92	92-93	93-94	94-95	95-96	96-97	97-98	98-99	99-00
Cnty	0.9779	0.9739	0.9680							
Dist				0.2093	0.4205	0.9394	0.9545	0.9669	0.9718	0.9707

In order to identify school tax rates for each aggroup, Census TIGER files were used to identify the spatial location of each school taxing jurisdiction in the state. These tax jurisdictions were then overlaid onto the corresponding census locations. The task of attaching tax rates to these aggroups is complicated by the fact that the tax jurisdictions do not share common borders with the aggroups. To address this problem, for each aggroup we compute the area weighted average tax rate. This area weighted average is given by equation 1:

$$\bar{\tau} = \frac{1}{A}\sum_{i=1}^{N} a_i \tau_i \qquad (1)$$

where A is the total aggroup area, a_i is the area covered by tax rate τ_i and N is the total number of unique tax jurisdictions within the aggroup.

One potential concern with this approach is the possibility for aggregation bias which could lead to attenuation of the parameter estimates on the tax variables due to measurement error. So that we could identify those aggroups with the largest potential for this type of bias and implement sensitivity analysis, we constructed tax dissimilarity indices for each aggroup. These indices accounted for the deviations from the area weighted average tax within the aggroup, while at the same time scaling these deviations by the sub-area of the deviating tax coverages. Specifically, the formula for this index is given in equation 2:

$$TaxSim = \frac{1}{A}\sum_{i=1}^{N} a_i\,(\tau_i - \bar{\tau})^2 \qquad (2)$$

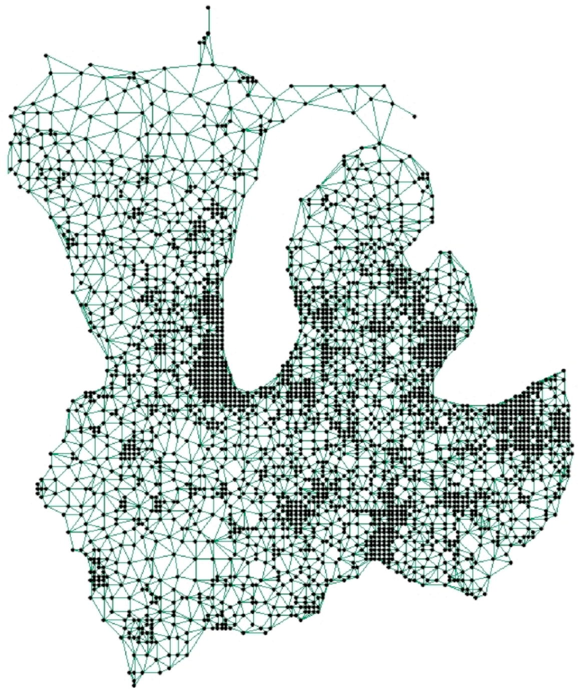
where all variables are defined as above for equation 1.

3.3 Additional Determinants of Second Home Demand

Finally, data was constructed to control for other determinants of second home demand. The first set of control variables captures the effect that large numbers of potential vacation home-owners have on the number of second home-owners in a given location. According to the National Association of Realtors, Typical vacation-home buyers in 2005 were 52 years old, earned $82,800, and purchased a property that was a median of 197 miles from their primary residence. In order to develop measures of potential demand, demographic data was collected for all tracts within the five states that share a boundary with the state of Michigan. This data was used to compute the count of householders between the age of 45 and 64 years old with a median income greater than $50,000 for both 1990 and 2000. We then computed the count of the householders that lived within 10, 50, 100, 250 and 500 miles of each aggroup. For each aggroup, this data was then used to construct counts of potential second home buyers residing in a set of four distant bands (10-50 miles, 50-100 miles, 100-250 miles, and 250-500 miles). Changes in these counts between 1990 and 2000 were also computed.

The distance calculations were complicated by the fact that for the Great Lakes region, distances need to be constructed over a non-convex surface. For instance, if an individual with a house in Chicago wanted to travel to Traverse City, Michigan, she would need to drive around Lake Michigan. Thus, simply calculating the straight line distance from the centroid of her home census tract to the centroid of the appropriate aggroup in Traverse City would greatly underestimate the true distance. To compute appropriate distances, which account for the need to travel around the Great Lakes, we first constructed a network of paths connecting all potential first home locations and all aggroups (see figure 3). For all possible combinations of first and second home locations, we then compute the shortest distance using a modified Dijkstra algorithm on the network and used this as the travel distance between the two locations.

Figure 3: Five State Distance Network



The second set of control variables account for the presence of public lands and bodies of water. In Northern Michigan and the Upper Peninsula, public lands comprise a large percentage of the total land area. These public lands include State and National Forest, State Parks, Military land, State Recreation Areas, State Wildlife Research Areas, and land under control of the Nature Conservancy. These lands are important for two reasons. First, the presence of public lands may be viewed as an amenity by vacation home owners because they provide public access to lands which may be used for recreational purposes. Second, the presence of public lands must be accounted for when the density of vacation homes is computed within an aggroup. Without this accounting, the density of development will be underreported, and the vacation home development potential would be overstated. To identify the public lands area in each aggroup, public lands boundary data provided by the Michigan Department of Geographic Information was intersected with the aggroup boundary files and the area of intersection was then calculated.

Lakes and Rivers are similarly important potential drivers of second home demand and have been identified by The National Association of Realtors as a major determinant in the location choices of vacation home owners. As with public lands, it is not only important to control for the amenity value, but also to remove from the computed aggroup area the portion covered by water. To identify these areas, year 2000 Census water boundary maps were combined with lake and river data from the State of Michigan Geographic Data Library and GIS routines were used to address differences in the boundary files. Two separate measures were constructed using this data. First, the area within each aggroup covered by water was computed in the same manner as was the area of public lands. Second, in order to measure the potential for waterfront development, the percentage of the total land area within each aggroup located within 100 meters of a shoreline was computed.

Finally, tract-level Census data was aggregated to the aggroup level to develop a set of demographic control variables. These variables include median income of aggroup residents, the percentage of aggroup residents that own their home, and the density of first homeowners in the aggroup (constructed in the same manner as the second home density variable). Summary statistics for all variables are presented in table 2.

Table 2: Summary Statistics

Summary Statistics (N=1828)		
Variable	Mean	Std. Dev.
chgVseasDensity	0.75	2.90
chg9395s	-13.69	6.74
chg9500s	1.06	2.14
m93s	35.88	4.98
m95s	22.16	4.27
m00s	23.23	3.72
pctAreaPublic	0.04	0.11
pctVacation90	0.08	0.27
medianIncome90	4.31	5.02
DensityFH90	494.75	521.75
DensityV90	1.93	10.71
pctlake	0.01	0.04
pctlakesq	0.00	0.02
nolake	0.75	0.43
Demand10o50in90	11.43	7.53
Demand50to100in90	12.77	8.05
Demand100to250in90	67.40	23.68
chgDemand10to50	9.16	5.24
chgDemand50to100	11.59	6.14
chgDemand100to250	62.99	19.73

4 Estimation and Results

As discussed above, our strategy for identifying the impact of school tax rates on second home development leverages the change in tax rates that occurred in Michigan between 1993 and 1995 as a result of the passage of Proposal A. This new law led to a complete re-alignment of property tax rates in the state of Michigan. Because these changes were driven by a state-level shift in policy and because the owners of second homes are not consumers of local school expenditures, this 'natural experiment' overcomes most of the problems with confounding influences that typically plague analysis of a pure tax effect on location choice. There is however one important caveat. The changes that occurred as a result of the new law were systematically linked to pre-change tax revenues. As a result, to insure that we are identifying an actual response to differential changes in tax rates, in our regression analysis we control for pre-change tax levels and pre-change levels of first and second homes. The inclusion of the baseline tax rates also helps to account for the fact that pre-tax change migration might have been driven by differences in the pre-tax change millage rates. Additionally, the urban dummy variable is interacted with both the tax change and baseline millage rate in order to control for the differential effects on mobility as a result of differing housing supply elasticities.

A further wrinkle in the data is the significant heterogeneity in size across aggroups. To account for this heterogeneity, we use as our dependent variable the density of second homes (number of second homes in the aggroup divided by the area of the aggroup that is neither public lands nor water). Finally, the urban dummy variable describing housing supply elasticity variable is included in the regression. This variable is interacted with both the tax change and baseline tax in order to control for the fact that the effect of taxes on mobility may be less in urban areas than rural areas.

The Basic model for estimation is given in equation 3.

$$\begin{aligned}\Delta VseasDensity_i = &\\ &\beta_1 + \beta_2 \Delta Tax_i + \Delta\beta_3 Intchg_i + \beta_4 BaselineTax_i + \beta_5 IntBaselineTax_i \\ &+ \beta_6 dumUrban + \beta_7 Demographics_i + \beta_8 Amenities_i + \beta_9 Demand_i \\ &+ \beta_{10} \Delta Demand_i + C_i + \mu_i\end{aligned} \tag{3}$$

Where $\Delta VseasDensity_i$ is the change in vacation home density in aggroup i from 1990 to 2000, ΔTax_i is the change in the tax rates between 1993 and 1995, $\Delta\beta_3 Intchg_i$ is the tax change interacted with the urban dummy variable, $BaselineTax_i$ is the 1993 tax rate, $IntBaselineTax_i$ is the Baseline tax interacted with the urban dummy variable, $dumUrban$ is the urban dummy (equal to 1 if census designated urban area, 0 otherwise), $Demographics_i$ consists of demographic controls such as median income and first and second home densities in 1990, $Demand_i$ are the relevant population in each distance band in 1990, and $\Delta Demand_i$ are the changes in the relevant populations located in the distance bands from 1990 to 2000. Finally, C_i is a county-specific fixed effect for the county in which aggroup i is located. As a result of the inclusion of these county fixed effects the model identifies changes in the distribution of second home locations that are driven by within county variation in the 1993-1995 tax rate change - controlling for within county variation in the other incorporated covariates.

Estimation results, including several sensitivity tests, are presented in Table 3. Model 1 reports results for the basic specification of equation 3. Model 2 controls for the fact that the simple model puts equal weights on aggroups with no second homes and those with large numbers of second homes, running a weighted regression using the number second homes in 1990 as weights.[9] Model 3 tests for the impact of outliers, dropping the 10 aggroups with the biggest gain and biggest loss in second home density. Model 4 both weights by second home population and drops outliers. Finally, model five addresses the issue of possible aggregation bias associated with aggroups which incorporate multiple school districts with different tax rates. This is done by dropping those observations that fall in the highest quartile of the dissimilarity index. In other words, the 1172 aggroups which have the least aggregation bias are used in this regression.

[9] Sample size drops in this model because ten aggroups contain no second homes in 1990.

Table 3: Change in Second Home Density (Based on 1993-1995Tax Change)

	Model1	Model2	Model3	Model4	Model5
chg9395s	-0.107**	-0.227***	-0.025	-0.060***	-0.056***
	(-2.15)	(-6.10)	(-0.98)	(-5.23)	(-2.86)
intchg	0.099*	0.124	0.020	0.084***	0.074**
	(1.87)	(1.27)	(0.73)	(2.79)	(2.09)
m93s	-0.253***	-0.453***	-0.071**	-0.099***	-0.105***
	(-3.66)	(-8.91)	(-2.00)	(-6.16)	(-3.97)
int93	0.157**	-0.011	0.002	-0.048	-0.048
	(2.10)	(-0.07)	(0.05)	(-0.94)	(-0.84)
dumUrban	-4.350**	-1.433	0.373	2.537*	2.423
	(-2.01)	(-0.30)	(0.34)	(1.67)	(1.45)
perVacation90	-0.780	-0.349**	-0.352	-0.257***	-0.499***
	(-1.64)	(-1.98)	(-1.35)	(-4.29)	(-6.51)
medianIncome90	0.002	-0.022*	0.008	0.003	-0.011
	(0.12)	(-1.77)	(1.09)	(0.79)	(-1.41)
pctAreaPublic	-1.114	0.169	-0.689	0.727***	1.012***
	(-1.01)	(0.34)	(-1.22)	(4.52)	(4.25)
DensityFH90	0.002***	0.010***	0.001***	0.003***	0.003***
	(7.36)	(9.96)	(8.66)	(7.33)	(7.23)
DensityV90	0.038***	0.023***	0.011**	0.015***	0.016***
	(4.38)	(7.10)	(2.46)	(14.54)	(13.82)
pctlake	15.268***	14.456***	3.748	5.021***	2.671
	(4.27)	(5.79)	(1.46)	(4.29)	(1.59)
pctlakesq	-28.631***	-26.218***	-5.108	-9.686***	-6.098
	(-4.18)	(-8.02)	(-0.70)	(-3.27)	(-1.40)
nolake	0.464*	0.237	0.203	0.131*	0.037
	(1.83)	(0.96)	(1.51)	(1.71)	(0.39)
Demand10to50in90	0.147	-0.810**	0.155*	0.165	0.144
	(0.85)	(-2.02)	(1.75)	(1.31)	(0.81)
Demand50to100in90	0.023	0.099	-0.003	0.389***	0.362*
	(0.08)	(0.26)	(-0.02)	(3.14)	(1.72)
Demand100to250in90	-0.245	-0.390	-0.237	0.123	0.038
	(-0.75)	(-1.18)	(-1.43)	(1.20)	(0.18)
Demand250to500in90	-0.326	-0.753**	-0.340*	-0.051	-0.172
	(-0.93)	(-2.34)	(-1.91)	(-0.51)	(-0.76)
chgDemand10to50	-0.241	1.137**	-0.251*	-0.224	-0.217
	(-0.83)	(2.16)	(-1.70)	(-1.36)	(-1.02)
chgDemand50to100	-0.045	-0.409	0.031	-0.486***	-0.491**
	(-0.12)	(-0.89)	(0.15)	(-3.33)	(-2.25)
chgDemand100to250	0.371	0.395	0.370*	-0.126	-0.029
	(0.95)	(1.08)	(1.87)	(-1.12)	(-0.14)
chgDemand250to500	0.446	0.893**	0.466**	0.068	0.179
	(1.08)	(2.54)	(2.23)	(0.62)	(0.80)
cons	-9.281	-1.331	-14.439*	-0.061	2.172
	(-0.61)	(-0.21)	(-1.84)	(-0.03)	(0.33)
r2	0.117	0.388	0.162	0.589	0.607
N	1825.000	1462.000	1787.000	1426.000	1172.000
Prob > F	0.724	0.260	0.636	0.404	0.563
Outlier Trimming	No	No	Yes	Yes	Yes
Population Weights	No	Yes	No	Yes	Yes
Similarity Control	None	None	None	None	sim00s < 6.8

Because, by construction, the weighted models (two, four and five), place more emphasis on those locations that comprise the bulk of the second home market in Michigan, we believe they will most accurately reflect the 'average' tax effect. For this reason, and because we are also concerned about the effect of outliers and the possibility of attenuation bias from aggregating multiple tax rates within some aggroups, we focus our discussion of the results on models four and five which we believe to be the most robust specifications. These specifications are identical and include all controls, except for the fact that model five drops those aggroups containing the most variation in within-aggroup tax rates. We would however note that our results are consistent across all specifications.

First, we consider the estimated effects for the control variables - focusing on those variables that are significant determinants of changes in second home density. In both models, higher percentages of the housing stock in use as second homes in 1990 is associated with lower rates of growth in second home density. While higher overall development densities (in terms of both first and second homes) is significantly and positively associated with growth in second home densities. As expected, the effect of the presence of public lands in the aggroup is both positive and significant. To allow for flexibility in the effect of access to lake frontage, we include both an indicator for the presence of no lake frontage and both linear and quadratic terms for the percentage of the aggroup in lake frontage. Both models predict that the change in second homes is increasing in percent lake frontage over the bulk of the observed distribution in lake frontages. However, these terms become insignificant when the sample size is reduced to control for tax heterogeneity within the aggroups. Finally, while jointly significant, the distanceXpopulation demand variables are all individually insignificant. This is likely due to the fact that inclusion of county fixed effects greatly reduces the relevant variation in these variables.

The model includes two different tax variables, the 1993 school millage rate (m93s) and the 1993 to 1995 change in the school millage rate. Both of these tax variables are interacted with the housing supply elasticity (urban) dummies. The 1993 tax rates are included as controls, and their coefficient may be biased due to the endogeneity issues discussed above. Coefficient estimates for this variable are negative and significant in all models, suggesting that second home-owners are sensitive to tax rates. However, we are sensitive to the fact that endogeneity could be a serious issue with this variable and are hesitant to draw strong conclusions from this particular result. Had endogeneity not been a concern, we would expect the coefficient on the interaction between our elasticity dummy and the 1993 tax rate to be positive – reflecting the fact that when supply is inelastic upward price adjustments would will offset the pull associated with lower tax rates. In our least robust specification, Model 1, this coefficient is positive and significant. In all other specifications this coefficient is not significantly different from zero. While numerous factors could drive this result, we take it as further evidence of the importance of focusing attention on the tax change associated with our natural experiment.

Finally, we consider the impact of our exogenous tax instrument, the change in tax rates between 1993 and 1995. This coefficient is negative in all models and highly significant in all models except for model 3. Focusing on our preferred models 4 and 5, the estimates suggest that in rural areas a one standard deviation increase in this change is associated with a slower rate of growth in second home density of between .25 and .3 second homes per square kilometer (approximately 1/10th of the observed standard deviation in the sample). Turning to urban areas, where we expect constrained supply elasticities to result in offsetting price changes, we find that all 5 models yield the expected positive sign on the interaction between urban and the tax change (intchg). The coefficient is significant in 3 of the five models, including models 4 and 5 which are the most robust specifications. For all models except model 2, An F-test on the total effect of the change in urban areas (sum of the coefficients on chg93953 and intchg) reveals that we can't reject the null hypothesis that the total effect on migration in urban areas is equal to 0. These differing results between urban and non-urban areas support the hypothesis that household tax-induced mobility is present in locations with a higher housing supply elasticity.

One possible remaining concern is that our results are driven by other changes in tax rates that occurred between 1995 and 2000. As a sensitivity analysis, Table 4 presents results for the same models, only using 1995-2000 tax changes as our policy variable. These results suggest that tax changes from 1995-2000 are not driving the location decisions of the vacation home population. [10] Taken together, the coefficients on the 1993 school millage rate and the 1993-1995 change in millage rates provides some of the strongest evidence to date of a pure-tax mobility effect and its link to the elasticity of housing supply.

Table 4: Change in Second Home Density (Based on 1995-2000 Tax Change)

	Model1	Model2	Model3	Model4	Model5
chg9500s	0.014	0.101*	0.011	0.014	0.009
	(0.23)	(1.92)	(0.36)	(0.85)	(0.47)
int9500s	0.001	-0.054	0.020	-0.056	-0.026
	(0.01)	(-0.26)	(0.55)	(-0.89)	(-0.39)
m93s	-0.138***	-0.234***	-0.044**	-0.039***	-0.049***
	(-3.17)	(-6.68)	(-1.98)	(-3.55)	(-2.82)
int93	0.051	-0.092	-0.020	-0.135***	-0.128***
	(1.07)	(-0.92)	(-0.84)	(-4.19)	(-3.56)
dumUrban	-1.958	-0.211	0.890	4.594***	4.278***
	(-1.14)	(-0.06)	(1.02)	(4.03)	(3.38)
perVacation90	-0.753	-0.314*	-0.337	-0.227***	-0.490***
	(-1.58)	(-1.76)	(-1.29)	(-3.78)	(-6.30)
medianIncome90	0.002	-0.016	0.008	0.004	-0.012
	(0.10)	(-1.30)	(1.13)	(1.11)	(-1.51)
pctAreaPublic	-1.095	0.361	-0.695	0.786***	1.066***
	(-0.99)	(0.71)	(-1.22)	(4.85)	(4.45)
DensityFH90	0.002***	0.010***	0.001***	0.003***	0.003***
	(7.35)	(10.03)	(8.62)	(7.26)	(7.21)
DensityV90	0.038***	0.023***	0.011**	0.014***	0.015***
	(4.41)	(6.96)	(2.47)	(14.32)	(13.71)
pctlake	15.212***	15.410***	3.661	5.597***	3.606**
	(4.25)	(6.10)	(1.43)	(4.75)	(2.17)
pctlakesq	-28.679***	-27.066***	-5.097	-11.250***	-8.533**
	(-4.19)	(-8.18)	(-0.70)	(-3.76)	(-1.98)
nolake	0.442*	0.210	0.202	0.134*	0.027
	(1.75)	(0.84)	(1.50)	(1.73)	(0.28)
Demand10to50in90	0.154	-0.673*	0.160*	0.144	0.094
	(0.91)	(-1.72)	(1.86)	(1.18)	(0.57)
Demand50to100in90	0.033	0.146	-0.001	0.326***	0.286
	(0.11)	(0.38)	(-0.01)	(2.68)	(1.46)
Demand100to250in9	-0.210	-0.112	-0.232	0.157	0.035
	(-0.65)	(-0.34)	(-1.42)	(1.57)	(0.18)
Demand250to500in9	-0.300	-0.632**	-0.333*	-0.050	-0.186
	(-0.86)	(-1.97)	(-1.88)	(-0.50)	(-0.86)
chgDemand10to50	-0.248	0.968*	-0.261*	-0.203	-0.163
	(-0.86)	(1.86)	(-1.78)	(-1.25)	(-0.79)
chgDemand50to100	-0.046	-0.374	0.030	-0.386***	-0.396*
	(-0.12)	(-0.83)	(0.15)	(-2.68)	(-1.91)
chgDemand100to25	0.330	0.079	0.364*	-0.171	-0.049

	(0.85)	(0.22)	(1.86)	(-1.54)	(-0.25)
chgDemand250to50	0.415	0.772**	0.458**	0.067	0.174
	(1.01)	(2.19)	(2.20)	(0.61)	(0.81)
cons	-11.294	-6.539	-14.880*	-1.235	3.857
	(-0.74)	(-1.04)	(-1.90)	(-0.64)	(0.60)
r2	0.115	0.373	0.162	0.580	0.603
N	1825.000	1462.000	1787.000	1426.000	1172.000
ftest	0.740	0.814	0.156	0.489	0.798
Outlier Trimming	No	No	Yes	Yes	Yes
Population Weights	No	Yes	No	Yes	Yes
Similarity Control	None	None	None	None	sim00s < 6.8

5 Conclusion

In this paper, we overcome the identification issues that are typically associated with isolating the effect of taxes on housing location choices. Identification is achieved by isolating exogenous changes in the distribution of local school tax rates that arose as a result of the passage of ‘Proposal A’ in Michigan in 1994. We then use a highly spatially disaggregated data set on local property tax rates and focus on the responses in the market for second homes to differential changes in property tax rates. This approach allows us to overcome issues of endogeneity, aggregation bias, and the confounding of tax rates and public goods provision that has been typical of previous empirical work on the subject. Our empirical results provide some of the clearest evidence to date that location decisions are sensitive to differences in property tax rates and consistent with the received wisdom, this migratory response is dampened in areas with inelastic land supplies.

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