**Property Tax Rates and House Prices: The Impact of Relatively High and Low Property Tax Rates**

by

Anthony Pennington-Cross, Norm Miller and Michael Sklarz

**Abstract: Here we investigate and summarize our research on three property tax issues. First, what is the impact of property taxes on home values, given that prior literature is inconsistent on this effect. Second, do higher property tax rates constrain appreciation? Third, how do relatively lower property tax rates tied to the household and tenure, impact home supply and prices?**

**Introduction**

In a classic article by Charles Tiebout (1956) he postulated that households would sort themselves locationally into the fiscal packages that best suits each household.[[1]](#footnote-1) The fiscal package consists of property taxes on the cost side and public services, such as schools, parks, fire protection, police and so forth on the benefit side. This theory could work if we were all locationally mobile, and if we had a variety of fiscal packages to choose from within our feasible locations. According to the theory of optimal public finance, we should see local expenditures increase public services until the benefits exceed or just equal the costs. Those families willing to pay for better schools would accept higher property taxes. Those without children would select areas where schools were less of a priority. But the literature since 1956 has been mixed and the use of property taxes as a dominant source of paying for local services varies by market. Other types of taxes might be used instead, such as hotel taxes or sales taxes or local income taxes. This has made the study of the impact of property taxes on home prices difficult and may explain why the empirical results are mixed. What has made the study even more challenging is that, in some jurisdictions, property taxes vary by length of residency or length since ownership began.[[2]](#footnote-2) This last topic is reviewed later in our discussion.

What property tax revenues were used for, also matters. For example, non-school spending had no impact on property values, while school spending increased property values (Bradbury, Mayer and Case 2001). These finding support the common-sense argument that taxes are viewed negatively, and yet local government does need some revenue to function and provide valued basic services. The question of what is the optimal or efficient property tax rate is much less straightforward. One approach is to define the optimal rate as the one at a local government can maximize the revenue collected. This can conceptually be thought of in the context of revenue hills. At least initially, higher property tax rates increase revenue but at a decreasing rate. Eventually property taxes become so high that revenues decline. In a study covering 4 cities, Houston, New York City and Philadelphia were near the peak of the revenue hill while Minneapolis was well short of the peak (Haughwout, Inman, Craig and Luce 2004). In the greater Toronto area, most local municipalities were very close to the peak and some were beyond the peak of the revenue hill (Tassonyi, Bird and Slack 2015). We observe a range of effective property tax rates by county and state. In Table 1 we show the range of effective property taxes by state, from .27% in Hawaii to 2.44% in New Jersey. At the county level the variation is even greater, with several counties, over 3% per year, like Camden County, NJ at 3.5% or Monroe County, NY at 3.2%, which is similar to having a permanent mortgage payment for life. When we check effective tax rates at the zip code level or below, the individual property level, we observe some rates as high as high as 6% to 9%, but we find within these observations that the dollar amounts are quite low and the values are quite low or that such owners have not bothered to appeal their property tax assessment. For example, in zip code 14744, Richburg, NY, the effective property tax rate is 6.27% of value, but the average listing price is $96,000 in 2020 and the average sold price is $66,000. Few observations are included from such markets, and we note that in most of the US, property tax rates appear to be fairly stable over the last few decades.

We illustrate the concept of optimal property tax rates, from the perspective of a local government, below in Exhibit 1. In this exhibit we suggest that rates above 2.2% will start to be capitalized into value such that affordability and prices are affected, thereby effectively reducing total property tax collections as they continue to increase. It is not clear exactly where the maximum effective rate for revenue collection lies, but our estimate is that it is somewhere north of 2.3%, just north of the rates we observe in Chicago, IL.

**Exhibit 1: Total Revenue Collected Increases as Tax Rates Rise and Then Peak out and Decline**

Early literature on this topic found substantial, if not full, capitalization of property taxes (negatively) and local expenditures on public schools (positively) into home values (for example, Oates 1969, King 1977, Stull and Stull 1991, Man and Bell 1996). However, others found no capitalization (Pollakowski 1973, Wales and Wiens 1974, Follain and Malpezzi 1981 and McMillan and Carlson 1977).

In this paper, we extend the literature by first using a national sample of single-family transactions from May through September in 2019. We use a set of properties as similar as possible in physical attributes and age, so that most of the variation we would expect in prices will be explained by location and property tax rates. We control for other taxes and examine the role of demographic and economic conditions to control for sorting of households by income and preferences. Later, we will also analyze appreciation rates as a function of property taxes and re-visit the impact of property taxes being tied to individual households.

**Data**

The empirical approach used in the first section of this paper is to estimate a standard hedonic model specification that starts with controls for the physical characteristics of the building and land. Using the distribution for a range of vintages and physical attributes, for the USA as a whole, a proto-typical home was identified. Observations were collected as close to this prototype as possible in age, size, lot size, number of bedrooms and baths. Again, the focus of the analysis could then be on the location and property tax variables, where a larger stratification was sought.

Table 2 provides a description of the base variables used in the study. The single-family transaction (no condominiums) data is collected from Multiple Listing Services (MLS) from May through September of 2019. Table 3, which provides the summary statistics with key variables used for the hedonic regression. In total, there are slightly more than 2,900 observed transactions with a large stratification by property tax rates. The average sales price of this sample is approximately $357,000. Table 4 shows the average property tax rate across a variety of buckets. It shows that, on average, higher property tax rates are associated with lower house prices. For example, house prices in locations with the lowest property tax rates (less than 0.5 percent) have an average price of $438,483, while house prices in locations with the highest property rates (2.7 percent or higher) have an average price is $242,520 dollars. Table 5 with Log natural percentage effects roughly corresponds to the concept presented in Exhibit 1 above.

**Results**

Table 4 provides four different Ordinal least Squares results using log-linear specifications. Errors are clustered at the state level. Column I shows the relationship between the log of the property tax rate and the log of the purchase price when no other control variables are used. Consistent with the summary statistics, higher property taxes are associated with lower prices. The point estimate can be interpreted as an elasticity. So, a 10 percent increase in taxes (not percentage points)[[3]](#footnote-3) is associated with a 2.72 percent decline in property value. Column II controls for property and land characteristics. The control variables function largely as expected. Specification II includes fixed effects to control for unobserved factors within each state and over time. This changes the identification of the property tax from variations across all locations to variations within a particular state. This is an important control because of state level property tax restrictions and revenue sharing schemes. In this specification, the magnitude of the property tax rate's impact on prices declines (closer to 0) and becomes statistically insignificant. Column IV includes controls for neighborhood sorting and possible substitution of other types of taxes. After these controls, the property tax rate again has a statistically significant effect on house prices. This result is intuitively consistent with household location sorting. Part of what households pay for with higher property taxes is good schools, good peers, and good economic conditions. After these positive factors are controlled for what is left is the fact that you have to pay taxes, so this should be capitalized negatively into prices.

Table 5 tests for non-linear relationships between property taxes and property values. Specification I looks for the inverted U shape, where very low tax rates could increase property value and at some point higher taxes decrease value. Columns I and II include dummy variables indicating the level of the property tax rate. The excluded category is the lowest tax level (less than 0.5 percent). Column I includes the price on the left hand side and column II includes the price per square foot on the left hand side. All the control variables from the prior table are included. In short, lower tax rates are associated with higher property values. However, the relationship is not linear. The capitalization of the tax rate is fairly stable (and statistically indistinguishable) when property tax rates vary from 0.7 percent to 2.1 percent. As tax rates increase above 2.1 percent, the negative capitalization increases at an increasing rate. For example, using Column 1 coefficients, the capitalization rate for a property taxed at a rate of 2.0 percent is -19 percent (calculated as e-0.215 -1, -0.215 is the coefficient), when compared to the value of the property that paid almost no taxes (less than 0.5 percent). As the tax rate increases to 2.2, 2.4, 2.6 and 2.8 percent, the capitalization rate increases to -21, -27, -30, and -36 percent respectively. In summary, there is little evidence of an inverted U-shaped relationship between tax rates and prices over most of the typical property tax rate range. We observe very little negative capitalization of property taxes over the typical range of .7 to 2.1 percent, however, very high property tax rates increasingly become negatively capitalized in price.

Sensitivity to property tax rates may also depend on the actual dollar amount of property taxes paid. This can reflect the easily identified nature of the property tax bill, as well as the lumpiness of the tax bill. There are also likely fixed costs associated with providing adequate municipal services (such as police and fire stations or public-school buildings), that make marginal services worth paying for at lower dollar levels and less worth paying for at higher dollar values. Column III explores this by interacting indicators of the level of the actual dollars paid for property taxes with the property tax rate. The results indicate that property taxes are not negatively capitalized for the bottom half of the tax bill distribution (property taxes less than $2,058). However, for above average tax bills (property taxes above $2,058), capitalization is strong and negative. A 10 percent increase in the tax rate decreases property value by 3.5 percent. These results echo the non-linear property tax rate results in columns I and II. There is a broad range of locations where modest changes in the property tax rate have modest to little marginal impact on property value. However, as the tax bill (actual dollar amount) rises, increases in property tax rates become strongly and negatively capitalized into house prices.

**Exploring Appreciation Rates versus Property Tax Rates**

On the basis that effective property tax rates impact affordability, and constrain price increases which directly increase the cost to carry a home, we examined the appreciation rates in the largest 200 counties in the US over the period of 2010 through 2018. Below in Exhibit 2 is a scatter diagram comparing the average cumulative price change, using a county level House Price Index, for all 200 counties over this nine year period, albeit without any other variable controls, such as changes in employment within the county. The results, while noisy and containing a variety of influences, still seem to indicate, via the non-linear trend line, stronger appreciation in the lower tax rate counties. Those with tax rates under 1% appreciated far more than those with property tax rates above 1% and those few counties with tax rates above 3% appreciated very little. All of these figures are in nominal terms, so the lower appreciation rates of 20% are akin to flat real price trends.

**Exhibit 2: Cumulative Home Price Appreciation Rates versus Effective Property Tax Rates**

To improve the overview analysis shown in Exhibit 2, we next ran a regression that controlled for the change in employment over this time period, a primary driver of demand for housing and we used our automated valuation models to estimate property values for all single-family property in each county. The results are highly significant and continue to suggest a very significant negative effect on property appreciation in those markets with higher property tax rates. With the price change as the dependent variable and the average county tax rate as one of the explanatory variables we have the following results, all of which are highly significant at the 95% level or higher.

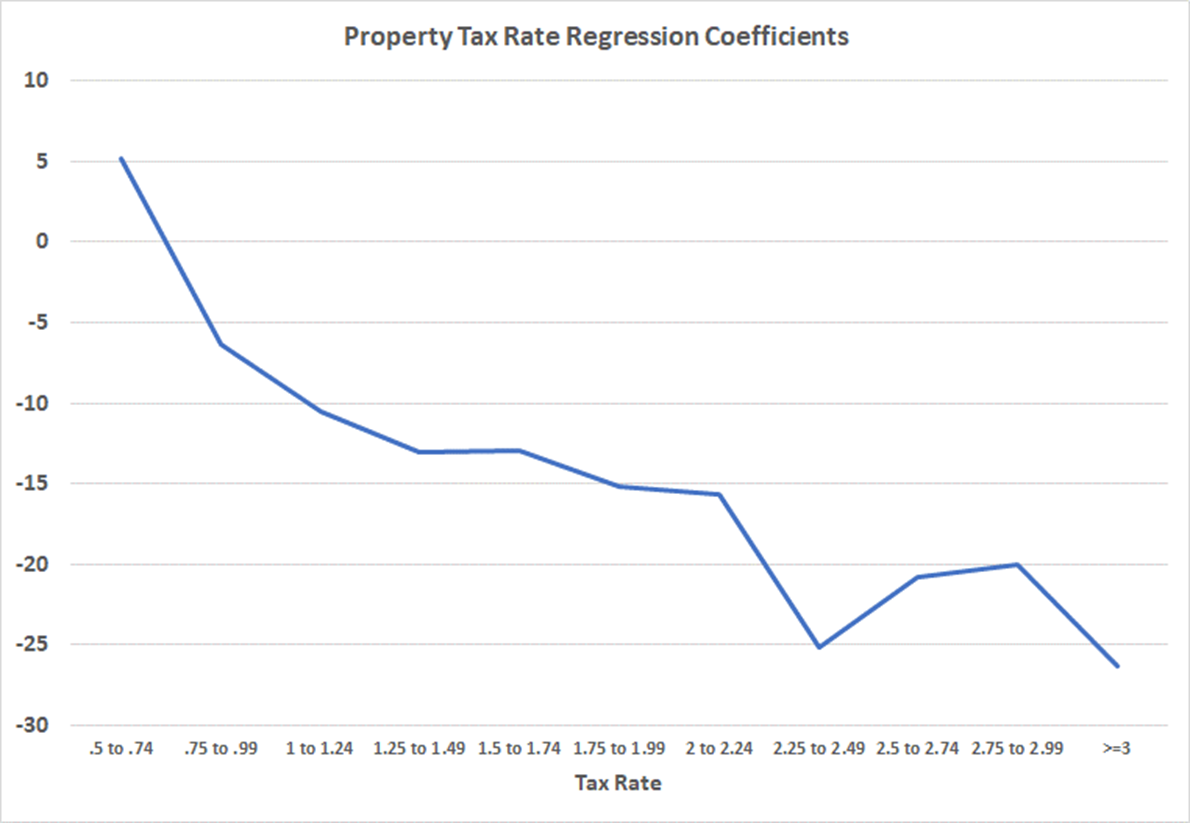
|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| SUMMARY OUTPUT | Top 200 Counties 2010-2018 HPI % Change | | | |
|  | versus effective property tax rates | | | |
| *Regression Statistics* | |  |  |  |
| Multiple R | 0.775465 |  |  |  |
| R Square | 0.601346 |  |  |  |
| Adjusted R Square | 0.597298 |  |  |  |
| Standard Error | 15.96906 |  |  |  |
| Observations | 200 |  |  |  |
| ANOVA |  |  |  |  |
|  | *Df* | *SS* | *MS* | *F* |
| Regression | 2 | 75779.63 | 37889.81 | 148.5812 |
| Residual | 197 | 50237.14 | 255.0109 |  |
| Total | 199 | 126016.8 |  |  |
|  |  |  |  |  |
|  | *Coefficients* | *Standard Error* | *t Stat* | *P-value* |
| Intercept | 24.50675 | 4.046333 | 6.056534 | 6.93E-09 |
| Average Tax Rate | -10.4433 | 1.79804 | -5.80816 | 2.5E-08 |
| 2010-2018 Employment % Change | 1.685621 | 0.150073 | 11.23204 | 6.06E-23 |
|  |  |  |  |  |

Last, we extended this analysis into property tax rate buckets, with the following results:

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SUMMARY OUTPUT |  | Top 200 Counties HPI % Change | | | |  |  |  |
| *Regression Statistics* | |  |  |  |  |  |  |  |
| Multiple R | 0.788908 |  |  |  |  |  |  |  |
| R Square | 0.622376 |  |  |  |  |  |  |  |
| Adjusted R Square | 0.598144 |  |  |  |  |  |  |  |
| Standard Error | 15.95229 |  |  |  |  |  |  |  |
| Observations | 200 |  |  |  |  |  |  |  |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ANOVA |  |  |  |  |  |  |  |  |
|  | *df* | *SS* | *MS* | *F* |  |  |  |  |
| Regression | 12 | 78429.85 | 6535.821 | 25.6835 |  |  |  |  |
| Residual | 187 | 47586.92 | 254.4755 |  |  |  |  |  |
| Total | 199 | 126016.8 |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |
|  | *Coefficients* | *Standard Error* | *t Stat* | *P-value* |  |  |  | *per 95.0%* |
| Intercept | 19.73233 | 5.719784 | 3.449839 | 0.000693 |  |  |  | 31.01593 |
| .5 to .74 | 5.141096 | 5.518784 | 0.931563 | 0.352763 |  |  |  | 16.02817 |
| .75 to .99 | -6.32194 | 5.20186 | -1.21532 | 0.225775 |  |  |  | 3.939931 |
| 1 to 1.24 | -10.5051 | 5.66976 | -1.85283 | 0.065483 |  |  |  | 0.679835 |
| 1.25 to 1.49 | -13.0756 | 7.070514 | -1.84931 | 0.065991 |  |  |  | 0.872631 |
| 1.5 to 1.74 | -12.9322 | 6.709454 | -1.92745 | 0.055439 |  |  |  |  |
| 1.75 to 1.99 | -15.1438 | 5.907877 | -2.56333 | 0.011154 |  |  |  |  |
| 2 to 2.24 | -15.6901 | 6.327517 | -2.47966 | 0.014035 |  |  |  |  |
| 2.25 to 2.49 | -25.1675 | 7.11072 | -3.53937 | 0.000506 |  |  |  |  |
| 2.5 to 2.74 | -20.8089 | 8.851263 | -2.35095 | 0.019767 |  |  |  |  |
| 2.75 to 2.99 | -20.0512 | 8.554601 | -2.34391 | 0.020133 |  |  |  |  |
| >=3 | -26.348 | 10.72257 | -2.45725 | 0.014912 |  |  |  |  |
| 2010-2018 Employment % Change | 1.688438 | 0.156504 | 10.78847 | 2.09E-21 |  |  |  |  |

To make these results easier to observe, we provide the following graph, Exhibit 3, showing the coefficients on the property tax rate buckets. While, not perfectly consistent, we do observe the generally lower appreciation rates at higher property tax rates. Note that there is a positive constant of 19.7% appreciation and a positive impact associated with employment changes. Then in addition to these controls, we observe at very low tax rates even higher positive appreciation rates. Then, as the rates rise the appreciation is offset with lower rates of home price increases.

**Exhibit 3: Property Appreciation Rates versus Effective Property Tax Rates by County**

**Price Effects When Property Taxes are Constrained and Tied to Individual Household Tenure**

In 2017 we completed an investigation of constrained property taxes tiled to household tenure, based on what is called Prop 13 in California.[[4]](#footnote-4) While the effective property tax rate is approximately 1% in most of California, Prop 13 limits the taxes to an increase of no more than 2% per year since 1978. The result has been a general decline in average effective property tax rates, such that the overall average effective rate is now about .64% of market value and declining over time. When households find they are paying property tax rates, well below market or that which they would pay as new residents, mobility decreases. We document this using neighborhood turnover rates in San Diego County from 2005 through 2014, shown in Exhibit 4 below.

**Exhibit 4: Turnover Rate of Homes Since 2005 through mid-2014 Versus Effective Property Tax Rate**

The impact of lower turnover rates suggests less supply of homes on the market, and as vintage is correlated with neighborhoods and neighborhood cycles, we find that neighborhoods with lower effective property tax rates also correspond to higher prices, relative to similar neighborhoods with higher property tax rates. These price premiums, which vary by submarket, correspond to part of the present value of the benefits that geographically clustered households receive when paying below average property taxes.

**Conclusions**

The literature on the capitalization of property taxes into property value is inconsistent. In this paper, we take a broad geographical examination, covering most of the US, of the relationship between property tax rates and property values. We find evidence that in many instances property taxes are not capitalized at all, such as when property taxes are low or considered very reasonable, whereas in other circumstances higher tax rates have very strong and negative impacts on value. We find a strong negative correlation between property tax rates and property value. After controls for school quality and demographics, the results here indicate that the elasticity of property tax rate capitalization into property value is on average inelastic and negative. For example, our base results indicate that on average a 10 percent (not percentage points) increase in property tax rates decreases property value by 2.2 percent. As property tax rates increase to a minimum threshold (approximately 0.7 percent), negative capitalization increases but holds relatively constant up to property tax rates of approximately 2.3 percent. As the property tax rate increases above 2.3 percent, negative capitalization increases at a faster pace. Relatively high tax rates may result in collecting less total revenue as property value are constrained by the affordability impact.

We also find that local markets with relatively high property tax rates, say above 2.3%, have tended to appreciate at lower rates. These high property tax rates are a cost of appreciation, that may in turn constrain appreciation. Last, we find that when households pay lower than average property tax rates, and are geographically clustered, such markets will have below normal turnover and housing offered for sale, which is turn corresponds to higher than average prices.

**References**

Follain, James and Stephen Malpezzi. 1981. The flight to the suburbs: Insights gained from an analysis of central-city vs suburban housing costs. *Journal of Urban Economics*. 9(3) 381-398. https://doi.org/10.1016/0094-1190(81)90034-6.

Haughwout, Andrew, Robert Inman, Steven Craig and Thomas Luce. 2004. Local Revenue Hills: Evidence from Four U.S. Cities. *The Review of Economics and Statistics*. 86(2) 570-585. https://doi.org/10.1162/003465304323031120.

King, A. Thomas. 1977. Estimating Property Tax Capitalization: A Critical Comment. *Journal of Political Economy*. 85(2) 425-31. www.jstor.org/stable/1830803.

McMillan, Melville and Richard Carlson. 1977. The Effects of Property Taxes and Local Public Services upon Residential Property Values in Small Wisconsin Cities. *American Journal of Agricultural Economics*. 59(1) 81–87. <https://doi.org/10.2307/1239611>.

Miller, N. and M. Sklarz, 2016, Note on the Impact of Prop 13 on EffectiveTax Rates, Turnover, and Home Prices, *Journal of Housing Research,* 25:2.

Oates, Wallace. 1969. The Effects of Property Taxes and Local Public Spending on Property Values: An Empirical Study of Tax Capitalization and the Tiebout Hypothesis. *Journal of Political Economy*. 77(6) 957-71. www.jstor.org/stable/1837209.

Pollakowski, Henry. 1973. "The Effects of Property Taxes and Local Public Spending on Property Values: A Comment and Further Results. *Journal of Political Economy*. 81(4) 994-1003. www.jstor.org/stable/1831140.

Stull, William and Judith Stull. 1991. Capitalization of Local Income Taxes. *Journal of Urban Economics*. 29(2) 182-190. https://doi.org/10.1016/0094-1190(91)90012-V.

Tassonyi, Almos, Richard Bird and Enid Slack. 2015. Can GTA Municipalities Raise Property Taxes? An Analysis of Tax Competition and Revenue Hills. Institute of Municipal Finance and Governance Papers, No. 20, University of Toronto, Institute on Municipal Finance and Governance.

Tiebout, C. (1956), "A Pure Theory of Local Expenditures", *Journal of Political Economy,* 64 (5): 416–424

Wales, T. J. and E. G. Wiens. 1974. Capitalization of Residential Property Taxes: An Empirical Study. *The Review of Economics and Statistics*. 56(3) 329-33. doi:10.2307/1923970.

Table 1: Effective Property Taxes By State Ranked from Lowest to Highest Source: WalletHub.com

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Rank | State | Effective Real-Estate Tax Rate | Annual Taxes on $194K Home\* | State Median Home Value | Annual Taxes on Home Priced at State Median Value |
| (1=Lowest) |
| 1 | Hawaii | 0.27% | $525 | $563,900 | $1,529 |
| 2 | Alabama | 0.42% | $817 | $132,100 | $558 |
| 3 | Louisiana | 0.52% | $1,006 | $152,900 | $795 |
| 4 | Colorado | 0.55% | $1,065 | $286,100 | $1,575 |
| 4 | District of Columbia | 0.55% | $1,055 | $537,400 | $2,930 |
| 6 | Delaware | 0.56% | $1,078 | $238,600 | $1,329 |
| 7 | South Carolina | 0.57% | $1,108 | $148,600 | $851 |
| 8 | West Virginia | 0.59% | $1,132 | $111,600 | $653 |
| 9 | Wyoming | 0.61% | $1,186 | $204,900 | $1,256 |
| 10 | Arkansas | 0.63% | $1,213 | $118,500 | $743 |
| 11 | Utah | 0.66% | $1,280 | $238,300 | $1,576 |
| 12 | Nevada | 0.69% | $1,331 | $216,400 | $1,489 |
| 13 | Arizona | 0.72% | $1,400 | $193,200 | $1,398 |
| 14 | Tennessee | 0.74% | $1,429 | $151,700 | $1,120 |
| 15 | Idaho | 0.75% | $1,447 | $176,800 | $1,322 |
| 16 | California | 0.77% | $1,490 | $443,400 | $3,414 |
| 17 | New Mexico | 0.78% | $1,502 | $163,900 | $1,272 |
| 18 | Virginia | 0.80% | $1,550 | $255,800 | $2,049 |
| 18 | Mississippi | 0.80% | $1,556 | $109,300 | $879 |
| 20 | Montana | 0.84% | $1,625 | $209,100 | $1,756 |
| 21 | North Carolina | 0.86% | $1,656 | $161,000 | $1,378 |
| 21 | Kentucky | 0.86% | $1,667 | $130,000 | $1,120 |
| 23 | Indiana | 0.87% | $1,679 | $130,200 | $1,130 |
| 24 | Oklahoma | 0.90% | $1,737 | $125,800 | $1,129 |
| 25 | Georgia | 0.91% | $1,769 | $158,400 | $1,448 |
| 26 | Florida | 0.98% | $1,897 | $178,700 | $1,752 |
| 27 | Missouri | 0.99% | $1,910 | $145,400 | $1,435 |
| 28 | North Dakota | 1.01% | $1,962 | $174,100 | $1,765 |
| 29 | Washington | 1.03% | $1,996 | $286,800 | $2,958 |
| 30 | Oregon | 1.04% | $2,006 | $265,700 | $2,755 |
| 31 | Maryland | 1.10% | $2,126 | $296,500 | $3,257 |
| 32 | Minnesota | 1.15% | $2,225 | $199,700 | $2,296 |
| 33 | Alaska | 1.19% | $2,303 | $261,900 | $3,117 |
| 34 | Massachusetts | 1.22% | $2,365 | $352,600 | $4,309 |
| 35 | South Dakota | 1.32% | $2,550 | $152,700 | $2,012 |
| 36 | Maine | 1.35% | $2,619 | $179,900 | $2,435 |
| 37 | Kansas | 1.40% | $2,713 | $139,200 | $1,952 |
| 38 | Iowa | 1.53% | $2,960 | $137,200 | $2,099 |
| 39 | Ohio | 1.57% | $3,042 | $135,100 | $2,124 |
| 40 | Pennsylvania | 1.58% | $3,054 | $170,500 | $2,691 |
| 41 | Michigan | 1.64% | $3,179 | $136,400 | $2,241 |
| 42 | Rhode Island | 1.66% | $3,206 | $242,200 | $4,013 |
| 43 | New York | 1.68% | $3,246 | $293,000 | $4,915 |
| 44 | Nebraska | 1.80% | $3,485 | $142,400 | $2,565 |
| 45 | Texas | 1.83% | $3,544 | $151,500 | $2,775 |
| 45 | Vermont | 1.83% | $3,544 | $220,600 | $4,040 |
| 47 | Wisconsin | 1.94% | $3,756 | $169,300 | $3,286 |
| 48 | Connecticut | 2.07% | $3,999 | $270,100 | $5,582 |
| 49 | New Hampshire | 2.20% | $4,257 | $244,900 | $5,388 |
| 50 | Illinois | 2.31% | $4,476 | $179,700 | $4,157 |
| 51 | New Jersey | 2.44% | $4,725 | $321,100 | $7,840 |

Table 2: Variable Description

|  |  |  |
| --- | --- | --- |
| Variable | Description | Source |
| Price | Purchase price. Single family residential only excluding condominiums. | MLS |
| Ptr | Property tax rate. The median property taxes paid divided by the median value of property by 5-digit zip code times 100. For owner occupied property only. | ACS |
| Lot | Lot size in square feet. | MLS |
| Sf | Square feet of building. | MLS |
| Bsf | Square feet in the basement. | MLS |
| Bath | Total number of bathrooms. Full baths plus half baths. | MLS |
| Pool | Dummy for pool. 1 for property with a pool and 0 otherwise. | MLS |
| stories | Number of stories. | MLS |
| Water | Dummy for waterfront property. 1 for property on water and 0 otherwise. | MLS |
| popdens | Population density. Population per square mile in the census block group. | ACS |
| bachelors | Fraction of population with bachelors degree. Population 25 years and older with a bachelors degree divided by the total population. | ACS |
| graduate | Fraction of population with a graduate level degree. Population 25 years and older with a masters or higher level degree divided by the total population. | ACS |
| Urate | Unemployment rate. Expressed as a fraction. | ACS |
| Lfpr | Labor force participation rate. Expressed as a fraction. | ACS |
| Math | Math score. Public school high school math score for the school district as calculated by the NCES for the 2017-2018 school year. | NCES |
| inc tax | State level income tax ranking. 1 is the state with the lowest effective income state rate, including ties. Effective tax rates were calculated as a percentage of the mean third quintile of U.S. income ($58,082). (Wallet Hub, <https://wallethub.com/edu/best-worst-states-to-be-a-taxpayer/2416/>, published on March 12 2019) | WH |
| sales tax | State level sales tax ranking. 1 is the state with the lowest sales tax rate, including ties. Effective tax rates were calculated assuming the household spends annually an amount equal to the spending of a household earning the median income. (Wallet Hub, <https://wallethub.com/edu/best-worst-states-to-be-a-taxpayer/2416/>, published on March 12 2019) | WH |

The American Community Survey (ACS) variables, unless otherwise indicated, are measured at the census block group level using the 2017 5-year estimates. The Multiple Listing Service (MLS) records property transaction and a variety of property characteristics. The National Center for Education Statistics (NCES) provides detail school/ school district level annual education statistics. Wallet Hub (WH) provides advice and assistance to help households with financial decision making.

Table 3: Summary Statistics: Ln is Log Natural

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Variable | Mean | Std. Dev. | Min | Max |
| ln(price) | 12.61 | 0.75 | 2.08 | 14.91 |
| ln(ptr) | 0.05 | 0.51 | -2.05 | 1.93 |
| ln(lot) | 9.15 | 0.14 | 8.85 | 9.39 |
| ln(sf) | 7.73 | 0.10 | 7.60 | 8.01 |
| ln(bsf) | 0.87 | 2.21 | 0.00 | 7.58 |
| Bath | 2.38 | 0.38 | 2.00 | 3.00 |
| Pool | 0.21 | 0.40 | 0.00 | 1.00 |
| stories | 1.20 | 0.68 | 0.00 | 3.00 |
| Water | 0.06 | 0.23 | 0.00 | 1.00 |
| ln(popdens) | 7.22 | 1.15 | 1.39 | 9.84 |
| bachelors | 0.19 | 0.08 | 0.00 | 0.43 |
| graduate | 0.10 | 0.06 | 0.00 | 0.38 |
| ln(urate) | 0.05 | 0.04 | 0.00 | 0.32 |
| ln(lfpr) | -0.46 | 0.23 | -2.46 | -0.11 |
| ln(math) | 3.91 | 0.51 | 0.69 | 4.60 |
| inc tax | 18.49 | 17.02 | 1.00 | 51.00 |
| sales tax | 33.79 | 13.11 | 1.00 | 51.00 |
| Observations | 2,946 |  |  |  |

ln() indicates that the variable is logged in the estimation data set. Each observation is associated with an individual property sale in 2019 during the months May, June, July, August and September.

Table 4: Log-Linear Results

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | I: Basic | II: Building | III: Month & State Fixed Effects | IV: Demographics and Other Taxes |
| ln(prt) | -0.272\*\*\* | -0.249\*\* | -0.150 | -0.219\*\*\* |
|  | (0.090) | (0.096) | (0.097) | (0.073) |
| ln(lot) |  | -0.417\* | -0.065 | -0.013 |
|  |  | (0.211) | (0.107) | (0.098) |
| ln(sf) |  | 0.696\*\*\* | 0.947\*\*\* | 0.696\*\*\* |
|  |  | (0.196) | (0.197) | (0.213) |
| ln(bsf) |  | -0.022 | -0.009 | -0.004 |
|  |  | (0.015) | (0.009) | (0.008) |
| Bath |  | 0.153\*\* | 0.077 | 0.070 |
|  |  | (0.061) | (0.058) | (0.044) |
| Pool |  | 0.202\*\*\* | 0.152\*\*\* | 0.109\*\* |
|  |  | (0.066) | (0.050) | (0.046) |
| Stories |  | -0.029 | -0.001 | -0.030 |
|  |  | (0.067) | (0.027) | (0.023) |
| Water |  | 0.221\*\*\* | 0.350\*\*\* | 0.358\*\*\* |
|  |  | (0.051) | (0.046) | (0.060) |
| ln(popdens) |  |  |  | 0.036\*\* |
|  |  |  |  | (0.014) |
| bachelors |  |  |  | 1.461\*\*\* |
|  |  |  |  | (0.159) |
| graduate |  |  |  | 1.476\*\*\* |
|  |  |  |  | (0.448) |
| ln(urate) |  |  |  | -0.598\* |
|  |  |  |  | (0.340) |
| ln(lfpr) |  |  |  | 0.104 |
|  |  |  |  | (0.064) |
| ln(math) |  |  |  | 0.055 |
|  |  |  |  | (0.033) |
| Inc tax |  |  |  | -0.013\*\*\* |
|  |  |  |  | (0.004) |
| sales tax |  |  |  | -0.010\*\*\* |
|  |  |  |  | (0.003) |
| constant | 12.619\*\*\* | 10.686\*\*\* | 5.354\*\*\* | 6.809\*\*\* |
|  | (0.076) | (2.228) | (1.193) | (1.292) |
| Month & State Fixed Effects |  |  | x | x |
| *N* | 2946 | 2946 | 2946 | 2946 |
| Adj. *R*2 | 0.034 | 0.073 | 0.267 | 0.329 |

Left hand side variable ln(price). Estimated using Ordinary Least Squares. Errors are clustered by state.

Table 5: Log Nonlinear Results

|  |  |  |  |
| --- | --- | --- | --- |
|  | I: lnprice | II: ln(price/ square feet) | III: lnprice - Tax Rate by Tax Dollar Amounts |
| Property Tax Rate Dummies (ptr<0.5 excluded) | | | |
| 0.7>ptr>=0.5 | -0.068 | -0.071 |  |
|  | (0.057) | (0.057) |  |
| 0.9>ptr>=0.7 | -0.201\*\* | -0.202\*\* |  |
|  | (0.085) | (0.085) |  |
| 1.1>ptr>=0.9 | -0.160\* | -0.161\* |  |
|  | (0.089) | (0.090) |  |
| 1.3>ptr>=1.1 | -0.150 | -0.149 |  |
|  | (0.103) | (0.104) |  |
| 1.5>ptr>=1.3 | -0.236\*\* | -0.234\*\* |  |
|  | (0.113) | (0.114) |  |
| 1.7>ptr>=1.5 | -0.250\*\* | -0.239\*\* |  |
|  | (0.100) | (0.101) |  |
| 1.9>ptr>=1.7 | -0.287\*\* | -0.280\*\* |  |
|  | (0.125) | (0.127) |  |
| 2.1>ptr>=1.9 | -0.215\* | -0.214\* |  |
|  | (0.118) | (0.118) |  |
| 2.3>ptr>=2.1 | -0.241\* | -0.240\* |  |
|  | (0.132) | (0.133) |  |
| 2.5>ptr>=2.3 | -0.319\*\*\* | -0.316\*\* |  |
|  | (0.117) | (0.117) |  |
| 2.7>ptr>=2.5 | -0.355\*\*\* | -0.354\*\*\* |  |
|  | (0.124) | (0.126) |  |
| ptr>=2.7 | -0.453\*\*\* | -0.451\*\*\* |  |
|  | (0.126) | (0.127) |  |
| Interaction of ln(ptr) and Quartiles of Dollars of Taxes Paid | | | |
| ln(ptr)\* Q1 |  |  | 0.003 |
|  |  |  | (0.108) |
| ln(ptr)\* Q2 |  |  | -0.125 |
|  |  |  | (0.081) |
| ln(ptr)\* Q3 |  |  | -0.355\*\*\* |
|  |  |  | (0.083) |
| ln(ptr)\* Q4 |  |  | -0.352\*\*\* |
|  |  |  | (0.119) |
| Month and Sate Fixed Effects | x | x | x |
| Table continues on next page… | | | |
| N | 2946 | 2946 | 2946 |
| Adj. R2 | 0.328 | 0.322 | 0.332 |

Table continues on next page. Errors are clustered by state. Q1 is an indicator variable that is equal to one if the dollars paid to property taxes is in the bottom 25 percent of the distribution. Q2 represents the 25 to 50th percentile. Q3 represents the 50th to 75th percentile. Q4 represents the 75th to 100th. For specification I and III, the left hand side variable is the log of the house price. For specification II, the left hand side variable is the log of the house price per square foot.

Table 5 Continued

|  |  |  |  |
| --- | --- | --- | --- |
|  | I: lnprice | II: ln(price/ square feet) | III: lnprice - Tax Rate by Tax Dollar Amount |
| … |  |  |  |
| ln(lot) | -0.019 | -0.032 | -0.000 |
|  | (0.097) | (0.092) | (0.096) |
| ln(sf) | 0.694\*\*\* |  | 0.688\*\*\* |
|  | (0.207) |  | (0.209) |
| ln(bsf) | -0.004 |  | -0.003 |
|  | (0.008) |  | (0.008) |
| Bath | 0.069 | 0.048 | 0.067 |
|  | (0.044) | (0.036) | (0.042) |
| Pool | 0.103\*\* | 0.102\*\* | 0.107\*\* |
|  | (0.046) | (0.048) | (0.046) |
| stories | -0.031 | -0.032 | -0.027 |
|  | (0.026) | (0.026) | (0.021) |
| Water | 0.350\*\*\* | 0.349\*\*\* | 0.354\*\*\* |
|  | (0.060) | (0.058) | (0.063) |
| ln(popdens) | 0.032\*\* | 0.031\*\* | 0.039\*\*\* |
|  | (0.015) | (0.014) | (0.014) |
| bachelors | 1.463\*\*\* | 1.432\*\*\* | 1.354\*\*\* |
|  | (0.162) | (0.172) | (0.164) |
| graduate | 1.478\*\*\* | 1.446\*\*\* | 1.410\*\*\* |
|  | (0.441) | (0.424) | (0.434) |
| ln(urate) | -0.573\* | -0.587\* | -0.576\* |
|  | (0.335) | (0.333) | (0.335) |
| ln(lfpr) | 0.094 | 0.099 | 0.108 |
|  | (0.067) | (0.068) | (0.065) |
| ln(math) | 0.051 | 0.050 | 0.046 |
|  | (0.034) | (0.034) | (0.034) |
| Inc tax | -0.010\*\*\* | -0.009\*\*\* | -0.011\*\*\* |
|  | (0.004) | (0.003) | (0.003) |
| sales tax | -0.010\*\*\* | -0.010\*\*\* | -0.012\*\*\* |
|  | (0.002) | (0.002) | (0.003) |
| \_cons | 7.015\*\*\* | 4.832\*\*\* | 6.898\*\*\* |
|  | (1.323) | (0.973) | (1.294) |
| Month and Sate Fixed Effects | x | x | x |
| *N* | 2946 | 2946 | 2946 |
| Adj. *R*2 | 0.328 | 0.322 | 0.332 |

Continued form prior page. Errors are clustered by state.

1. See Charles Tiebout (1956), "A Pure Theory of Local Expenditures", Journal of Political Economy, 64 (5): 416–424 [↑](#footnote-ref-1)
2. Such as Prop 13 in California, passed in 1978, where property taxes are constrained to increasing no more than 2% in any one year, independent of appreciation rates. [↑](#footnote-ref-2)
3. For instance, if the existing property tax rate is 1 percent, a 10 percent increase in the tax rate means that it goes up to 1.1 percent, not 11 percent. [↑](#footnote-ref-3)
4. See N. Miller and M. Sklarz, “A note on the impact of Prop 13 on Effective Tax Rates, Turnover and Home Prices”, *Journal of Housing Research,* 25:2, June, 2016 [↑](#footnote-ref-4)