Oregon Property Tax Capitalization:
Evidence from Portland

NeRC

Northwest Economic Research Center
College of Urban and Public Affairs

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Portland State UNIVERSITY

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The League of Oregon Cities was founded in 1925 and it is formed by an intergovernmental agreement among all of Oregon's 242 incorporated cities. The League of Oregon Cities is the effective and collective voice of Oregon's cities and their authoritative and best source of information and training. More LOC information can be found on their website: www.orcities.org.

NERC is based at Portland State University in The College of Urban and Public Affairs. The Center focuses on economic research that supports public-policy decision-making, and relates to issues important to Oregon and the Portland Metropolitan Area. NERC serves the public, nonprofit, and private sector communities with high quality, unbiased, and credible economic analysis. The Director of NERC is Dr. Thomas Potiowsky, who also serves as the Chair of the Department of Economics at Portland State University. Dr. Jenny Liu is NERC's Assistant Director, as well as an Assistant Professor in the Toulan School of Urban Studies at PSU. This report was researched and written by Dr. Jenny Liu, Assistant Director, and Jeff Renfro, Senior Economist. Research support was provided by Janai Kessi and Marisol Cáceres, NERC Research Interns. The report was formatted by Marisol Cáceres.

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EXECUTIVE SUMMARY

The passage of Measures 5 and 50 drastically changed the way property taxes were assessed in Oregon. The measures were intended to limit the ability of government to raise property taxes, while achieving other goals such as equalizing school funding across the state. The property tax system that resulted is complex and has introduced inequities into the system based on differing rates of changes between assessed value (AV) and real market value (RMV).

The League of Oregon Cities (LOC) asked the Northwest Economic Research Center (NERC) to investigate the effect of the tax structure on residential sale prices as part of ongoing efforts to understand the impacts of Oregon's property tax system on local governments. Specifically, we wanted to investigate the magnitude of property tax capitalization - if two houses are similar in all ways except for their property tax payments, do their sale prices differ as a result?

We found that differences in property tax payments are having a significant effect on sale price. Assuming a discount rate of 3% and perpetual lifespan of properties, we expect a property that would last into perpetuity to show capitalization of $33.33 for every dollar decrease in property taxes. To illustrate capitalization of property tax differences in property value, we use the average house sold in our sample as an example. The average house is approximately 1,600 square-feet, sold for $313,995 and has an AV/RMV ratio of 65.27% and an effective tax rate of 1.37% (based on RMV). Depending on the estimation specification, we find that the capitalization of property taxes into property value in the Portland area ranges from 15% to 92%. This is illustrated in Figure 1 for a range of AV/RMV ratios above and below the average.

Figure 1: Summary of Effects

Average Portland House

Sale Price = $ 313,995 | 1,600 Sqft

Tax Rate (on AV) = 2.1% | RMV = $291,490

AV/RMV Ratio = 65% | Effective Tax Rate (on RMV) = 1.37%

	AV/RMV Ratio				
	45%	**55%**	**65%**	**70%**	**75%**
Assessed Tax	$2,755	$3,366	$3,979	$4,284	$4,591
Actual Tax	$2,755	$3,366	$3,979	$4,284	$4,372
Sale Price	**$320,203 - $344,829**	**$317,099 - $329,412**	$313,995	**$312,443 - $306,287**	**$310,891 - $298,578**
Sale Price Change (Lower Bound)	**$6,208**	**$3,104**		**-$1,552**	**-$3,104**
Sale Price Change (Upper Bound)	**$30,834**	**$15,417**		**-$7,709**	**-$15,417**

In order to quantify this effect, we used regression analysis to isolate the influence of property taxes while controlling for other relevant determinants of sale price. Certified tax rolls from Multnomah County were combined with sales data to create a database with residential characteristics for Portland tax lots. We considered only single-family homes (and condominiums occupied by single families) that were sold between 2010-2013, and dropped from the dataset sales that were classified as "distressed" or not as "arm's length." Neighborhood characteristics and school quality are also important determinants of residential value. We geocoded our addresses and joined them with geographical characteristics like crime rate, school quality, and distance to downtown.

Using a variety of regression specifications, we estimated the effect of property tax on sale price. To measure the effect of property tax on sale price we used three variables: AV/RMV ratio, compression ratio, and effective tax rate. Due to estimation issues, we did not arrive at one definitive coefficient estimating property tax capitalization. We are confident that property tax policy is having an effect on sale price, but must report a range of possible values.

The inequities in the property tax system are largely driven by changes in RMV. Although this effect is not uniform because of differing tax rates, houses that have experienced large growth in value since the inception of the current system tend to be paying less as a percentage of their homes' value in taxes, which is increasing sale price. From a policy perspective, the distribution of this effect is arbitrary and may be disproportionately benefitting property owners who can afford to buy in areas with faster increases in property values. This report focuses on Portland, but this same dynamic is likely at play in the rest of the state. We would expect to see this effect in other Oregon cities in which there are large disparities in the increase in home values since the inception of Measures 5 and 50 by neighborhood or area. The property tax system creates a hidden subsidy for these property owners. Some of the burden of funding government and school services is transferred away from these properties. This results in revenue shortfalls, or creates the need for property owners in areas with a smaller increase in RMV to fill the gap.

I. INTRODUCTION

Northwest Economic Research Center (NERC) has been charged with examining how differences in property taxes due to Measure 5 and 50 have impacted the real estate market in Oregon. In particular, we will examine whether housing prices have been impacted by differences in assessed values and property taxes imposed by these two measures. We begin our study with an overview of Oregon's property tax system. The following sections describe relevant literature that guides our research direction, data sources, methodology, estimation results and discussion of further research.

Oregon's Property Tax System Since 1990 – Measure 5 and 50

In the 1990s, Oregonians passed Measures 5 and 50, setting off a series of major changes. The intent was to limit and establish predictability of property taxes. While these intentions have been mostly realized, there have been additional outcomes which have wreaked havoc on local government revenue streams and potentially affected purchasing decisions of Oregon homebuyers, the subject of this report.

History of Oregon's Property Tax Legislation

Property owners, especially homeowners, became increasingly concerned by growing tax rates in the 1980s. This was mostly driven by two factors: property values were stagnant and local governments continued to expand the tax base at the maximum allowed six percent per year. Voters responded to their concerns by passing Measure 5 in 1990 (City Club of Portland, 2013). This was the first in the series of pivotal acts passed by voters in the 1990s. Measure 5 placed limits on property tax collected per $1,000 of real market value (RMV). The measure set a $5 per $1,000 limit on property taxes going to fund schools - to be phased in between the 1991-92 and 1995-96 biennia - and a limit of $10 per $1,000 of RMV for all other government services. In many areas taxes exceed these limits. In each case where the limit is exceeded, taxes are reduced down to the limit. This process, called *compression*, lowers property tax bills for many residents, but also results in millions of dollars of decreased revenues for many local governments (cities, counties and special districts) and schools.

Unfortunately, for those voters expecting Measure 5 to reduce their property tax bill, the 1990s were characterized by a surge in property values. Because the Measure 5 property tax caps are linked to RMV, some tax bills grew in spite of the imposed limits. This gave voters the impression that their vote to limit property taxes had done little to nothing (Linhares & Provost 2011).

Seven years after Oregon voters showed their support for Measure 5 they approved Measure 50, an even more aggressive attempt to limit property taxes. Where Measure 5 imposed limits in the form of rates, Measure 50 went further; it changed the concepts of both tax rates and assessed taxable values (Oregon Department of Revenue, 2009). Essentially, local district tax rates were reduced and made permanent. This action officially moved Oregon's system from a levy to a rate based system. In addition, the measure de-coupled real market values from taxable, or assessed values. The measure pegged the new assessed value at 90% of a property's 1995-96 value and restricted annual growth in assessed value to three percent. Furthermore, this new law stipulated that assessed value could not exceed real market value.

In Portland, property values in 1995-96 varied significantly across the city. These variations were essentially locked into the system in perpetuity by Measure 50. As home values have grown or decreased at different rates since the mid-90s, it is now possible for property owners with similar and even proximate properties to pay drastically different taxes. Although the objectives of stabilizing property taxes have been achieved, the structure of Oregon's property tax laws may have produced unintentional costs and inequalities.

Effects of Measure 5 and Measure 50

The two measures created two separate limits that come into play depending on the AV and RMV of a property.

- *Measure 50 Limit: AV * Tax Rates = Tax Extended*
- *Measure 5 Limit: RMV * Maximum Category Rate ($5 schools/ $10 general gov't) = Maximum Allowable Tax*

If the tax extended is greater than the maximum allowable tax, compression occurs, reducing the amount of tax each jurisdiction can collect.

According to Linhares & Provost (2011), the Oregon property tax system is functioning in line with what voters approved more than two decades ago. They explain that the bulk of responsibility to fund public education has been shifted to the state and property tax bills have been made more predictable; however, these outcomes are tilted in favor of the property owner. When other key stakeholders are considered the viability of the system as it exists may be questioned.

These other stakeholders -- citizens in general, the local governments, and the state government -- have each felt the pinch of restricted revenue streams and the subsequent struggle of state and local government to provide adequate services. In a recent report, the City Club of Portland identified several issues with the Oregon system as it is currently functioning:

- The system contains and is exacerbating inequities
- It appears to be undermining local control
- It is failing to maintain voter approved service levels
- The system is "wretchedly" complex, effectively undermining constituent confidence in its functionality (City Club of Portland 2013).

Calculating Property Taxes

Calculating the actual tax due for a household can be complicated due to the multiple rates and valuation methods. The calculation begins with the comparison of two values, based on a property's AV and RMV. Based on its location in various taxing districts, each property will have a number of government tax rates and a number of education tax rates. The sum of these rates is then multiplied by the AV to calculate the base tax. If the calculated base tax exceeds the Measure 5 cap [1.5% of current RMV (1% for general government and 0.5% for educational taxes)], any temporary voter-approved property tax measure for specific services (such as increased funding for public safety, libraries or schools) is reduced first, all the way to $0 if necessary. If the taxes still exceed Measure 5 caps, each permanent tax rate component within the base tax is then compressed proportionally such that the base tax will equal the Measure 5 cap.

In order to calculate final taxes, the bonded general government and bonded education rates, which fund capital construction projects, such as new buildings or equipment, are multiplied by the AV and added to the base tax. These bonded rates are not subject to the property tax caps.

In addition, it appears the system may be inconsistent with market movements. Property tax imposed in Oregon as a whole has been growing at a decreasing rate since 2010, while inflation has been growing at a consistently higher rate. This relationship can be observed in Multnomah County where total property tax imposed grew by a little less than 1.4 percent between 2011 and 2012 while inflation grew by 2.3 percent (Oregon Department of Revenue 2013).

Among the above mentioned issues, perhaps one of the most prominent is that the Oregon system has effectively disconnected the amount paid in property taxes from the value of the property. This is made apparent by horizontal inequity, the case in which property owners with similarly valued properties and levels of service pay dramatically different property tax rates.

II. RELEVANT LITERATURE

Over the years there has been substantial attention given to the economic effects of the property tax, and up until the late 1960s it was generally considered to be much like any other tax - i.e., it created deadweight loss, leaving some capital un-invested and some property unproduced (Hamilton 1976). But Hamilton points out that this assumption was challenged by Mieszkowski in 1969.[1] Mieszkowski (1969) suggested that the variation in property tax rates between localities would be capitalized into the value of the property, whether it is land, buildings, etc. This concept of capitalization is the underlying interest in this analysis.

[1] Note that Mieszkowski (1969) did not challenge Hamilton (1976) but rather Hamilton cited Mieszkowski's work. The publishing dates may create confusion but they do not contradict each other.

Full Capitalization and the Implications

Expanding on the work of Mieszkowski, Hamilton (1976) concluded that perfect capitalization may result in horizontal equity – i.e., property owners that are in similar economic situations pay the same tax. Hamilton bases his findings in a theoretical model that assumes a proportional property tax in every community as well as an equal distribution of public services. It is important to note that his model is highly stylized. For instance, it only considers residential property and it assumes that there are only two classes of property – high income and low income. Furthermore, it holds that there are communities which are only composed of one or the other of these property types.

The Incidence of the Property Tax

While much attention – e.g., Mieszkowski and Hamilton – has been given to the economic effects of the property tax, the incidence is still a contested point among researchers. Zodrow (2007) presents an overview and analysis of the research to date. He compares and contrasts the three principle views of property tax incidence: the Traditional, Benefit, and Capital Tax views. The author suggests that the capital tax view is grounded in the traditional view and incorporates elements of the benefit view; namely, that local residents will shoulder the full burden of any increase in property tax. This being said, there are distinct differences between the two views. The capital tax view holds that a property tax distorts the distribution of capital (e.g., land, buildings, etc.) within a local region, whereas the benefit view holds that a property tax has no effect on the distribution of resources.

Examples of Capitalization from Other Locales

The theoretical discussions of capitalization and incidence of the property tax are useful, but empirical proof is necessary. Two studies looking at the effects of property tax legislation in California and Massachusetts helped provide this empirical proof. The passage of California's Proposition 13 in 1978 and Massachusetts's Proposition 212 in 1980 both placed significant limitations on the amount of property tax levied. These major shifts in tax policy inspired many research inquiries, looking at topics ranging from the political economy that led to the passage of the propositions to the distributional effects; but there was also the question of whether the tax reductions were capitalized into the value of the property.

In 1982 Kenneth Rosen analyzed home value and property tax rate data across 64 jurisdictions in the San Francisco Bay area. He looked at data pre- and post- Proposition 13 and found compelling evidence that the reduced property taxes were in fact capitalized into the property values. Using regression techniques, Rosen found that a one dollar decrease in property tax in California led to a seven dollar increase in property value (Rosen 1982). However, there may be longer term effects associated with decreased levels of public services associated with lower property tax revenues.

Similarly Bradbury, Mayer, and Case analyze the effects of property tax limitations resulting from Massachusetts' Proposition 212 (2001). Their analysis sought to identify whether towns that were more restricted in their ability to generate revenue tended to spend less on local services, effectively reducing the town's attractiveness to potential home buyers. They found that school spending was affected the most and their analysis revealed that cities with "good schools" - as measured by 1990 test scores - saw significantly greater rates of appreciation in home values.

III. METHODOLOGY & DATA

Before performing the regression analysis detailed in the next section, we needed to combine data from a variety of sources to allow us to isolate the effect of tax policy from the other determinants of house sale price.

Housing prices are determined by a combination of factors such as property characteristics (e.g., interior square-footage, lot size, number of rooms, age, quality, etc.), neighborhood and location characteristics (e.g., distance to central business district, access to transportation, access to shops, etc.), and public service characteristics (e.g., public school districts, safety, etc.). After controlling for differences in these factors, housing prices can additionally vary due to differences in property tax levels (and effective tax rates) resulting from Measure 5 and Measure 50. The reduced-form equation for our housing price regression models can be expressed as follows:

$$P_i = \beta_0 + \beta_1 \mathbf{H_i} + \beta_2 \mathbf{S_i} + \beta_3 \mathbf{N_i} + \epsilon_i$$

where P_i is the property sale price, H_i is a vector of property characteristics, S_i is a vector of public school characteristics and N_i is a vector of neighborhood characteristics that includes public services and amenities. The estimated β coefficients will represent the marginal value of these characteristics to a homebuyer, and ε represents the remaining residuals.

The combination of time-variant and -invariant variables led us to use a mixed-effects OLS regression specification. The mixed-effect functional form isolates the effect of each individual variable on home sale prices. A properly specified function should include all major determinants of property sale prices, allowing for an unbiased estimation of the effect of program participation.

Whether housing prices have increased as a result of lower assessed values dictated by the combination of Measure 5 and 50 can be answered by examining the degree of capitalization of property tax differences into property values. In the *Handbook of Regional and Urban Economics*, Ross and Yinger (1999) specify the capitalization of property tax differences into property values as follows:

$$\Delta V = \frac{-\alpha \Delta T}{r}$$

where ΔV represents the change in property value, ΔT represents the difference in property tax paid, r represents the discount rate and α represents the degree of capitalization. The equation can be altered to represent capitalization with a limited lifespan of n years as follows:

$$\Delta V = -\alpha \Delta T \left[\frac{1 - (1 + r)^{-n}}{r} \right]$$

Assuming known discount rates and known lifespan of properties, the estimated coefficients on property tax measures in the regression analysis will provide the basis to calculate the degree of capitalization for properties in the Portland area.

Specification refers to the functional form of the estimation equation, and includes the choice of variables. Sensitivity analysis involves making small changes to the regression specification. The way in which estimates react to small changes gives the researcher clues about the validity of the model, and can also draw attention to issues that still need to be resolved. If the estimated effect of the variable in question changes drastically due to changes in other variables, or by changing the functional form, then the estimates are not trustworthy. We utilized sensitivity analysis to validate our regression results as well as the capitalization measures.

Data

In order to construct the dataset for our estimations, we began with the last four years of certified tax rolls from Multnomah County (including the most recent, 2013-2014). This dataset covers every tax lot in Multnomah County. From this dataset, we had the location of the house and information about the house itself, like square footage, number of bedrooms, etc. Each record also included the current RMV, AV, and tax code for each property (more on these measures later).

The study only considers single family, residential units so commercial properties, multi-family housing, and other properties that did not fit our definition were dropped. The tax lots we considered were made up almost exclusively of single-family houses and single-family condominiums[2]. Because we are measuring the effect of tax policy on sale price, we needed to further reduce the records to only include houses that had been sold during the period for which we had certified tax information. To do this, we combined a separate dataset of Multnomah County home sales dating back to 2000. This allowed us to identify which houses had been sold during our study period, and when they were sold. It also allowed us to track the type of sale. During our study period, there were an unusually large number of foreclosures, short sales, and other types of distressed transactions. We eliminated these types of distressed sales, as well as sales that were not conducted at "arm's length" (transfer between family members, for example).

The dataset included RMV and AV for each property, which we used to calculate the actual tax paid in each year. Multnomah County publishes the tax limited and bonded tax rates for each taxing district in the county. These taxing districts overlap, meaning that houses relatively close to each other could be subject to different rates. Using the tax code for each property from the certified tax rolls, we matched education and government rates (both limited and bond), and used these rates to calculate the actual tax paid. The sidebar on page 6 explains this process. In addition, we calculated the compression ratio and the effective tax rate on RMV as alternative measures of property tax levels. The compression ratio is calculated as calculated taxes (excluding bond rates) divided by the Measure 5 cap of 1.5% of RMV times 100, representing the percentage of the total calculated taxes that is actually paid by the household. Effective tax rate is the actual tax paid divided by RMV, representing the effective tax rate as a percentage of the real market value.

A goal of this study was to move beyond existing measures of tax policy on property value and incorporate controls related to other determinants of value. To do this, we geocoded all of our property addresses, and assigned a neighborhood to each property. Then, we used a dataset showing incidence of crime in Portland to calculate a crime rate for each neighborhood (number of crime per 1000 residents) in 2012. The distance from each neighborhood centroid to downtown was used to measure distance to the central business district. Walk Score® produces measures of the walkability, bikeability, and quality of public transit in each neighborhood. We found collinearity between these neighborhood amenities measures, which indicated that neighborhoods that tended to have good walkability also tended to be highly bikeable and have better access to public transportation. Therefore, the specifications shown in this report utilize only the Walk Score® as a measure of neighborhood accessibility.

[2] Single family condominiums refer to multi-family properties that have been converted to condominiums, where ownership of each unit is separate. Apartment buildings (and other types of multi-family units) that are owned by commercial entities are not considered in this study.

In the literature covering the determinants of sale price, school quality is frequently found to be significant. To incorporate this variable, we used the geocoded addresses and joined each to an elementary school catchment area. Most of the properties were assigned a Portland Public Schools elementary school, but the properties in East Portland were assigned to the appropriate school in the Reynolds, David Douglas, Parkrose, or Centennial School Districts. The state publishes reading and math scores for each school which represented the percentage of students that met or exceeded state standards; these were used as our measure of school quality.

The following figures illustrate differences in sale property characteristics by neighborhood. As we explain in later sections, property characteristics and neighborhood amenities tend to cluster geographically; properties tend to be grouped by size, age, and sale price. This means that we can experience confounding effects when using all potential variables. Table I below summarizes population, population growth, mean sale price, mean age of house sold and mean size of house sold as a supplement to the graphical presentations.

Table I – Summary statistics by neighborhood

Neighborhood	Pop. (2010)	Pop. Growth (2000-2010)	Mean Sale Price (2010-2013)	Mean Age of House Sold	Mean Size of House Sold (sqft)
Alameda	5,214	3.51%	$ 533,807	85	2,259
Arbor Lodge	6,153	1.45%	$ 270,907	77	1,488
Ardenwald-Johnson Creek	4,748	-0.17%	$ 259,681	56	1,590
Argay	6,006	3.23%	$ 237,117	45	2,052
Arlington Heights	718	3.46%	$ 643,570	53	2,670
Arnold Creek	3,125	6.66%	$ 438,278	25	2,609
Ashcreek	5,719	2.84%	$ 312,730	37	1,901
Beaumont-Wilshire	5,346	0.26%	$ 434,227	76	1,861
Boise	3,311	6.16%	$ 284,818	90	1,451
Brentwood-Darlington	12,994	13.18%	$ 165,021	52	1,206
Bridgeton	725	107.14%	$ 302,500	9	2,262
Bridlemile	5,481	-3.03%	$ 449,122	44	2,388
Brooklyn	3,485	-1.61%	$ 291,639	92	1,454
Buckman	8,472	6.93%	$ 338,442	95	1,621
Cathedral Park	3,349	10.42%	$ 218,419	62	1,329
Centennial	23,662	11.05%	$ 150,013	46	1,371
Collins View	3,036	32.52%	$ 383,946	43	2,059
Concordia	9,550	-0.15%	$ 307,094	70	1,600
Creston-Kenilworth	8,227	-0.09%	$ 255,051	80	1,387
Crestwood	1,047	-3.06%	$ 264,987	36	1,580
Cully	13,209	2.93%	$ 213,492	59	1,364
Downtown	12,801	28.65%	$ 340,320	27	1,088
East Columbia	1,748	17.32%	$ 222,312	35	1,744
Eastmoreland	5,007	0.58%	$ 539,654	73	2,402
Eliot	3,611	7.50%	$ 303,384	75	1,601
Far Southwest	1,320	-16.72%	$ 371,729	30	2,420
Forest Park	4,129	20.34%	$ 603,580	25	3,575
Foster-Powell	7,335	-0.45%	$ 198,250	76	1,270
Glenfair	3,417	32.70%	$ 171,050	40	1,649
Goose Hollow	6,507	16.30%	$ 328,172	36	1,254
Grant Park	3,937	4.46%	$ 535,028	88	2,142

Table I (continued) – Summary statistics by neighborhood

Neighborhood	Pop. (2010)	Pop. Growth (2000-2010)	Mean Sale Price (2010-2013)	Mean Age of House Sold	Mean Size of House Sold (sqft)
Hayden Island	2,270	6.57%	$ 228,186	31	1,320
Hayhurst	5,382	1.22%	$ 331,231	49	1,965
Hazelwood	23,462	17.19%	$ 174,097	49	1,491
Healy Heights	187	-4.10%	$ 738,790	52	3,288
Hillsdale	7,540	8.08%	$ 381,083	52	2,082
Hillside	2,200	12.42%	$ 698,291	54	2,665
Hollywood	1,578	13.61%	$ 321,472	67	1,493
Homestead	2,009	23.86%	$ 506,349	21	1,697
Hosford-Abernethy	7,336	4.70%	$ 402,064	87	1,757
Humboldt	5,110	0.97%	$ 329,253	83	1,675
Irvington	8,501	0.18%	$ 567,069	86	2,406
Kenton	7,272	4.87%	$ 219,769	64	1,268
Kerns	5,340	4.81%	$ 315,136	81	1,334
King	6,149	3.55%	$ 292,420	85	1,473
Laurelhurst	4,633	1.85%	$ 501,440	86	2,237
Lents	20,465	9.96%	$ 146,701	56	1,245
Linnton	941	-9.87%	$ 247,653	44	1,685
Lloyd District	1,142	88.76%	$ 140,426	55	712
Madison South	7,130	2.02%	$ 197,551	57	1,517
Maplewood	2,557	-1.58%	$ 317,075	48	1,808
Markham	2,248	-3.19%	$ 298,320	40	1,955
Marshall Park	1,248	8.62%	$ 377,155	43	2,177
Mill Park	8,650	24.80%	$ 162,209	48	1,435
Montavilla	16,287	0.32%	$ 204,552	68	1,272
Mt. Scott-Arleta	7,397	1.79%	$ 199,696	71	1,241
Mt. Tabor	10,162	1.80%	$ 379,296	71	1,865
Multnomah	7,409	11.18%	$ 292,228	46	1,577
North Tabor	5,163	15.43%	$ 303,543	75	1,557
Northwest District	13,399	6.38%	$ 400,436	64	1,427
Northwest Heights	4,806	112.84%	$ 575,362	11	3,268
Old Town-Chinatown	3,922	33.81%	$ 178,526	22	830
Overlook	6,093	0.00%	$ 307,734	75	1,518
Parkrose	6,363	5.52%	$ 171,497	62	1,338

Table I (continued) – Summary statistics by neighborhood

Neighborhood	Pop. (2010)	Pop. Growth (2000-2010)	Mean Sale Price (2010-2013)	Mean Age of House Sold	Mean Size of House Sold (sqft)
Parkrose Heights	6,119	0.43%	$ 173,722	54	1,379
Pearl	5,997	438.81%	$ 457,106	29	1,178
Piedmont	7,025	9.30%	$ 255,658	74	1,502
Pleasant Valley	12,743	57.65%	$ 269,567	18	2,307
Portsmouth	9,789	17.88%	$ 203,935	53	1,334
Powellhurst-Gilbert	30,639	34.23%	$ 153,409	41	1,336
Reed	4,399	10.72%	$ 326,943	55	1,878
Richmond	11,607	3.22%	$ 345,295	85	1,527
Rose City Park	8,982	1.55%	$ 365,452	85	1,757
Roseway	6,323	-1.57%	$ 259,867	75	1,403
Russell	3,175	0.13%	$ 193,146	53	1,580
Sabin	4,149	0.68%	$ 375,919	86	1,596
Sellwood-Moreland	11,621	8.85%	$ 341,821	75	1,493
South Burlingame	1,747	12.35%	$ 337,607	54	1,935
South Portland	6,631	36.30%	$ 350,769	31	1,468
South Tabor	5,995	-2.22%	$ 257,436	65	1,414
Southwest Hills	8,389	1.10%	$ 732,081	62	2,844
St. Johns	12,207	7.59%	$ 180,850	57	1,216
Sullivan's Gulch	3,139	3.15%	$ 264,786	61	1,212
Sumner	2,137	1.81%	$ 154,040	68	1,159
Sunderland	718	22.74%	$ 251,000	58	2,117
Sunnyside	7,354	2.78%	$ 321,114	48	1,384
Sylvan-Highlands	1,317	9.02%	$ 478,022	37	2,367
University Park	6,035	14.95%	$ 274,993	68	1,613
Vernon	2,585	-11.59%	$ 310,432	83	1,599
West Portland Park	3,921	3.87%	$ 265,386	34	1,781
Wilkes	8,775	13.33%	$ 199,944	31	1,633
Woodland Park	176	-41.72%	$ 158,446	67	1,316
Woodlawn	4,933	0.90%	$ 247,135	72	1,404
Woodstock	8,942	5.55%	$ 273,399	68	1,422
Overall Mean			$ 313,995	60	1,623

Figure 2 displays the mean sale price of each property in our dataset by neighborhood. There appears to be a tendency for prices to decrease the further the property is from the city center. It should be noted that even with a large dataset featuring a large number of records, some neighborhoods had few sales during the study period. Forest Park has a high mean sale price, but this is driven by a relatively small number of high-value houses. In contrast, the dark area in the center of the map includes the Irvington neighborhood which had a large number of sales and is still in the highest sale price category.

Mean square footage of sale properties (Figure 3) is more dispersed than sale price. Again, we can identify two neighborhoods (Irvington and Eastmoreland) in the inner-east side that tend to have larger houses, but there are also clusters of larger properties in the southwest and far-south east. The combination of high sale prices and small properties in the central part of the city on both sides of the river again demonstrate the premium placed on living in the city center.

Figure 4 displays the mean age of properties at time of sale by neighborhood. There is a clear clustering of older properties in the inner-south east and inner-north east areas. The Downtown and Pearl neighborhoods have clusters of relatively new residences.

Figures 5 and 6 taken together illustrate a primary driver of the findings of the analysis. Figure 5 displays the AV/RMV ratio as a percentage. The inner-eastside in general has a larger split, reflecting the fact that properties values in this area have increased faster than in other areas with older residences. The grouping of neighborhoods in blue includes the areas of North and Northeast Portland that have rapidly increased in value over the last decade. When we check these areas on Figure 6, which shows actual tax paid, some of these same neighborhoods fall in the low-tax categories. A large gap between AV and RMV does not mean that the owner of a property is paying low taxes because of differences in rates. Instead it means that these neighborhoods are paying less than what is expected based on location and sale price.

Figure 2: Mean Sale Price 2010-2013[3]

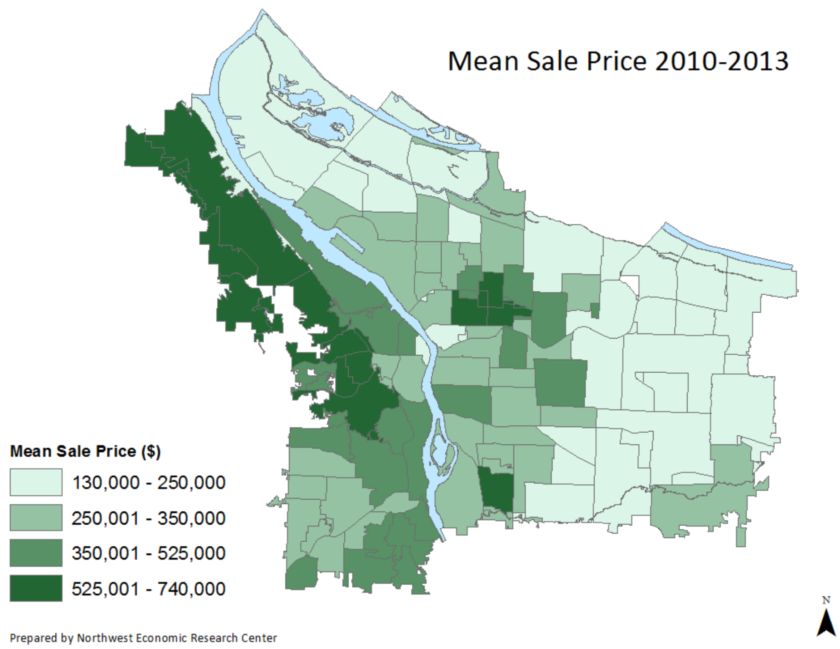
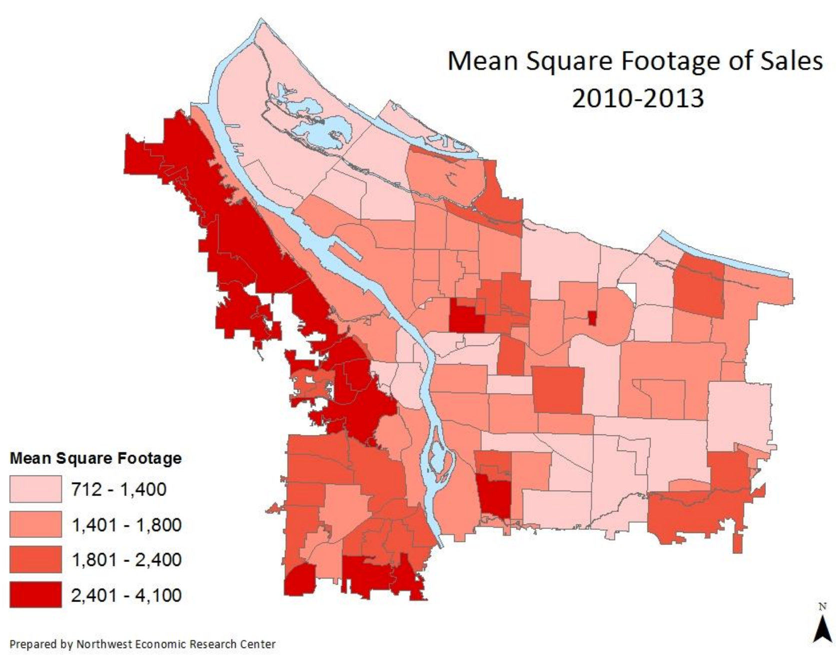


Figure 3: Mean Square Footage of Sales 2010-2013



[3] A map showing neighborhood groupings and names can be found in the Appendix (pg. 31)

Figure 4: Mean Age at Time of Sale 2010-2013

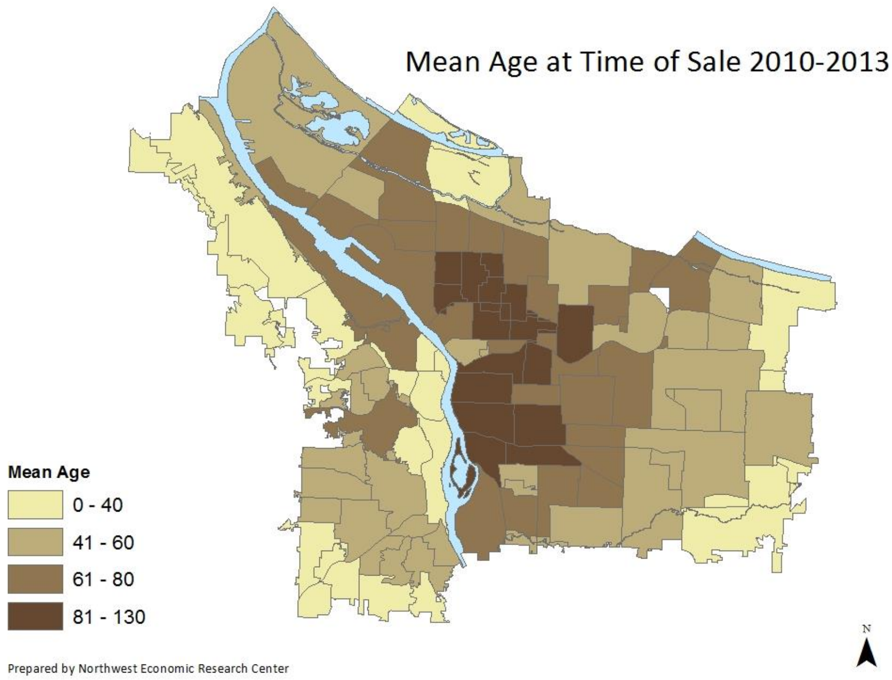


Figure 5: Mean AV/RMV of Sales 2010-2013

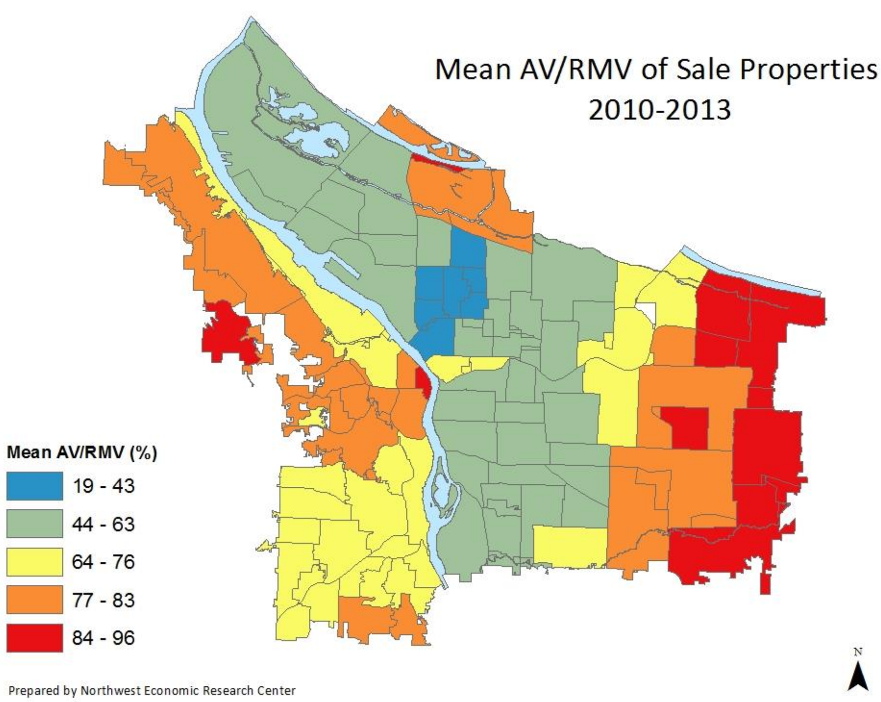
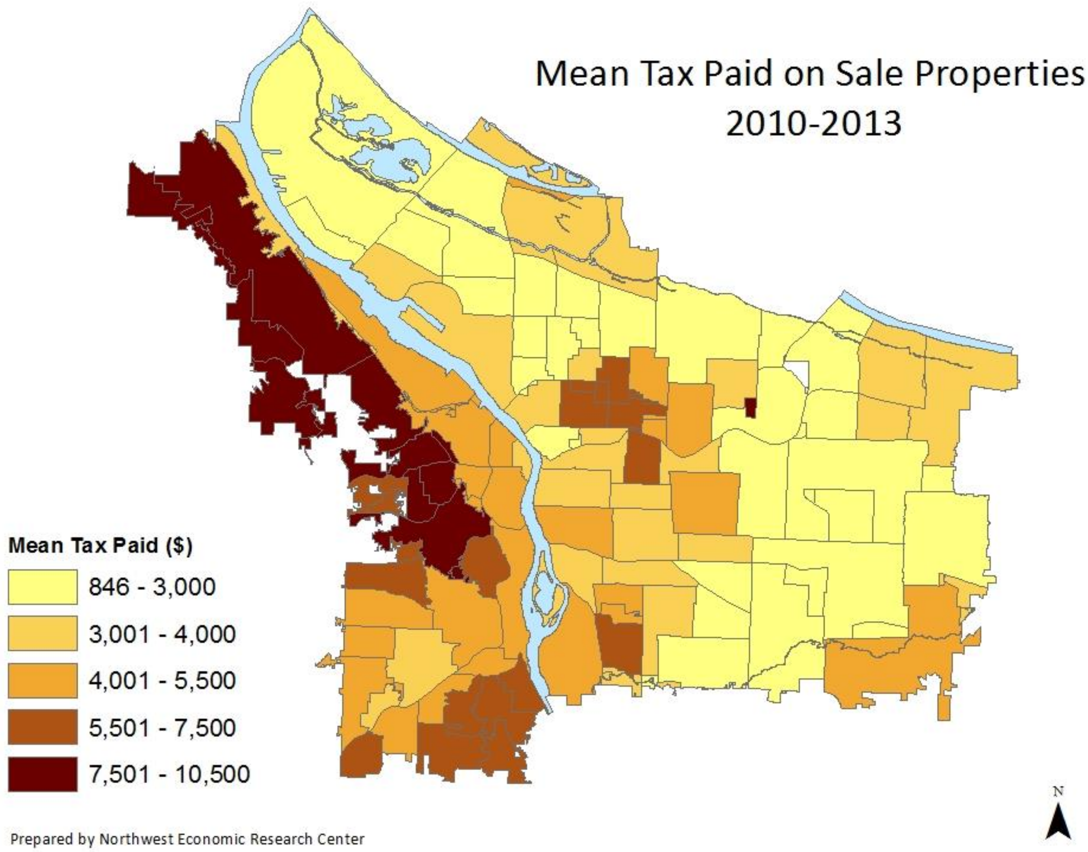


Figure 6: Mean Tax Paid on Sale Properties 2010-2013



IV. ESTIMATION RESULTS

Tables II through V present regression results using variables and methodology discussed in previous sections. We estimated the effects of property tax capitalization using multiple specifications.

Because the main purpose of this study is to estimate the effects of property tax differences on home values, we utilize three different measures of property taxes: AV/RMV ratio, combined AV/RMV ratio and compression ratio, and effective property tax rate (defined as taxes paid divided by RMV). All model specifications include the three measures, denoted as (a), (b) and (c), respectively. Across all three measures, we find that home values are generally higher when the property taxes are relatively lower compared to other properties with similar characteristics. However, the magnitude of influence varied significantly across model specifications.

Property Tax Measures - Notation

AV/RMV ratio = $\frac{AV}{RMV} \times 100$

Compression ratio = $\frac{CalculatedTax}{M5Cap} \times 100$

Effective Tax Rate =
$$\frac{(AV \times TaxRate) \times (CompressionRatio \div 100)}{RMV}$$

In Table II, we start with a simple specification (model I-I) to estimate property sale prices as a function of property size, age and AV/RMV ratio. The results show that every square-foot increases sale price by $176.39, each additional year of age decreases sale price by $74.89 and each additional percentage point increase in AV/RMV ratio (bringing assessed value closer to the real market value) decreases sale price by $1259.11. The R-squared value is known statistically as a coefficient of determination. It denotes the proportion of variation in property sale prices explained by the regression models. Model I-I(a) has an R-square equal to 50%, which indicates that the model captures 50% of the variation in sale prices without controlling for other factors that may also contribute. The regression results show that every additional square-foot consistently adds approximately $157 to $176 to home values, but property age did not always show a consistent sign. When measures of public school quality were incorporated, the estimations showed statistically significant positive impacts of both elementary level reading and math scores (percentage of students in a given public elementary school who meet or exceed standards on state exams) on home values. In addition, homes generally garnered higher sale prices when they were located closer to the central business district, had higher accessibility to amenities (as measured by the Walk Score®) and when crime rate per 1000 residents were lower.

R-squared values ranged from 49% to 70% depending on model specifications, indicating that between 49% and 70% of the variation in housing prices is explained by our explanatory variables. We report robust standard errors (heteroscedasticity-consistent standard errors) to account for heteroscedasticity, or differences in variance across sub-populations of our dataset. In order to deal with endogeneity, we employed two separate sets of strategies: mixed-effects models and instrumental variable (IV) approach. We incorporated time fixed-effects using the year that the sale occurred to account for overall economic conditions and other omitted variables that vary across time. We also estimated additional neighborhood fixed-effects in order to capture unobserved heterogeneity that only varies across neighborhoods. Due to a lack of proper instrumental variables in our dataset, we only used whether a property was built before Measure 50 (1997) as an instrument for the AV/RMV ratio, but did not find convincing estimation results (specification tests showed that this particular instrument did not effectively deal with endogeneity).

Capitalization

Using the definition of property capitalization presented by Ross and Yinger (1999), at discount rates of 3%, 5% and 7%, we expect a property that would last into perpetuity to show capitalization of $33.33, $20.00 and $14.29, respectively, for every dollar decrease in property taxes. If we assumed a 40 year lifespan for the properties, the capitalization of property tax decreases would become $23.11, $17.16 and $13.33, respectively.

To illustrate capitalization of property tax differences in property value, we use the average house sold in our sample as an example. The average house is approximately 1600 square-feet, sold for $313,995 and has an AV/RMV ratio of 65.27% and an effective tax rate of 1.369%. Using the AV/RMV ratio as our variable of interest, our regressions show changes of -$310.39 to -$1541.70 in property sale price for every percentage point increase in the AV/RMV ratio. Therefore, every dollar decrease of property tax results in a property value increase from $5.06 to $25.11. Using the effective tax rate on RMV as our variable of interest, we estimate a change of between -$1766.49 to -$8969.64 in property value per 0.1% increase in the effective tax rate (or increase of one mill). In this case, every dollar decrease of property tax translates to between $6.05 and $30.72 of increase in the property value.

Figure 7: Summary of Effects

Average Portland House

Sale Price = $ 313,995 | 1,600 Sqft

Tax Rate (on AV) = 2.1% | RMV = $291,490

AV/RMV Ratio = 65% | Effective Tax Rate (on RMV) = 1.37%

	AV/RMV Ratio				
	45%	**55%**	**65%**	**70%**	**75%**
Assessed Tax	$2,755	$3,366	$3,979	$4,284	$4,591
Actual Tax	$2,755	$3,366	$3,979	$4,284	$4,372
Sale Price	**$320,203 - $344,829**	**$317,099 - $329,412**	$313,995	**$312,443 - $306,287**	**$310,891 - $298,578**
Sale Price Change (Lower Bound)	**$6,208**	**$3,104**		**-$1,552**	**-$3,104**
Sale Price Change (Upper Bound)	**$30,834**	**$15,417**		**-$7,709**	**-$15,417**

Assuming a discount rate of 3% and perpetual lifespan of properties, we find that the capitalization of property taxes into property value in the Portland area ranges from 15% to 92%. Assuming a higher discount rate of 7% and a perpetual lifespan, capitalization of property taxes into property values is estimated to be between 35% and 215%. If property lifespans are assumed to be shorter, the capitalization effect will increase accordingly. We can conclude that property tax differentials within the jurisdiction do indeed impact home values (i.e., artificially lower property tax results in higher property value, holding everything else constant). It is clear that property values are a function of its own property characteristics, neighborhood characteristics, overall economic conditions and quantity and quality of public services.

However, because many of these characteristics may be unobservable, non-quantifiable or imprecisely measured by the available data, it is difficult to definitively define the exact magnitude of capitalization through this exercise. The necessary assumptions to accurately characterize property tax capitalization (e.g., choices of an appropriate social discount rate and property lifespan) further circumvent our ability to pinpoint the magnitude of capitalization without further research. Further research directions and improvements are outlined in the following section.

Table II - Property sale price regression results. Dependent variable: Sale price. (n=21216)

	I-I(a)	I-I(b)	I-I(c)	I-II(a)	I-II(b)	I-II(c)	I-III(a)	I-III(b)	I-III(c)
Property Characteristics									
Size of property (sqft)	176.39**	176.45**	175.71**	176.48**	176.52**	176.05**	157.81**	157.87**	157.63**
	(3.09)	(3.09)	(3.09)	(3.08)	(3.08)	(3.08)	(3.47)	(3.48)	(3.48)
Age of property	-74.89*	-89.32**	96.00**	-134.75**	-140.43**	0.49	-87.58**	-91.65**	-59.73*
	(42.01)	(41.88)	(40.15)	(42.51)	(42.40)	(40.87)	(33.83)	(34.14)	(34.04)
Tax Characteristics									
AV/RMV ratio	-1259.11**	-1978.03**		-1412.32**	-1945.92**		-1100.00**	-1201.59**	
	(64.82)	(93.34)		(67.83)	(94.55)		(91.62)	(124.56)	
Compression ratio		-1801.74**			-1375.51**			-209.15	
		(219.45)			(218.23)			(206.78)	
Effective tax rate (mills)			-4611.55**			-6477.28**			-5721.55**
			(360.76)			(389.15)			(527.51)
Fixed Effects – Year Sold (base = 2010)									
2011				-4423.25	-4649.38	-8118.88**	-11834.9**	-11692.66**	-13524.15**
				(2813.14)	(2829.23)	(2842.85)	(2325.98)	(2334.81)	(2342.72)
2012				12236.5**	10502.38**	5515.53**	5087.60**	5056.15**	2121.39
				(2815.08)	(2793.20)	(2862.67)	(2453.29)	(2451.04)	(2478.81)
2013				39440.57**	37081.58**	40481.86**	35153.34**	34978.5**	37719.94**
				(2788.57)	(2785.38)	(2913.91)	(2373.44)	(2366.43)	(2586.84)
Fixed Effects – Neighborhood									
Neighborhoods							*Omitted*	*Omitted*	*Omitted*
Constant	114298.8**	332633**	86175.41**	114011.1**	280592.3**	105185.3**	236781.6**	263552.4**	246478.6**
	(8195.65)	(25697.35)	(5405.53)	(8148.17)	(25494.16)	(8378.461)	(12184.05)	(26580.62)	(12329.54)
R-squared	0.50	0.50	0.49	0.51	0.51	0.50	0.70	0.70	0.69

* Significantly different from zero with 90% confidence.
** Significantly different from zero with 95% confidence.

Table III - Property sale price regression results with school characteristics. Dependent variable: Sale price. (n=21216)

	II-I(a)	II-I(b)	II-I(c)	II-II(a)	II-II(b)	II-II(c)	II-III(a)	II-III(b)	II-III(c)
Property Characteristics									
Size of property (sqft)	159.46**	159.54**	158.89**	159.45**	159.52**	159.08**	157.40**	157.46**	157.22**
	(3.13)	(3.12)	(3.13)	(3.12)	(3.12	(3.12)	(3.48)	(3.49)	(3.49)
Age of property	-75.67**	-89.94**	43.10	-140.66**	-146.13**	-74.39**	-93.89**	-97.72**	-66.00*
	(32.27)	(37.11)	(36.07)	(37.46)	(37.35)	(36.48)	(33.82)	(34.13)	(34.03)
Tax Characteristics									
AV/RMV ratio	-1373.89**	-2085.68**		-1541.70**	-2053.67**		-1092.98**	-1188.34**	
	(57.07)	(85.39)		(59.32)	(86.13)		(91.74)	(124.81)	
Compression ratio		-1779.84**			-1316.63**			-196.09	
		(202.27)			(200.63)			(207.02)	
Effective tax rate (mills)			-6630.94**			-8969.64**			-5673.93**
			(330.31)			(356.30)			(528.01)
School Characteristics									
Reading score	3369.22**	3417.88**	3404.23**	3294.20**	3402.59**	3523.72**	643.85**	653.45**	669.47**
	(144.39)	(146.80)	(146.53)	(142.75)	(145.01)	(145.00)	(212.54)	(212.67)	(212.88)
Math score	553.05**	414.90**	469.03**	551.94**	450.15**	406.61**	124.42	114.70	103.08
	(130.28)	(132.52)	(132.23)	(128.63)	(130.81)	(130.49)	(177.58)	(177.99)	(178.17)
Fixed Effects – Year sold (base = 2010)									
2011				-4242.38*	-4452.78*	-5196.43**	-11789.81**	-11656.71**	-13487.34**
				(2558.31)	(2556.11)	(2571.42)	(2324.45)	(2333.32)	(2341.30)
2012				13433.97**	11781.79**	11177.65**	4945.78**	4916.47**	1973.71
				(2547.25)	(2527.26)	(2598.50)	(2451.183)	(2448.86)	(2478.06)
2013				42495.08**	40240.67**	48393.3**	35217.38**	35044.47**	37729.93**
				(2527.32)	(2524.12)	(2643.05)	(2371.70)	(2363.39)	(2585.56)
Fixed Effects – Neighborhood									
Neighborhoods							*Omitted*	*Omitted*	*Omitted*
Constant	-134512.6**	79430.42**	-144013**	-136431.1**	21815.01	-125847.6**	169374.2**	194468.7**	178447.3**
	(8212.86)	(23553.78)	(8339.02)	(8131.03)	(23338.97)	(8234.96)	(14105.38)	(27842.26)	(14365.38)
R-squared	0.59	0.59	0.58	0.60	0.60	0.59	0.70	0.69	0.70

* Significantly different from zero with 90% confidence.
** Significantly different from zero with 95% confidence.

Table IV - Property sale price regression results with school and neighborhood characteristics. Dependent variable: Sale price. (n=21216)

	III-I(a)	III-I(b)	III-I(c)	III-II(a)	III-II(b)	III-II(c)
Property Characteristics						
Size of property (sqft)	164.06**	164.03**	165.96**	165.96**	165.88**	165.84**
	(3.07)	(3.07)	(3.14)	(3.14)	(3.18)	(3.19)
Age of property	-76.02**	-62.82*	-93.53**	-81.64**	-95.04**	-84.68**
	(34.72)	(33.92)	(36.06)	(35.30)	(35.95)	(35.18)
Tax Characteristics						
AV/RMV ratio	-345.12**		-319.33**		-310.39**	
	(67.54)		(67.33)		(67.52)	
Effective tax rate (mills)		-1985.21**		-1835.66**		-1766.49**
		(383.84)		(383.33)		(381.84)
School Characteristics						
Reading score	1005.51**	1036.38**	1150.78**	1181.60**	1144.85**	1172.08**
	(146.40)	(147.49)	(146.80)	(147.89)	(147.10)	(148.06)
Math score	462.22**	428.56**	410.33**	378.41**	414.06**	385.11**
	(126.59)	(126.69)	(126.31)	(126.40)	(126.90)	(127.12)
Neighborhood Characteristics						
Distance to CBD	-28773.46**	-29035.75**	-26714.68**	-26925.35**	-26749.76**	-26965.56**
	(702.10)	(661.03)	(855.78)	(824.63)	(850.29)	(818.84)
Walk Score ®			299.23**	303.77**	313.90**	325.42**
			(81.35)	(81.42)	(82.33)	(82.56)
Crime rate per 1000					-7480.78	-11180.14
					(13323.83)	(13295.42)
Fixed Effects – Year sold (base = 2010)						
2011	-16138.94**	-16387.63**	-16422.04**	-16654.52**	-11491.54**	-16736.22**
	(2479.90)	(2479.57)	(2483.07)	(2482.35)	(2473.94)	(2474.68)
2012	-696.30	-1230.60	-1071.76	-1569.195	-1173.51	-1685.06
	(2457.47)	(2490.98)	(2460.97)	(2494.28)	(2454.79)	(2470.63)
2013	31382.46**	32661.75**	31089.68**	32270.01**	31011.08**	32121.99**
	(2423.29)	(2530.01)	(2423.79)	(2531.66)	(2420.52)	(2527.02)
Constant	81457.21**	86266.8**	42712.21**	46577.58**	42440.79**	46078.11**
	(7405.97)	(7722.52)	(11505.74)	(11737.05)	(11475.12)	(11697.75)
R-squared	0.64	0.64	0.64	0.64	0.64	0.64

* Significantly different from zero with 90% confidence.

** Significantly different from zero with 95% confidence.

Table V - Instrumental variable regression results with school and neighborhood characteristics. Dependent variable: Sale price. (n=21216)

	IV
Property Characteristics	
Size of property (sqft)	166.25**
	(3.26)
Age of property	-1622.76**
	(128.86)
Tax Characteristics	
AV/RMV ratio	-6374.25**
	(447.71)
School Characteristics	
Reading score	3500.60**
	(272.09)
Math score	39.89
	(176.97)
Neighborhood Characteristics	
Distance to CBD	-5949.47**
	(1729.37)
Fixed Effects – Year sold (base = 2010)	
2011	44687.62**
	(5481.80)
2012	78550.89**
	(6598.84)
2013	94671.16**
	(5522.21)
Constant	257221.7**
	(16156.86)
R-squared	0.48

* Significantly different from zero with 90% confidence.

** Significantly different from zero with 95% confidence.

V. FURTHER RESEARCH

In order to deal with potential selection bias and endogeneity that may exist within our sample of home sales, we may be able to construct a time series dataset that includes multiple sales of the same properties. In this alternative specification, we can then employ the change in sale prices as the dependent variable, and changes in property characteristics, property tax characteristics, neighborhood/location characteristics and public service characteristics as explanatory variables. Additional socioeconomic and demographic data from the Census or American Community Survey (ACS) may also be incorporated into the analysis to provide additional instruments for statistical issues, and to provide better controls for neighborhood heterogeneity.

Before Measure 50 was implemented, home values were re-evaluated on a 7 year rolling schedule. When Measure 50 was implemented, assessed values were set at 90% of 1995-1996 tax rolls. Home values may or may not have been subject to a recent re-evaluation, adding an additional layer of arbitrary treatment of properties in the property tax system. If we are able to obtain data on when the most recent re-assessment occurred before Measure 50, it may enable us to better explain more of the property tax variations.

One method of estimating how differences in property tax treatment can capitalize into property values is to utilize the difference-in-difference (DID) approach. This approach was popularized by Card and Krueger (1994) in their article studying the effects of increasing minimum wages in New Jersey by including Pennsylvania (which did not have an increase in minimum wage) as a control. Because of Portland metropolitan area's unique geographic location with portions located in both Oregon and Washington, we may be able to adopt the DID approach with property data from neighboring Oregon and Washington counties to isolate the impacts of differential property tax regimes. Additionally, this approach may also be applied across different Oregon jurisdictions that experienced booms in property development during varying time periods (before and after Measure 5 and 50 were implemented).

VI. CONCLUSIONS

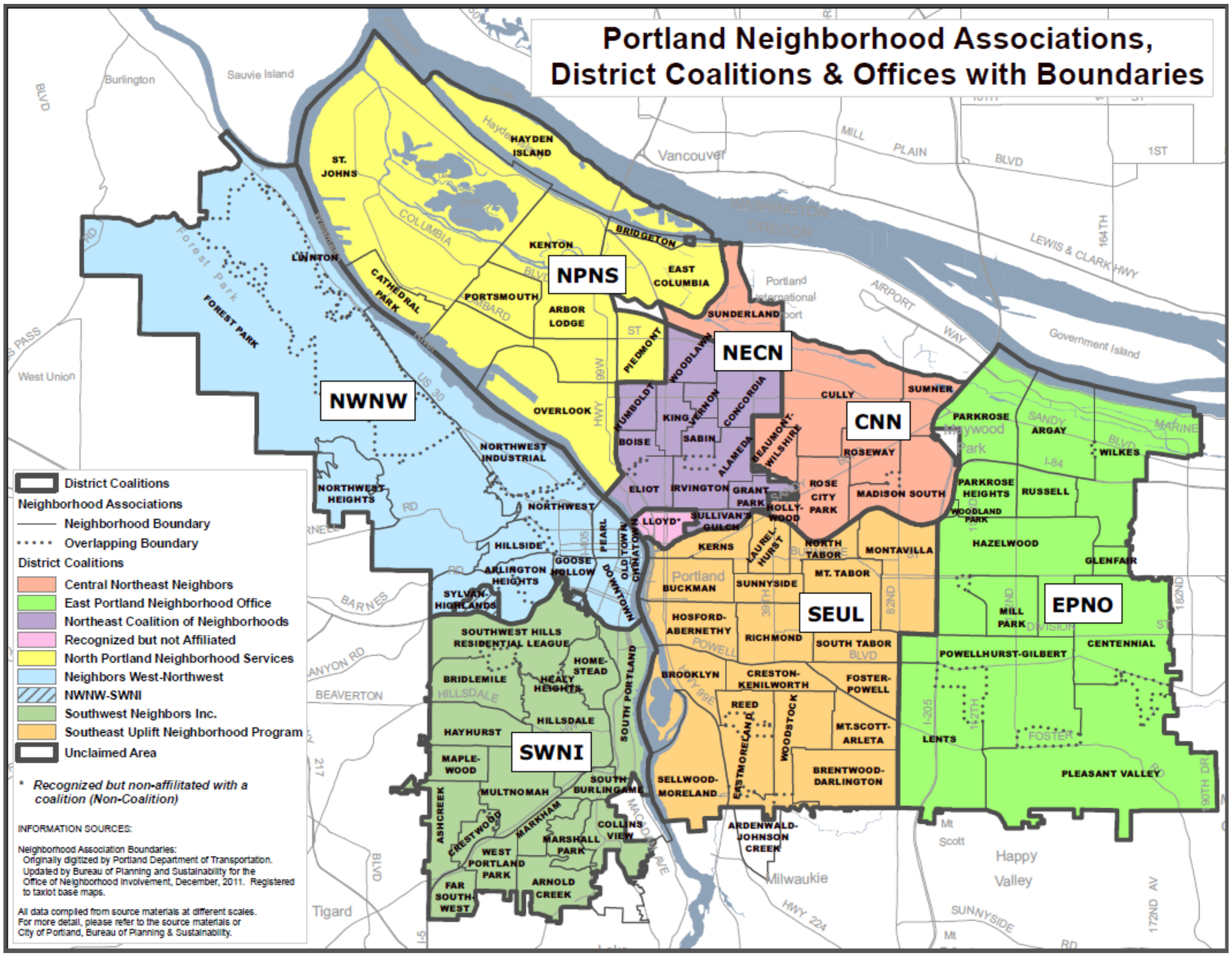
Based on our estimation results, we believe that Oregon's property tax structure is significantly affecting home sale prices in Portland. Statistical issues prevent us from confidently stating the exact size of the effect, but the consistent sign and high significance of the estimated coefficients lead us to that conclusion. The structure of the tax is creating a distortion in the market for houses and condos, which benefits certain property owners (and harms others) for reasons that are arbitrary from a policy perspective.

Changes in the ratio between assessed value (AV) and real market value (RMV) are driven mostly by changes in RMV; in areas where RMV has risen quickly, this gap grows. Our study indicates that this gap adds additional value to homes, exacerbating existing inequities. Property owners living in areas where RMV rises quickly relative to AV are enjoying an increase in their property value that is not derived from property or neighborhood improvements. Instead this increase is a by-product of a property tax system separated from the market.

Expanding this analysis was beyond the scope of the project, but it is reasonable to expect these dynamics to be present in other parts of Oregon. In cities where properties in different neighborhoods or areas have appreciated faster than in others since the passage of Measures 5 and 50, we would expect to see similar results. The size of the distortion would vary based on local characteristics, but we would expect to see evidence of capitalization.

Because these inequities are concentrated in areas where residential values have increased rapidly relative to AV, the property tax system creates a hidden subsidy for these property owners. Some of the burden of funding government and school services is transferred away from these homeowners. This results in revenue shortfalls, or creates the need for property owners in areas with a smaller increase in RMV to disproportionately fill the gap. The unequal distribution of funding responsibility created by the property tax system may clash with existing government priorities in a way that is not understood by policymakers or voters.

APPENDIX: Portland Neighborhood Map [4]



[4] Map from City of Portland: Neighborhood Involvement. Can be found at: https://www.portlandoregon.gov/oni/28385 [Last Accessed 2/27/2014]

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