Hedonic Analysis and Time Varying Amenities: An Application Using School Quality

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1. Introduction

During the past decade housing markets have been used by applied economists to investigate the value households place on school quality. The evidence from these housing market studies suggests that school quality matters to households and is capitalized into property values (e.g. Black 1999, Figlio and Lucas 2004, Ries and Somerville 2010, Tra, Lukemeyer, and Neil 2013). One current criticism of school quality studies in housing market is that they focus on estimating a single coefficient for school quality capitalization (see e.g. Down and Zabel 2002, Nguyen-Hoang and Yinger 2010). Of particular interest in public finance is the extent that the capitalization of school quality varies over time or remains stable especially during cyclical housing market booms and busts.

Housing prices fell dramatically throughout the United States as a result of the deflating of the housing bubble in 2006. By April 2009 nationwide housing prices were down at least one-third from their peak in July 2006, and stayed down at least one-fourth below the peak through August 2010 (S&P/Case-Shiller Home Price Index). One may argue that households self-select into areas with good schools as a hedge against the risk of future housing price drops during market downturns (Sinai and Souleles 2013). Another possibility is that households may heavily select into neighborhoods with good schools during housing market downturns to avoid the additional expense of private schools. Most households experienced declining wealth when housing prices fell as home equity is the largest portion of U.S. household wealth. Thus it is possible that they view high-quality public schools as a viable alternative to private schools. All of these factors point toward the possibility that the property value capitalization of school quality may be very different during periods of housing booms compared to periods of housing market downturns.

Our main contribution from this research is to show that the capitalization of school quality into property values is more prevalent during periods of house price declines compared to periods of house price increases. Our empirical analysis uses data from four counties in the greater Baltimore-Washington metropolitan area between the years 2004 through 2010. During this period housing prices rose dramatically until the second quarter of 2006 and fell sharply thereafter to reach a bottom around the year 2010. This trend is observed in the S&P/Case-Shiller Home Price Index and presented in Figure 1.[1] We use repeat-sales methods to control for time-invariant unobserved factors. We address potential bias from time-varying unobservables using disaggregated housing price indices (Ries and Somerville 2010, Towe and Lawley 2013) as well as year-specific neighborhood fixed effects. Using the year 2006 as the peak of the housing market, we find that while the capitalization of middle school quality into property values was positive and strongly significant during the housing downturn (2007 through 2010), the capitalization effect was nearly non-existent during the housing boom period (2004 through 2006).

2. The housing market crisis and school funding

There is little doubt of the tumult in the housing market nationally, regionally, and locally in the recent years, a massive overinvestment in the early 2000's followed by an almost equally large retraction after 2006. Figure 1 provides a clear indication of a shift in the trajectory of housing

[1] http://www.spindices.com/index-family/real-estate/sp-case-shiller

prices in the Washington DC metro area. The housing market in our study region of Maryland was buffered from the full force of the housing decline due to the regional stability of the labor market arising from the state's relative proximity to and dependency on federal jobs. However, the region was not unscathed. Figures 2, 3 and 4 show the price per square foot of sold properties by middle school district in 2004, 2006, and 2009, respectively. These figures clearly show the regional boom in 2006 followed by a rather spatially heterogeneous bust in 2009 and thus are a good illustration of both the change in value before and after the market peak as well as the spatial heterogeneity in the valuation decline. These figures show an across the board price increase in the '04 to '06 period followed by a somewhat dispersed decline in prices in '09. In this paper we explore school quality as a potential explanation for this dispersed decline.

This recession, led by the housing decline, was made exceptional by the large increases in mortgage loan defaults and foreclosures. National foreclosure starts increased from 1.5 million in 2007 to 2.8 million in 2009. In addition, the share of mortgage loans that were seriously delinquent reached 5.2 percent by the third quarter of 2008, compared to the 1979–2006 average of 1.7 percent and the previous high of 2.7 percent in 2002（Mayer, Pence, and Sherlund 2009）. As pointed out by Towe and Lawley (2013), the Bureau of Labor Statistics reported that the unemployment rate in Maryland was 15th lowest in the nation in 2009, and the year-over-year increase in the unemployment rate was 7th lowest amongst states. At the same time, the counties in our study area all rank in the bottom third in national unemployment rate, but according to Realty Trac (DHCD 2009), Maryland ranks 12th in the nation in foreclosure rate over the same time interval. In short, Maryland is at or near the lowest quartile in unemployment statistics while being near the highest quintile in foreclosure activity.

Despite the downturn in valuation of real estate properties in Maryland, the counties are obligated by law to match or increase school funding year-over-year and face penalties for failing to do so. This is called “maintenance of effort”. Several counties (8 of 23) including Montgomery and Prince George from our sample requested waivers from the full increases in 2010.[2] Prince George’s requested relief from $23m of a $609m budget and Montgomery requested $94m in relief from a budget of $1.5 billion. The requests were denied by the state and the counties were ordered to pay fines if they failed to commit funds which the counties chose to do. In order to meet these requirement many counties in the state including those in our sample sought budget savings across the board to maintain school funding during this period. In short, the legislation performed its defined task of forcing the counties to maintain school budgets in economic downturns. It is in this unique combination of housing recession in rather wealthy and high quality school districts with thick housing markets that make this region an ideal laboratory to explore the capitalization of school quality in a tumultuous housing market.

3. Methodology

Following the standard hedonic approach, the price of a housing unit *i* in a neighborhood *j* during year *t* is expressed as a log-linear function of time-invariant housing attributes (X_i), neighborhood characteristics (Z_{jt}), school quality (s_{jt}) measured at the elementary or middle school level, and an error term (ε_{ijt}):

$$ln\ P_{ijt} = \alpha X_i + \beta Z_{jt} + \gamma_1 s_{jt} + \gamma_2 s_{jt} * PostBubble_t + \varepsilon_{ijt}. \ (1)$$

[2] American Reinvestment and Recovery Act monies prevented such requests earlier.

Where, *PostBubble*$_t$ is a dummy variable that equals to zero for the years 2004 through 2006 and equals one for the years 2007 through 2011. The error term contains unobserved housing attributes (μ_j), unobserved neighborhood characteristics which vary over time (δ_{jt}) and a random error term (u_{ijt}), so that:

$$\varepsilon_{ijt} = \mu_i + \delta_{jt} + u_{ijt}. \text{ (1a)}$$

Direct regression estimation of the school quality coefficients (γ_1 and γ_2) is subject to classic bias from arising from correlation of unobserved house attributes and neighborhood characteristics. School quality, s_{jt}, is very likely to be correlated to δ_{jt}. This is because good schools are likely to be located in neighborhoods with better amenities that may not be observed by the researcher. We would also expect that s_{jt} is correlated to μ_i, since good schools will tend to be more prevalent in neighborhoods that have a nicer suite of amenities well maintained, and high-quality houses.

The literature suggests three alternative approaches to address the omitted variables bias in school quality capitalization estimates.[3] The boundary fixed effects approach (Gill 1983; Cushing 1984; Black 1999), uses differences in house prices across school boundaries to identify the capitalization of school quality into housing values. The identification of the school quality capitalization effect using the boundary fixed effect approach holds as long as all other housing and neighborhood characteristics are continuous across school boundaries. Alternatively, some

[3] See Nguyen-Hoang and Yinger (2011) for a comprehensive discussion of the approaches used to address the omitted variable bias in school quality capitalization estimates.

studies (e.g. Downes and Zabel 2002, Gibbons and Machin 2003) use an instrumental variables (IV) approach to address the omitted variables bias in school quality capitalization estimates. Instruments are valid if they are correlated with school quality but are exogenous with respect to the unobserved housing and neighborhood characteristics. If valid instruments can be found, unbiased estimates of the school quality capitalization effect can be obtained by two-stage least squares (2SLS). The third approach makes use of multiple-sales, i.e. repeat-sales, on individual houses. This approach relies on house-specific fixed effects to control for time-invariant unobserved house and neighborhood characteristics. The repeat-sales methodology has few applications in the school quality literature. Figlio and Lucas (2004) employ this approach to investigate the effect of elementary school later grades on house prices in Florida. Ries and Somerville (2010) use the repeat-sales model to measure school quality capitalization effects resulting from changes in school zones in Vancouver, British Columbia.

This study applies the repeat-sales methodology following a similar approach as Ries and Somerville (2010). Applying first-differences to both sides of equation (1) gives rise to the repeat-sales model:

$$\ln\left(\frac{P_{ijt}}{P_{ijt-k}}\right) = \delta_{jt} - \delta_{jt-k} + \gamma_1(s_{jt} - s_{jt-k}) + \gamma_2(s_{jt} - s_{jt-k}) * PostBubble_t + (u_{ijt} - u_{ijt-k}). \quad (2)$$

Equation (2) can be estimated by OLS regression. Our identification of the school quality parameters (γ_1 and γ_2) comes from the changes in house prices within neighborhoods after controlling for time-invariant factors. Alternatively, the parameters of equation (2) can be estimated by a panel fixed-effect regression. We estimate equation (2) by panel fixed-effect regression as a robustness check.

The estimation of the school quality effect from equation (2) may still suffer from an upward bias if housing prices rose faster in areas with high-quality schools compared to areas with relatively low-quality schools. To address this potential issue, the neighborhood price controls (δ_{jt} - δ_{jt-k}) need to be as disaggregated as possible (Ries and Somerville 2010). We compute repeat sales house price indices at the U.S. Census subdivision level using the methodology of Towe and Lawley (2010). The study area comprises about 30 census subdivisions, compared to nearly 120 middle schools. Hence we have a large number of repeat sales observations for each neighborhood, which helps to obtain smoothed neighborhood-level house price indices. Of course census subdivisions are quite large and there can be unobserved time-varying factors that are heterogeneous within a census subdivision. We address this issue by including year-specific fixed effects for 12-digit watershed zones obtained from the Maryland Department of Natural resources.[4] Our study area comprises approximately 190 watershed zones.

4. Data

As the home state of the fourth largest Census metropolitan statistical area in the United States, Maryland provides a unique opportunity to study the capitalization effect of school quality into housing prices. Our study area comprises four contiguous counties in Maryland that combine the suburbs of Washington, DC and the suburbs of Baltimore. These counties include Prince George's County, Montgomery County, Howard County, and Baltimore County, see Figure 2 for

[4] http://mddnr.chesapeakebay.net/wsprofiles/surf/prof/prof.html.

context. These counties constitute 51% of the state's population and are the 1st, 2nd, 3rd, and 5th most populous counties in the state. In addition the state of Maryland has an established record as having some of the best public schools in the country each year from 2008-2013.[5] We have assembled a unique dataset which combines repeat-sales housing transactions, household characteristics, and school characteristics, including student performance. Summary statistics are provided in Table 1.

Housing sample

The housing data for this study comes from county level tax and assessment data from each county in the state of Maryland, updated annually via Maryland's Department of Planning and packaged in a data product called Maryland Property View (MPV). We use the MPV data to extract arms-length sale transactions of residential properties, which occur between 2004 and 2011. We restrict all samples to single family dwellings, condos, or townhouses. When utilizing repeat observations, we drop all homes that sold in subsequent or the same year (flips) and all observations above the 95th and below the 5th percentile of the distribution of all sales by county and sale year pair. For example, if a home sold in 1999 and 2005 we compare the price change for this home against all homes in the same county that sold in the same years and drop based on the percentiles from this distribution.

[5] http://www.washingtonpost.com/blogs/maryland-schools-insider/post/maryland-schools-ranked-number-one--again/2012/01/11/gIQA7NEqrP_blog.html
And
http://www.edweek.org/ew/articles/2013/01/10/16sos.h32.html?tkn=RLRF%2B4mUV1fjxGZAPk7Od%2FfW1p2K2SFHTAx9&cmp=clp-edweek&intc=EW-QC13-EWH

Heterogeneity in the neighborhood price decline across the region is extremely important in our model. Both Bajari, Chu, and Park (2010) and Foote, Gerardi, and Willen, (2008) clearly demonstrate this in analyzing default activity. As we mentioned earlier we follow Towe and Lawley (2013) and include an annual repeat sales house price index at the census tract level where there is adequate sample to estimate the index, and at the census subdivision level where the sample is not adequate.[6]

The MPV data is supplemented with household income and race variables obtained from the Home Mortgage Disclosure Act database (HMDA) and painstakingly cross-referenced with lender and tax and assessment data to assign a unique income value to many homes in the sample. See Bishop and Timmins, 2013, Tra, Lukemeyer, and Neil (2013), and Bayer, Ferreira, and McMillan (2007) for similar implementations. The addition of the HMDA data provides a unique opportunity to analyze the heterogeneity of school quality capitalization, a question that has not received significant attention in the literature. The only exception are cross-sectional studies by Tra, Lukemeyer, and Neil (2013) and Bayer, Ferreira, and McMillan (2007), who estimate heterogeneous preference parameters for school quality that vary with household income and race.

School quality

The Maryland School Assessment (MSA) test assesses student performance in mathematics, reading, and science in grades 3 through 8.[7] The test was developed by the Maryland Department

[6] We set the cutoff at 150 repeated sales to construct the index at the tract level. Approximately 30% of the sample has index values at the tract level.
[7] http://mdk12.org/assessments/k_8.

of Education to comply with the requirements of the federal No Child Left Behind Act (NCLB). The MSA tests are administered annually to students. The MSA test data is available starting in 2003. For each school, the MSA data provides the percentage of students performing at each achievement level (basic, proficient, and advanced). We focus on the math and reading assessment tests since the science test is not administered at all grade levels. We construct aggregate measures of student performance for elementary schools (grades 3 through 5) and middle schools (grades 6 through 8) in our study area. For elementary schools, the aggregate student performance measure is computed as the average proportion of students performing at either a proficient or advanced level, in math and reading in grades 3, 4, and 5. For middle schools, the aggregate student performance measure is computed as the average proportion of students performing at either a proficient or advanced level, in math and reading in grades 6, 7, and 8. Figures 6 and 7 show the average from 2004 to 2011 of the aggregate student performance measures for elementary and middle schools, respectively. The overall elementary school quality is remarkably high throughout much of the study area, leaving less spatial differentiation for home buyers to select from. Figure 6 demonstrates the lack of heterogeneity in elementary scores within each county and across the region. In contrast, figure 7 shows that middle school quality varies both within each county and across the study area.

Our identification of school quality capitalization relies on repeat sales. However, small changes in student performance are likely to mean little to households if the school is already perceived as good or bad. Hence, the school quality variable is constructed as a categorical dummy variable which takes the value of 1 if the proportion of students performing at either the proficient or advanced level is above 90 percent, and zero otherwise. This implies that we are estimating the capitalization effect of having a high-achieving school in the neighborhood. The repeat sales strategy therefore identifies the housing price effect of a school going from not very good to very good.

Watershed zones

In addition to the housing and schooling data we control for unobserved neighborhood factors using the watershed zones (HUC 12 designation) obtained from the Maryland Department of Natural Resources. We use this spatial characterization of neighborhoods because it is truly exogenous to our spatial geography of interest, yet groups similar regions and their houses to allow non-parametric designations of heterogeneous price effects at a disaggregated scale. Of course, other options exist such as zip code or census tract. These designations are problematic in this type of analysis because all too often the same natural (i.e. streams) and man-made (i.e. roads) barriers that define their boundaries also define the boundaries of the school district. In all models we include not only watershed fixed effects but watershed by sale year fixed effects, allowing for extremely flexible modeling of the time and space unobservable factors. Our study area comprises approximately 190 watershed zones. See figure 8 for the watershed boundaries and scale.

5. Results

Elementary school quality

Columns (1) trough (3) of Table 2 show the elementary school capitalization results. Column (1) shows the estimates for the standard hedonic model (Equation 1) while columns (2) and (3) show the repeat-sales model estimates (Equation 2). The repeat-sales estimates for the capitalization of elementary schools are not significant. The cross sectional estimates are positive and significant but cannot be relied on due to the fact that they may suffer from an upward bias (see Section 2). The elementary school results are consistent with the exiting empirical evidence on the capitalization of elementary school quality which shows effects that are either very small (Nguyen-Hoang and Yinger 2010) or not significant at all (e.g. Ries and Somerville 2010). The failure to find positive and significant capitalization effects for elementary schools may be explained by the fact that the overall elementary school quality is remarkably high throughout much of the study area. Figure 6 demonstrates the lack of heterogeneity in elementary scores within each county and across the region.

Middle school quality

Columns (4) trough (6) of Table 2 show the middle school capitalization results. Column (4) shows the estimates for the standard hedonic model (Equation 1) while columns (5) and (6) show the repeat-sales model estimates (Equation 2). The results show a strong positive capitalization of middle school quality. The estimates are also quite robust across the three specifications. Most importantly, all three specifications suggest that the capitalization of middle school quality is substantially different in periods of housing market boom compared to post-bubble market periods. We do not find a significant capitalization effect of middle school quality during the market boom period. On the other hand, we find a positive and strongly significant capitalization effect for high-achieving schools during the post-bubble period of rapid housing price depreciation. The estimated coefficients suggest that, during the post housing bubble years, the effect of a neighborhood school entering the category of high-achieving (i.e. over 90 percent students are proficient) is a 9 to 11 percentage point increase in house prices or about $42,000 to

$50,000 at the median house price for improving areas. These findings also suggest that pooled estimates of school quality capitalization across serial time periods may have little meaning, especially when the sample time frame incudes periods of housing market booms and busts.

Heterogeneity of school quality capitalization

Given the middle school quality capitalization results, one may wonder about the amount of heterogeneity in the capitalization estimates among households. For instance, the heterogeneity of the capitalization effect with respect to household income tells us which households are paying the premiums for the high-achieving schools in post-bubble periods. To answer this question we split the sample into four income quartiles based on the household income reported in the HMDA data see figure 9 for this distribution. Given the robustness of the cross-sectional capitalization estimates for middle school quality, and the large losses of observations in the repeat-sales models, we estimate the income quartile regressions by cross-section.

The results in Table 3 are quite striking. As in Table 2, there is no capitalization effect for middle school quality during the housing boom period. During the post-bubble period we find that middle income households are the group that is essentially paying the premium for high-achieving schools. The sales transactions of low-income households do not show a price premium for high-achieving schools. This is probably because those households are priced out the neighborhoods where those good schools are likely to be located.

The fact the sales transactions for households in the top income group do not reflect a school quality premium may seem odd at first sight. Empirical results from Tra, Lukemeyer, and Neil

(2013) suggest that households with higher income levels have a higher willingness to pay (WTP) for school quality, which is in accordance with the hypothesis that school quality is a normal public good. However, our result is intuitively plausible since many of the highest-income households are not geographically constrained by housing location and are able to send their children to one of the many private schools accessible throughout the region.[8]

[8] In our four county region there are 293 private schools covering in varying degrees K-12 education.

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Table 1: Summary statistics

Housing Data				Schools Data		
Variable	**mean**	**sd**		**Variable**	**mean**	**sd**
lnprice	12.65	(0.60)		Parent Teacher Ratio Middle School	15.62	(4.01)
sqftstrc1000	1.72	(0.91)		Proportion Minority Students MS	0.52	(0.31)
built30s40s	0.07	(0.26)		Average Score Grade 6, 7, 8	0.64	(0.18)
built50s	0.15	(0.35)		Indicator for Aver MS score >90%	0.07	(0.26)
built60s	0.11	(0.31)		Parent Teacher Ratio Elementary Sch	15.60	(3.02)
built70s	0.11	(0.31)		Percentage Minority Students ES	51.34	(32.17)
built80s	0.20	(0.40)		Average Score Grade 3, 4, 5	0.77	(0.15)
built90s	0.14	(0.34)		Indicator for Aver ES score >90%	0.29	(0.45)
built2000s	0.17	(0.38)				
builtmiss	0.03	(0.17)				
grade==below average	0.28	(0.45)				
grade ==not ranked	0.17	(0.37)				
priceindexSD	2.09	(0.36)				
story==1 story	0.21	(0.41)				
story==3 story or more	0.03	(0.16)				
story==not ranked	0.17	(0.38)				
story==split foyer	0.04	(0.19)				
dwelling==condo	0.05	(0.22)				
dwelling ==no classification	0.12	(0.32)				
dwelling ==split foyer	0.08	(0.28)				
dwelling ==townhouse ctr	0.18	(0.39)				
dwelling ==townhouse end	0.12	(0.32)				
saleyear==2005	0.20	(0.40)				
saleyear==2006	0.17	(0.38)				
saleyear==2007	0.14	(0.34)				
saleyear==2008	0.09	(0.28)				
saleyear==2009	0.08	(0.27)				
saleyear==2010	0.08	(0.27)				
saleyear==2011	0.05	(0.21)				
Number of Observations				274,908		

Table 2: The effect of school quality – regression results

	Elementary school						Middle school					
	Cross-section		Panel first-difference		Panel fixed-effect		Cross-section		Panel first-difference		Panel fixed-effect	
	(1)		(2)		(3)		(4)		(5)		(6)	
Top school	0.028251	***	-0.0263		-0.0220	**	0.006616		-0.0095		0.0029	
	(0.0036)		(0.0101)		(0.0098)		(0.0057)		(0.0194)		(0.0185)	
Postbubble*top school	0.017948	***	0.0128		0.0139		0.061383	***	0.1135	***	0.0945	***
	(0.0042)		(0.0186)		(0.0183)		(0.0074)		(0.0362)		(0.0344)	
Pupil-teacher ratio	0.001559	***	-0.0020		-0.0016		0.001275	***	0.0001		0.0002	
	(0.0004)		(0.0015)		(0.0014)		(0.0003)		(0.0005)		(0.0005)	
Proportion minorities	-0.258804	***	-0.0545		-0.0973		-0.192478	***	0.0760		0.1224	
	(0.0049)		(0.0943)		(0.0911)		(0.0048)		(0.1086)		(0.1069)	
Repeat-sale price index	0.147221	***	0.2215	***	0.3371	***	0.131011	***	0.2070	***	0.3185	***
	(0.0069)		(0.0407)		(0.0270)		(0.0067)		(0.0403)		(0.0269)	
House attributes	Yes		x		x		Yes		x		x	
House fixed-effect (FE)	No		Yes		Yes		No		Yes		Yes	
County FE	Yes		x		x		Yes		x		x	
Neighborhood FE	Yes		x		x		Yes		x		x	
Salemonth FE	Yes		Yes		Yes		Yes		Yes		Yes	
Saleyear FE	Yes		Yes		Yes		Yes		Yes		Yes	
Saleyear*county FE	Yes		Yes		Yes		Yes		Yes		Yes	
Saleyear*neighborhood FE	Yes		Yes		Yes		Yes		Yes		Yes	
Drop flips and outliers	No		Yes		Yes		No		Yes		Yes	
R-sqr	0.8142		0.8517		0.8554		0.806		0.8523		0.8577	
Obs.	218238		4221		8559		234615		4640		9293	
Groups					4338						4653	

Notes: * Significant at the 10% level. ** Significant at the 5% level. *** Significant at the 1% level. Standard errors are clustered at the house level.

Table 3: Cross-section regressions by household income quartiles – middle schools

	1st quartile < $64k		2nd quartile $65k – $89k		3rd quartile $90k – $128k		4th quartile > $129k	
Top school	0.0389		-0.0324		-0.0043		-0.0062	
	(0.0534)		(0.0297)		(0.0152)		(0.0089)	
Postbubble*top school	0.0657		0.1626	***	0.0893	***	0.0093	
	(0.0702)		(0.0430)		(0.0214)		(0.0125)	
Pupil-teacher ratio	0.0020	***	0.0011	***	0.0017	***	0.0028	***
	(0.0005)		(0.0004)		(0.0007)		(0.0010)	
Proportion minorities	-0.0636	***	-0.0619	***	-0.1781	***	-0.3004	***
	(0.0105)		(0.0109)		(0.0125)		(0.0169)	
Repeat-sale price index	0.1371	***	0.0741	***	0.0393	***	0.0297	*
	(0.0187)		(0.0158)		(0.0168)		(0.0163)	
Observations	0.7887		0.7996		0.8275		0.8721	
R-squared	17478		16930		16092		16545	

Notes: * Significant at the 10% level. ** Significant at the 5% level. *** Significant at the 1% level.
Standard errors are clustered at the house level.

Figure 1: Case-Shiller House-Price Index for Washington-DC Metropolitan Area

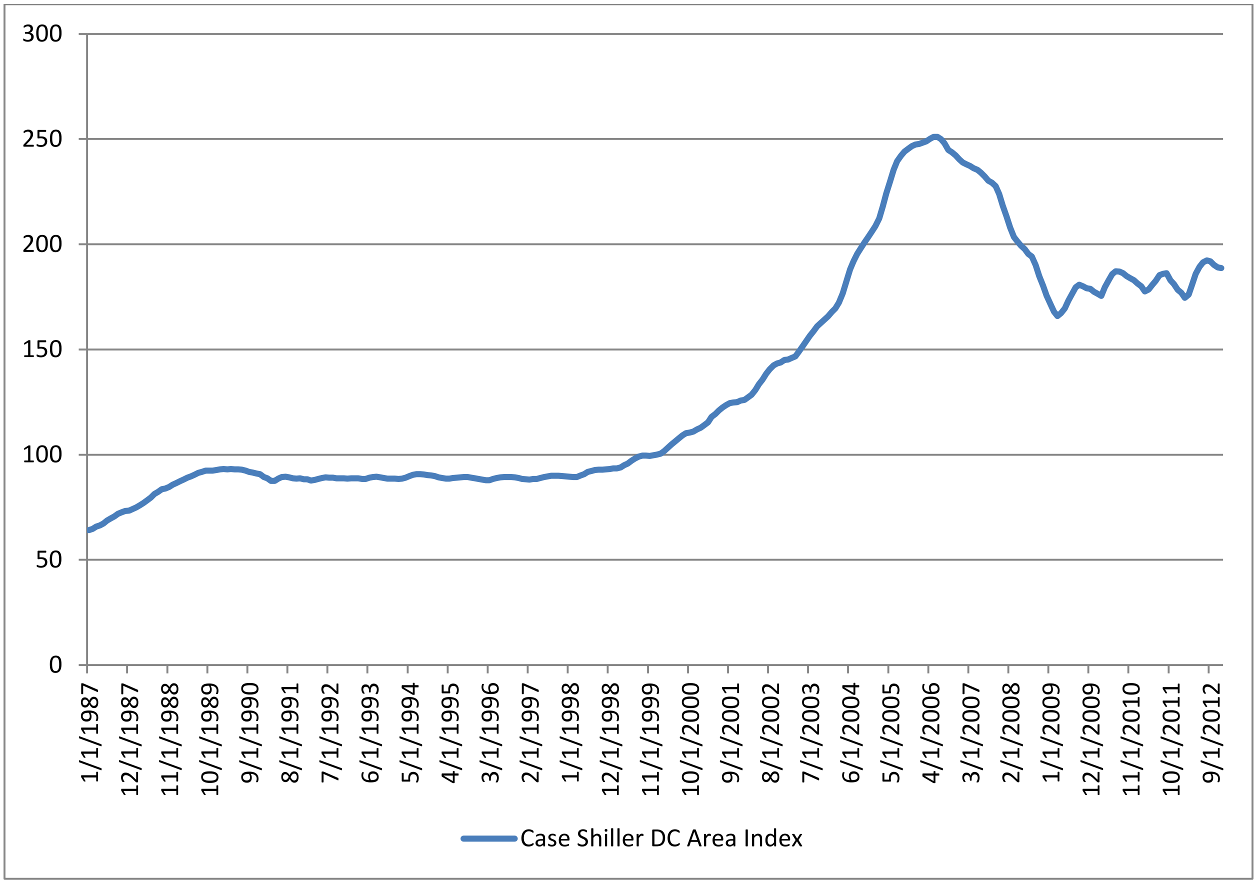

Figure 2: Study Area

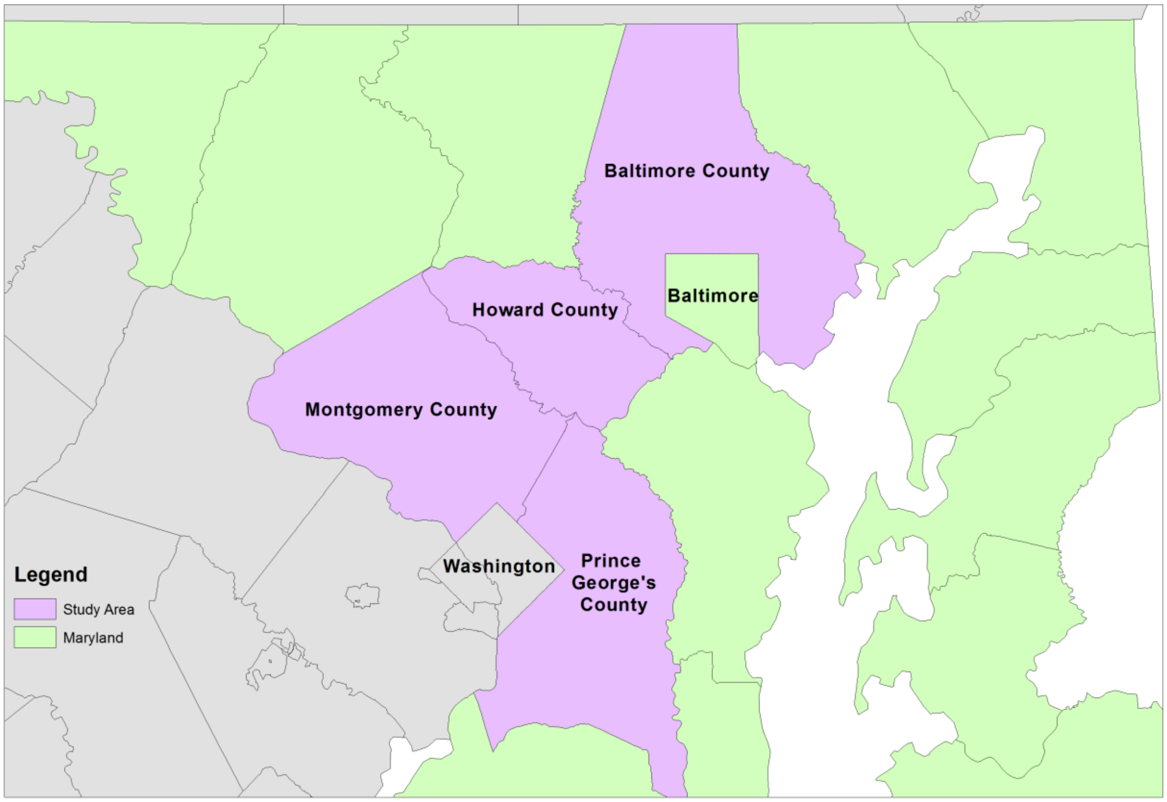

Figure 3: Price per Foundation Square Foot – 2004 Sales by Middle School District

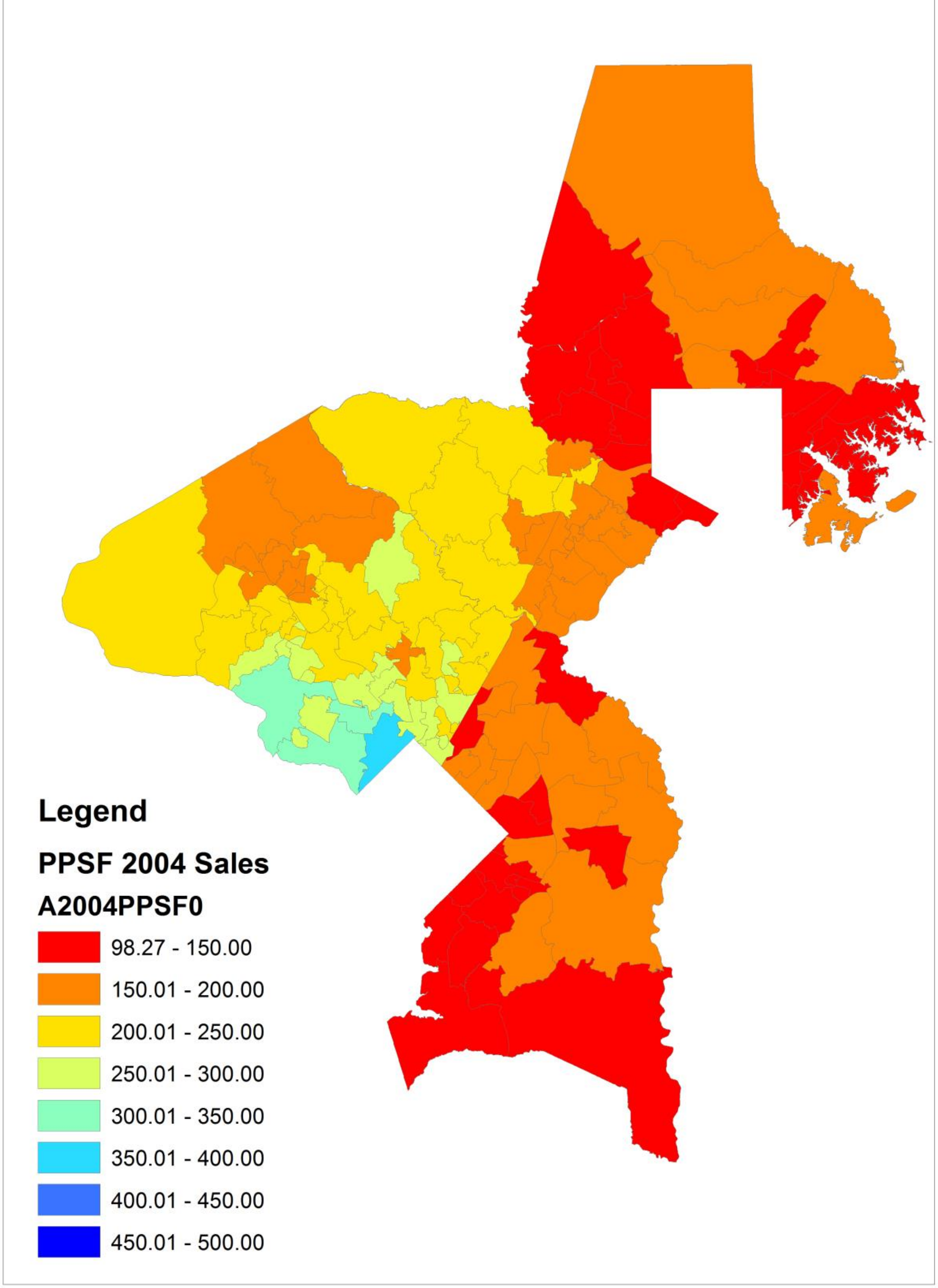

Figure 4: Price per Foundation Square Foot – 2006 Sales by Middle School District

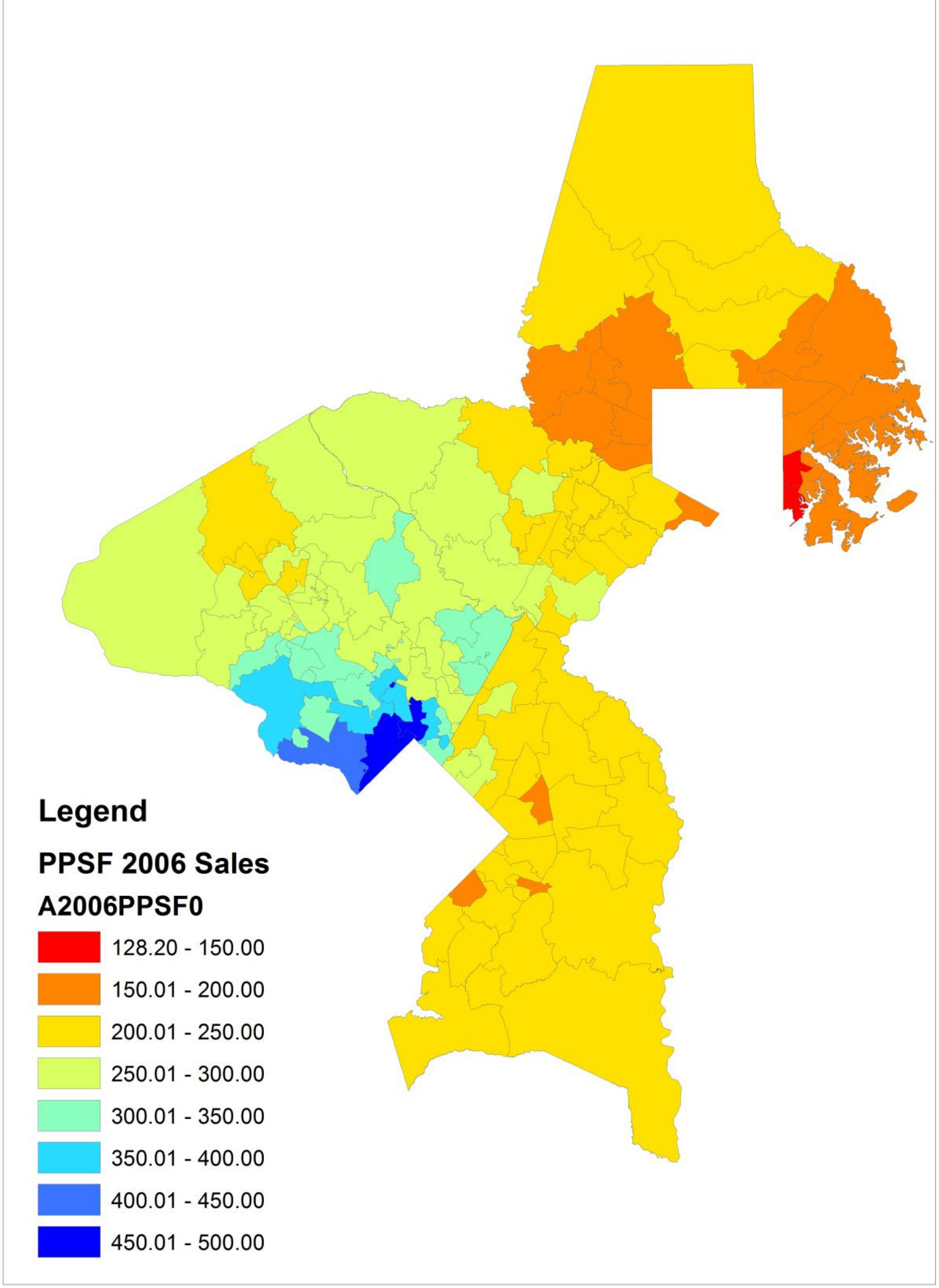

Figure 5: Price per Foundation Square Foot – 2009 Sales by Middle School District

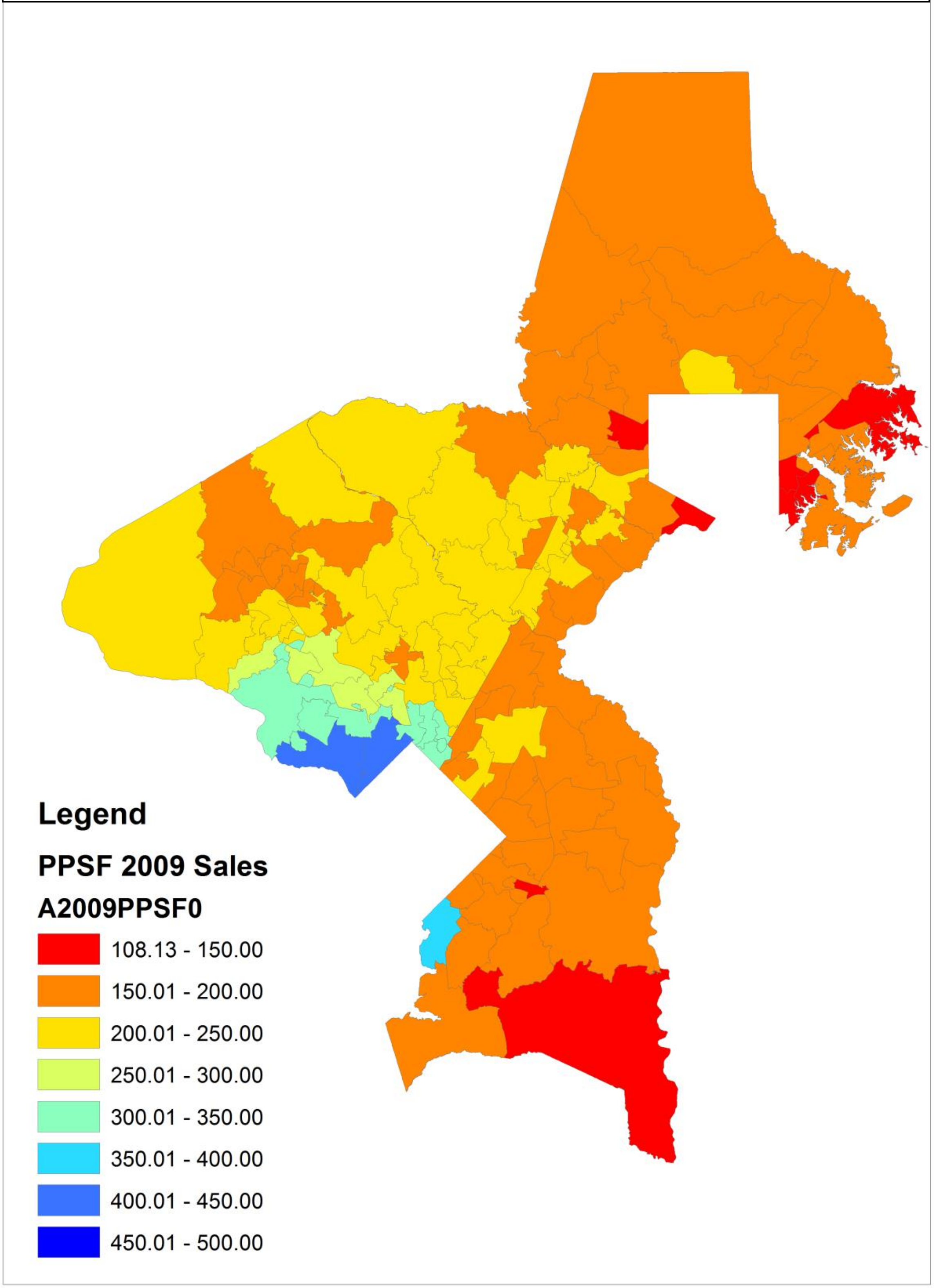

Figure 6: Proportion of Students Proficient in Math & Reading Grade 3-5 from 2004-2011 by School District

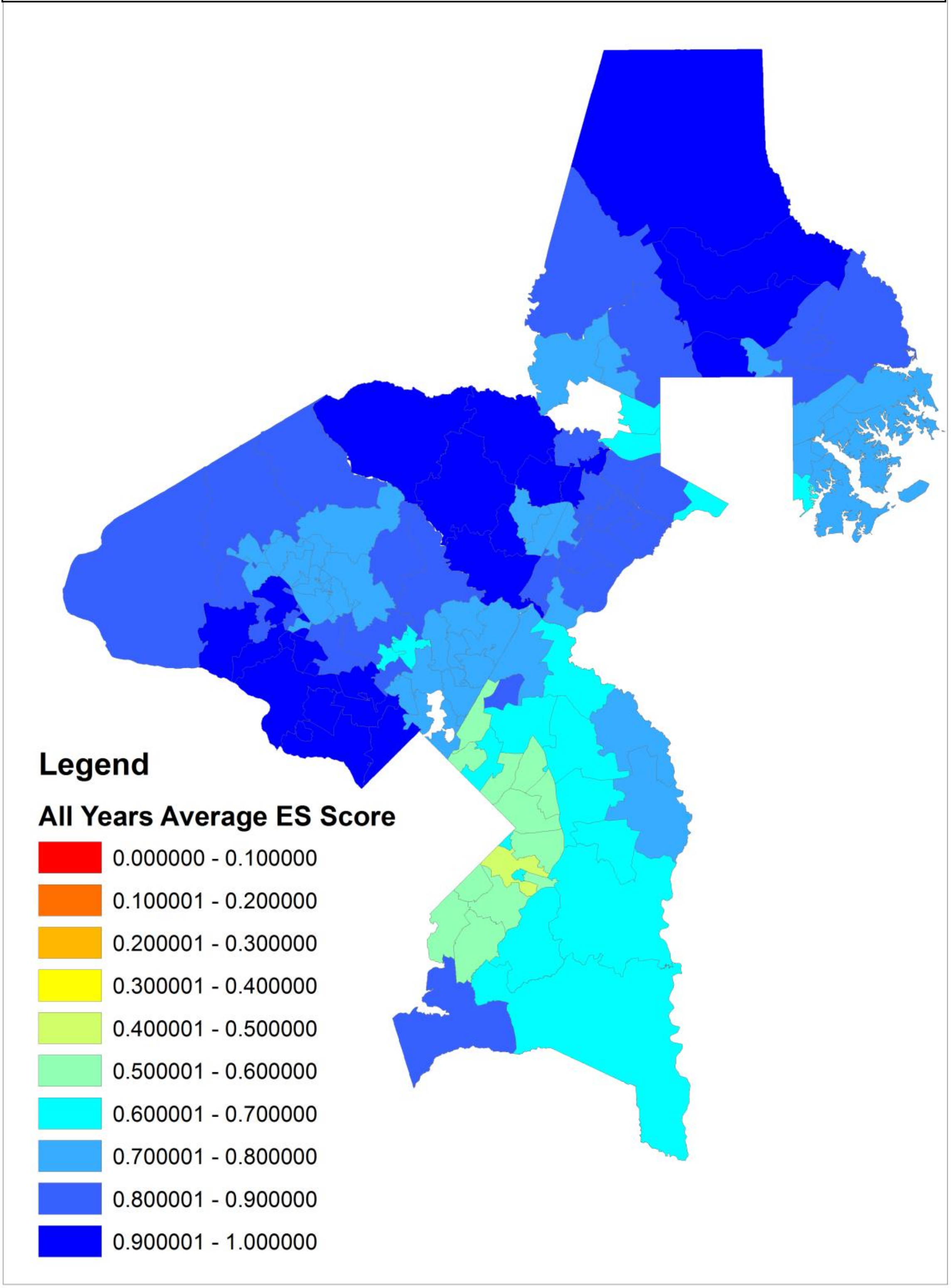

Figure 7: Proportion of Students Proficient in Math & Reading Grade 6-8 from 2004-2011 by School District

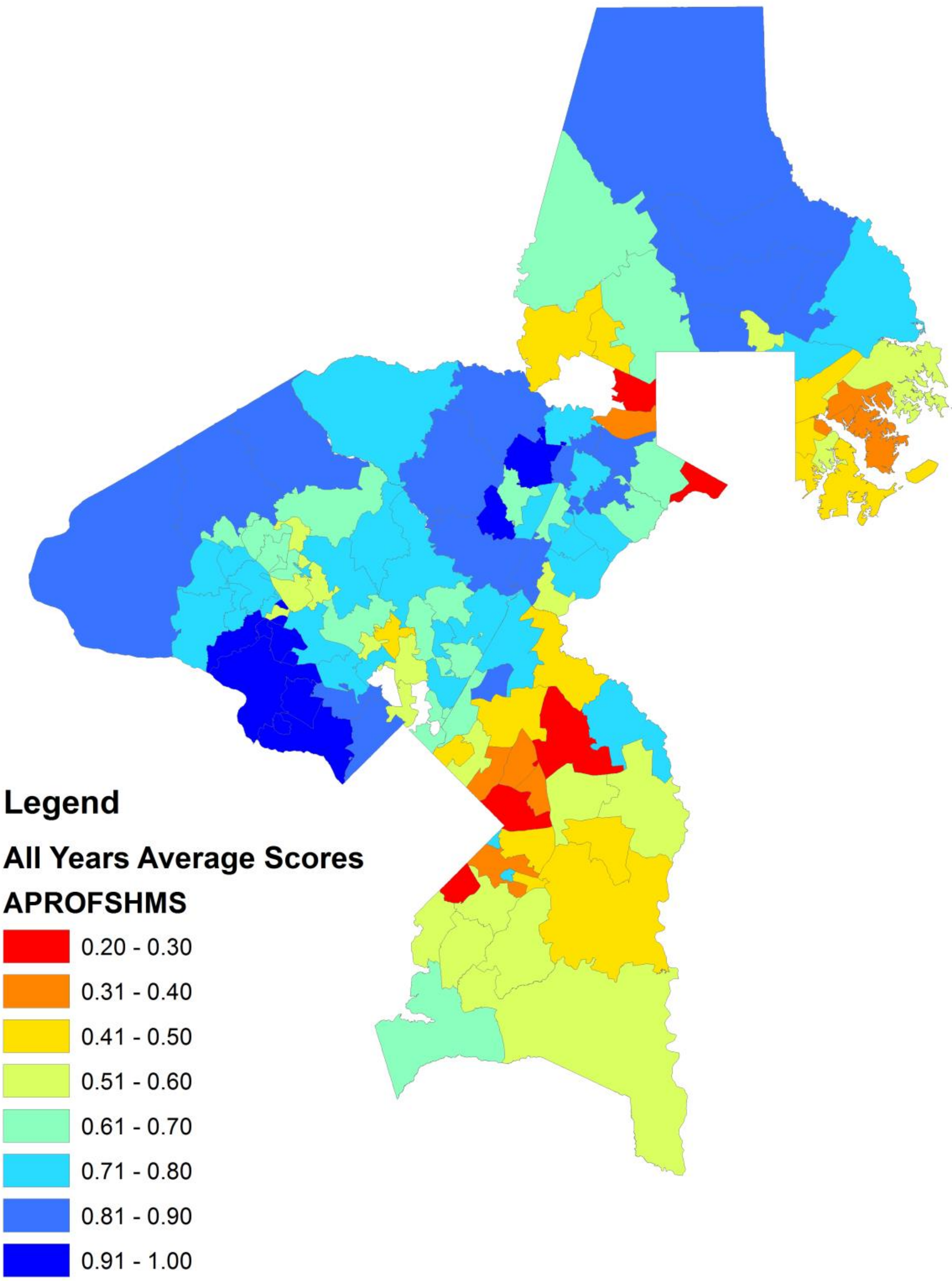

Figure 8: Map of Watershed designations

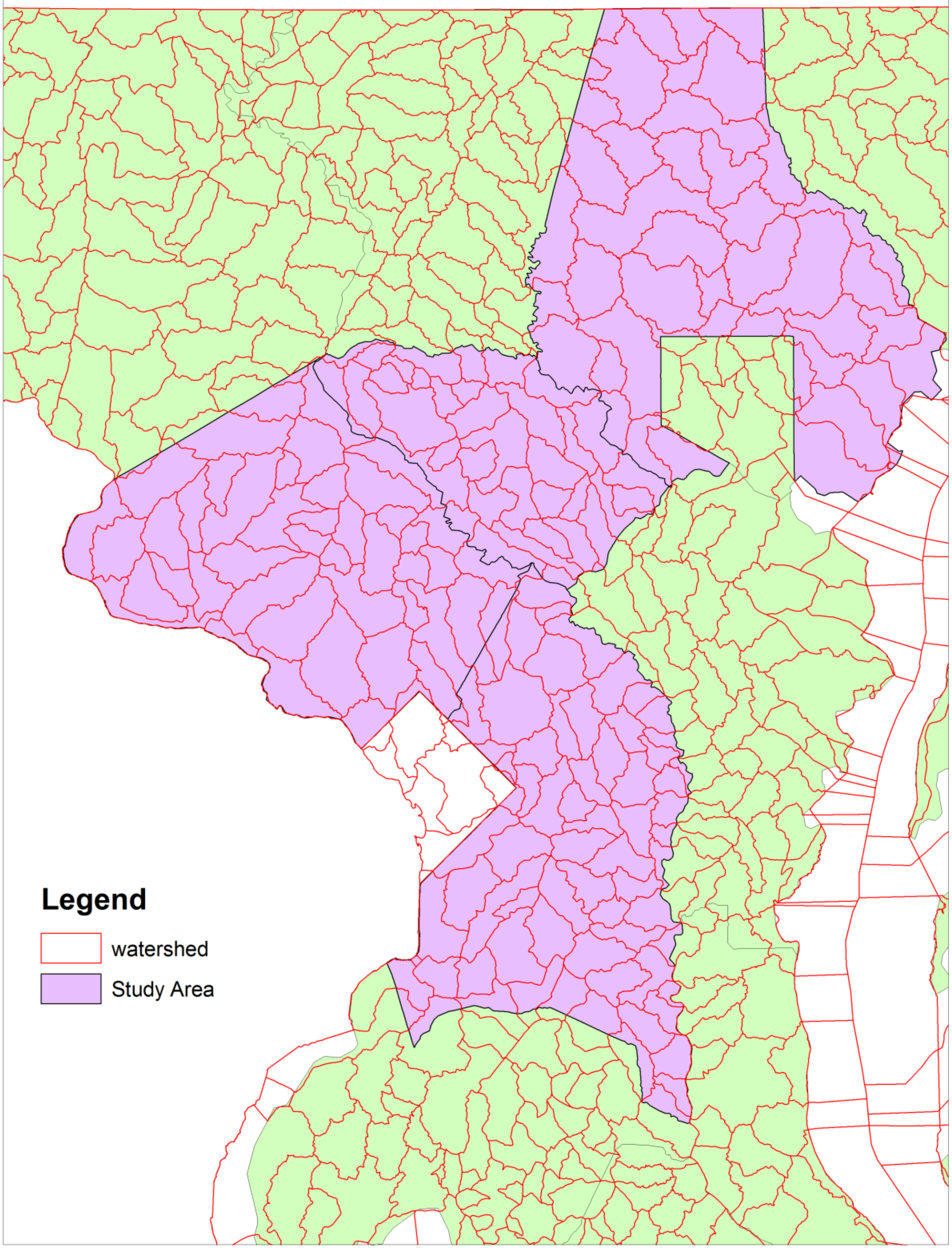

Figure 9: Distribution of Income in subsample