House Price Capitalization of Education by Part Year Residents

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ABSTRACT

This thesis employs hedonic techniques to quantify the extent that educational quality is capitalized into house values. The research extends the standard housing hedonic models in two fundamental ways. First, models examine the differences between resident and non-resident education capitalization. We show that residents are willing to pay more than non-residents to live in school districts that are perceived to be of higher quality. Based on this finding, we recommend that future research incorporate homebuyer residency status into housing hedonic models. Secondly, we consider regressions that evaluate education as a positional good. The findings suggest that high school educational quality may be partially capitalized as a positional good, though high correlations between the absolute and relative education variables suggest that caution is appropriate when interpreting this result. In addition, we find that due to limited variation between districts in our sample, the data are not sufficiently robust to simultaneously estimate the marginal resident and non-resident homebuyers' absolute and relative valuation of education. These results suggest that more research is needed to examine the extent to which public education is a positional good.

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I. INTRODUCTION

Do homebuyers consider the quality of local education when purchasing homes? More specifically, in what ways has educational quality been capitalized into the purchase price of homes, and how does this capitalization differ between residents and non-residents?

There has been much recent housing market- and education policy-based research that examines the value individuals place on the quality of education when purchasing homes in urban and suburban neighborhoods.[1] No studies, however, have examined the level of capitalization of public education in regions where non-residents own a substantial percentage of homes, where schools are typically small, or where the distance between schools is great. The school districts in the Adirondack Park, the state park that encompasses 6.1 million acres in northeastern New York, exhibit all of these characteristics. Meanwhile, strict land-use regulations make for a relatively inelastic supply of land throughout the Adirondack Park.[2,3] Lastly, a significant proportion of homes in the region are owned by part-time residents, who pay school taxes despite not being permitted to vote on district spending, further making this region unique from previously studied areas. The extent to which educational quality is capitalized into home values in rural, second-homeowner frequented communities with inelastic housing supply is an unexplored field of research at the intersection of housing market economics and educational policy research. The goal of this paper is to make a preliminary step towards analyzing the peculiarities of educational capitalization in atypical, historically unstudied regions. Specifically, data are drawn from in and around the southeast quadrant of the Adirondack Park over the past six years. This region well represents the phenomenon of differing capitalization rates of education into house values in a market where a large number of houses are owned, and taxes paid, by people who cannot vote and who do not benefit from much of the local public services.

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[1] The predominant use of urban and suburban areas for research purposes is likely driven by practicality. Housing data are typically collected at the county level. One county in a densely populated area may easily constitute a large enough sample size for research purposes; in rural locations, however, data from multiple counties must be compiled to capture a sufficiently large sample size, creating additional work. In addition, questions regarding school district valuation and tax capitalization are sometimes driven by litigation, the magnitude of which is greater in urban and suburban neighborhoods.

[2] As discussed below, both theory and previous research suggest that increased land supply inelasticity leads to an increased degree of capitalization.

[3] http://www.apa.state.ny.us/Regulations/index.html

The following section summarizes the conceptual framework behind the research and the relevant literature. It is followed by Section III, which contains information regarding the data collected and descriptive statistics, and Section IV, which explains the model specifications. Section V describes the findings of the research, and the final section contains concluding observations and remarks.

II. RELEVANT LITERATURE AND CONCEPTUAL FRAMEWORK

The relevant literature falls into two fields of research: education and hedonic analysis of housing markets. I will discuss the theoretical foundations and corresponding relevant literature of both realms, and then will focus on their intersection. As this junction lies at the determination of educational capitalization into housing prices, I will conclude by explaining what is meant by educational capitalization.

EDUCATION

From lawyers to economists, scientists to bankers, and farmers to nurses, most people abstractly agree that education is a good thing. As proof, we might consider that during the 2000-2001 school year, the combined spending of all U.S. state and local governments on primary and secondary education was $594,591 million, representing over 34% of total state and local government direct general expenditures (calculated from Digest of Education Statistics (DES), 2005). New York State government does not trail far behind national averages, with nearly 30% of its general expenditures going toward education in that school year, and over 80% of these expenses directly providing for elementary and secondary education (DES, 2005). Americans are not alone in their educational conviction: in the G8 countries in 2000, per student spending at primary and secondary levels combined ranged from a low of $5,135 in the United Kingdom to a high of $7,877 in the U.S. (Organization for Economic Cooperation and Development (OECD), 2003). Anecdotally, the willingness of household to pay for private schools when "free" public schools are available is evidence of the private value of education. Despite the abstract consensus, as soon as educational conversation turns to specifics, debates tend to heat up. Quantifying and agreeing upon what makes education valuable has historically proven elusive.

Public policy in the area of primary and secondary education is based on the assumption that schools of better quality[4] generate external benefits, and much economic literature is devoted to justifying this assumption. Educators and economists agree that education creates value at both the private (individual) and public (social) level, and research over the past half-century has

[4] School quality is generally measured in high school graduation rates and standardized exam scores, and the advantages and disadvantages of that methodology are described in more detail below.

sought to quantify both the direct and indirect benefits created by education. At the private level, Card and Krueger (1996) note that the benefits to education are often realized in pure financial terms; compiling previous studies, they suggest that "a 10 percent increase in school spending is associated with a 1 to 2 percent increase in earnings for students later in life" (p. 43). Similarly, at the public level, the returns to education have been touted to include everything from increased total factor productivity to decreased crime levels, as will be discussed below.

Given that higher per pupil expenditures are often empirically linked to higher test scores, which are in turn associated with positive individual and social benefits, we must pause here to address the question of why test scores should be considered by policy makers, homebuyers and educators. At this stage one might ask: if education produces measurable benefits, why not measure these outputs directly instead of relying on examination scores? Although test scores seem to be an unnecessary middleman in the input-output world of per pupil expenditures and subsequent societal value, they are far from unnecessary. The production of education is not a "black box" where money flows in and value (in the elusive form of better educated students) flows out; expenditure is not the only policy variable that affects education. Factors such as efficiency, efficacy, quality of peers and educational methodology all factor into the overall educational quality attained with each dollar of expenditure. These values vary at the school, district and inter-district level, and consequently prohibit use of a simplistic input-implies-output educational production model. The economic evolution that moved analysis away from using inputs (such as per pupil expenditure) to measure outcomes is described in more detail below in the **Education and Housing Hedonics** subsection. For now, it is important to realize that expenditures measure one aspect of education production, while test scores measure many other facets. Specifically, we know that not all children are equally costly to educate up to a certain standard, and therefore the correlation between input measures like expenditure per student and educational outcomes is weak. In addition, we are not certain whether residents value the educational <u>outcome</u> (in which case test scores might be a reasonable measure) or the expected educational <u>effort</u> put toward their child (in which case expenditure per pupil might be appropriate). Thus, both standardized test scores and expenditure per pupil remain important hedonic variables candidates.

Most studies that have sought to quantify what makes education "good" have relied on test scores as a measure of school quality. Some studies have motivated this proxy by citing previous research that estimates a causal relationship between test scores and future private and public economic benefits. At the public level, for example, Hanushek and Kim (1996) suggest that level of student performance on standardized tests directly affects the productivity of a nation's future labor force, and thus increased student performance is correlated with increased national growth rates. Hanushek and Kim (1996) also find a strong correlation between a nation's international test scores, which closely mirror national test performances, and its labor force productivity. As one would expect if Hanushek and Kim's (1996) theories are accurate, empirical evidence shows that these positive correlations are echoed at the private level. Murnane, Willett, and Levy (1995), for instance, use data from *The National Longitudinal Study of the High School Class of 1972* and *High School and Beyond* to determine the effect of students' high school mathematics exam scores on their wages six years after high school graduation. Their findings suggest that exam scores are positively and significantly correlated to higher post-graduation wages. Currie and Thomas (1998) use *National Child Development Survey* data to examine the effects of test scores on wages of a cohort of British children born within one week of each other in 1958. Controlling for parental and childhood socio-economic factors, Currie and Thomas's results also suggest that exam scores have positive and significant effects on future labor market outcomes.

Many economists advocate that education provides other key external benefits besides higher economic productivity; these benefits contribute to both the social value and the private value of education. As Schultz explains, "education is widely viewed as a public good (with positive externalities) [that] increases the efficiency of economic and political institutions while hastening the pace of scientific advance" (1988). Lucas, in his 1988 research, finds that an additional year of U.S. education increases total factor productivity by 3.2%. Rauch's findings largely concur with Lucas', estimating that TFP is increased by 2.8% for each additional year of education (1993). Lucas (1988) and Rauch (1993) both propose that the social returns to education exceed the private returns, suggesting by a factor of 1.6 and 1.7, respectively. Economists such as Hanushek and Kim (1996) measure the economic benefit of education by associating educational attainment with standardized[5] test scores, and then identifying and measuring individual benefits and positive externalities of education as measured by scores. For example, Hanushek (1996) implies that racial and intergenerational correlations with income can be lessened through greater educational attainment of all students. Other research suggests that a significant positive externality from public education is reflected in crime reduction. Lochner and Moretti (2001), for example, find that individuals with higher levels of educational attainment have a lower likelihood of crime perpetration (Lochner and Moretti, 2001). These examples provide some clear pieces of evidence that positive externalities make education worthy of public support.

Most economists and policy makers agree that increased school quality in the form of higher test scores and lower student-to-teacher ratios is an appropriate goal. However, since increasing quality is expensive, the debate then becomes: what is the optimal level of school quality? That is, how can society optimize its resources such that the marginal cost of education is equal to the marginal benefit created by the last dollar spent? In answering this critical question, there is much less consensus. Determining the cost of some educational inputs is relatively straightforward: the cost of hiring additional teachers at a given skill level or per pupil expenditure at aggregate levels may be easily calculated. Meanwhile, determining the cost of a specific educational outcome such as a one standard deviation increase in test scores is more difficult, and additional research is needed to quantify these costs. The initial step in the educational cost-benefit analysis is to determine the actual economic value of various educational characteristics. For our purposes, the question then becomes: what is the value of increases or decreases in school quality along each measurable index? Only once the economic values of various school characteristics are firmly estimated will it be appropriate to ask the type of questions that Hanushek (1996) poses: what causes differences in school test scores and other commonly accepted measures of school quality amongst schools,[6] and how can we achieve the optimal quality level? This study seeks to answer the question of how various educational

[5] Note the use of "standardized" test scores. The use of standardized scores is important since student grades, students per teacher and per pupil expenditures can plausibly vary both intra- and inter-districts with little or no impact on the actual educational output.

[6] In other words, are these differences caused by better teachers, better peers, better parents, better administrators, and how do we optimize the cost-benefit of each of these inputs?

characteristics, namely standardized test scores, Regents diploma rates, and student-to-teacher ratios, are valued, leaving the optimization of educational inputs for future work.

HOUSING HEDONICS

If education produces direct economic benefits, how is the household to gain access to these benefits? In most American cities, access to public education is determined by residential location. So, if improved education produces economic net-of-taxation benefits of $A per year, and if the present value of this stream of net benefits is $K, then a rational household should be willing to pay $K extra to purchase a home that allows them to reside in the given school attendance zone and thereby obtain these benefits. The present value of this stream of expected benefits is the capitalized value of education, or educational capitalization.

In the current economic literature, one of the most widely implemented means to estimate the value of education is to determine the incremental value that homebuyers are willing to pay for an increase in the quality of local public education.[7] Since residence in a particular area is required for entry into the region's schools, examining the extent to which educational quality is capitalized into housing prices provides a quantitative measure of the value that homeowners place on local school performance in a particular region. Though this method may not take into account the full extent of positive externalities associated with education, it does short-circuit the need to prove associations between many independent variables, as demonstrated, for example, by Hanushek and Kim (1996). The hedonic method simply estimates the isolated value that homebuyers place on individual characteristics such as test scores. Therefore, hedonic regressions that estimate how much increased test scores, increased Regents graduation rates and lower student-to-teacher ratios in Adirondack schools are worth to local homeowners shed insight into the economic value of these schools.[8]

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[7] The other main approach implemented to analyze the value of education is wage hedonics, where wage or income is regressed on a multitude of descriptive variables (age, race, gender, health) including various measures of education such as test scores, educational attainment, field of study, etc. This wage method is well suited for determining the private benefit of education. Assuming equilibrium in the labor market (such that wages equal the marginal value of labor), wage hedonics estimate the marginal benefit on the human mind associated with what is being measured by test scores.

[8] Further, this method has the advantage that it captures the value of at least some local externalities of education. The downside is that, to the extent that omitted community characteristics such as neighborhood

Hedonic analysis is used to determine prices of characteristics of differentiated products or implicit markets. Differentiated products are broadly defined as products that are quite heterogeneous, yet are sold in a single market (Palmquist, 2003). Similarly, implicit markets are markets where goods are mainly sold in bundles (Sheppard, 1999). The housing market is an ideal example of an implicit market where differentiated products – houses – may be examined to determine if sales prices can be successfully decomposed into specific values for each characteristic's level of quantity or quality. The quantity inputs of a house purchase range from the actual dimensions of the property, such as lot size, square foot living area, or waterfront footage, to the associated quantities of local public "goods," such as municipal public service provision, acreage of public parks, school district graduation rates, or district average test scores. Similarly, the quality levels of a particular home "bundle" range from home-specific inputs such as quality of construction material, construction design, or view, to neighborhood characteristics, peer effects, local culture, etc. Thus, to the extent that these inputs can be measured, quantified, or categorized, equations that regress housing sales prices on the associated quantities and qualities are an attempt to associate a value with each additional unit of the respective characteristic. Simply put, hedonic theory predicts that economic commodities like educational quality will be positively (or, for disadvantageous "inputs," negatively) correlated with housing prices (Chay and Greenstone, 2005). Therefore, the hedonic approach is applied to estimate the value of individual quantities and qualities within a bundle of goods.

Hedonic analysis has been used in economics since the nineteen-hundreds, beginning in 1929 with Frederick Waugh, who studied the impact of vegetable quality on sales prices (Waugh, 1929).[9] However, the term "hedonic" was not coined until Andrew Court, an economist for the Automobile Manufacturers' Association, developed hedonic methods for determining automobile

effects or peer effects are correlated with the school district test scores in our regressions, our estimates of educational capitalization will be biased in the direction of these effects. Therefore, in order to more precisely estimate the degree of educational capitalization and thus estimate the economic value of school quality, we identify as many of these neighborhood features as possible and also include municipality indicator variables.

9 Most economists credit Waugh with the birth of hedonics, but historians will note that Colwell and Dilmore (1999) recently unearthed the true Lucy, a Masters thesis written by G.C. Haas in 1922 that used a hedonic approach.

prices in his 1939 paper (Court, 1939).[10] Though many economists researched ways of valuing individual attributes or quality changes in implicit markets, hedonic methods lay largely dormant until the research of Griliches, who is credited with much of hedonic analysis's groundbreaking work (1961, 1971). Griliches (1961, 1971) sought to quantify the value of quality changes, and like Court, his research focused mainly on the automobile industry: Griliches constructed price indexes that controlled for automobile quality improvements. More broadly, though, his work popularized hedonic techniques and analyses that seek to quantify the breakdown of prices between similar but non-homogeneous goods (Sheppard, 1999).

Since Griliches, economists have applied hedonic regressions to estimate the value of housing "inputs," such as individual housing features, the economic impact of environmental hazards, and the economic value of educational improvement, by examining their impacts on property values. By the 1960s and 70s, economists were examining the degree to which homebuyers capitalize tax rates into their purchase prices (Orr, 1968; Oates, 1969; Polinsky and Shavell, 1976). Ridker and Henning (1976) use data from the St. Louis metropolitan area housing market and apply hedonics to estimate individuals' average marginal willingness to pay for clean air, and thus provide the first empirical evidence that air pollution affects property values. More recently, Chay and Greenstone (2005) implement housing hedonics to determine the economic impact of air pollution in counties across the U.S. The creativity and applicability of hedonic models has been continually expanding. Locally, for example, Jessica Erickson (2001) wrote her Williams College honors thesis on the economic impact of PCB contamination in Pittsfield. Using traditional housing hedonic methods, Erickson determines that PCB contamination of waterways is associated with significant and long-term economic costs. Other variations on standard hedonic modeling techniques have produced estimates of neighborhood effects, amenities, and other location-specific housing factors (Cheshire and Sheppard, 1995).

[10] Court's desire to abandon the stifling limitations of single variable estimations was quite apparent. In his 1939 article he wrote, "Passenger cars serve so many diverse purposes that such a single, most important specification can not be found like rated tonnage in the case of trucks. The simple method is inapplicable, but why not combine several specifications to form a single composite measure?" (p. 107)

EDUCATION AND HOUSING HEDONICS

Before discussing the intersection of education research and housing hedonic modeling, it is important to note that, although the presence of social benefits accruing from education is largely undisputed, the hedonic model is not very useful for estimating the social value of education. That is to say, unless the externalities of education accrue primarily to individuals residing within the school district where the education is produced, housing values will not reflect the full extent of these benefits. On the other hand, hedonic models have proven quite useful in estimating the private value of educational quality.

The use of housing hedonics to estimate the value of education dates back to the 1960s. Originally, expenditure per pupil was the main variable used to proxy school quality (Oates, 1969). However, the untenable assumption that outcomes can be measured by inputs was quickly abandoned when the need to measure efficiency was recognized and other measures, such as test scores, became widely available. By 1977, Rosen and Fullerton empirically showed that proficiency examination scores provided a much more solid measure of educational output than expenditure levels.[11] Additionally, the education literature began arguing that school *inputs* have limited impact on the future success of students. Hanushek (1998), for example, analyzes data from the past century with a focus on data from the 1970s to the late 1990s, and suggests that there is little, if any, correlation between additional school resources and school performance outcomes. For these reasons, and recalling the motivations discussed in the **Education** subsection above, the inclusion of standardized examination scores as a main proxy for educational value in housing hedonic models has become commonplace.

Most subsequent studies have followed in the footsteps of Rosen and Fullerton, implementing various student achievement measures as the main indicators of school quality.[12] The first studies to implement test scores in traditional hedonic models include Sonstelie and Portney (1980), Li and Brown (1980), and Jud and Watts (1981). More recent studies include Haurin and Brasington (1996, 2005), Bogart and Cromwell (1997), Downes and Zabel (2002), and Black (1999), to name only a few. All of the research following Rosen and Fullerton has

[11] Argued emphatically, in fact, writing, “We have stressed that it is inappropriate to use variables such as per pupil expenditure, because inputs should not be used to measure outputs” (Rosen and Fullerton, 1977).
[12] However, most researchers have recognized, like Rosen and Fullerton, that school achievement scores are still “an imperfect measure of perceived educational quality” (Rosen and Fullerton, 1977).

observed that examination scores are positively, and in most cases significantly, correlated with housing prices. To the extent that test scores reveal school inputs *and* household inputs, this capitalization may also reflect the valuation of neighbors and peer effects. We will pause here to consider the research of some of the key above-mentioned authors in more detail.

Bogart and Cromwell's (1997) study focuses on locations where individual municipalities are separated into two school districts. Thus, homes in the samples are divided into area pairs that benefit from identical public service levels, and theoretically differ only in schooling services and school tax bills. Bogart and Cromwell effectively isolate the economic value of schooling from other difficult-to-measure public services, and use the corresponding district dummy coefficients in housing hedonic regressions to determine this value. It is worth noting that, as Bogart and Cromwell mention, this method easily would be flawed if neighborhood boundaries coincide with school district lines, which would bias schooling estimates in the direction of neighborhood effects. Bogart and Cromwell's sample selection technique requires finding municipalities massive enough to span multiple school districts; it is therefore not surprising that their data come from housing sales in three *large* municipalities bordering Cleveland. Thus, Bogart and Cromwell's results must be read with caution for the purposes of this study, since their sample is based upon large, urban areas, and is likely ill-adapted for predicting education capitalization in other regions, such as rural Adirondack villages. The main thrust of Bogart and Cromwell's finding is that high-quality schools "provide services valued in excess of the higher taxes that they levy" (Bogart and Cromwell, 1997, p 230). Based on varying tax capitalization assumptions,[13] these results indicated that schools' annual economic after-tax valuation ranged from \$209 to \$2,403[14] per household, providing economic valuations of public schooling that are tangible, though not entirely exempt from criticism.

Black (1999) approaches public schooling valuation by building upon Bogart and Cromwell's (1997) technique. Black rightly suggests that hedonic regressions have historically overestimated the value of education because they are unable to sufficiently distinguish between neighborhood effects and school quality effects, as in the research of Bogart and Cromwell (1997). To circumvent these limitations, Black introduced the use of boundary fixed effects. She

[13] Explained below.
[14] Adjusted to \$2002 using the Housing Price Index explained below.

constructs samples within specific distances of intra-school district attendance boundaries with the goal of separating unmeasurable neighborhood housing quality influences on house prices from school quality influences; she then uses these samples to estimate the effect of better test scores on housing prices (Black, p. 582). Black finds that home purchasers are willing to pay housing prices that are 2.5% higher for each 5% increase in test scores (Black). Black's findings are useful for estimating the financial benefits of different educational policies, which could in turn be used to determine the efficacy of various educational programs. Black is more specific than Bogart and Cromwell, who abstractly estimated the capitalization of "better schools" into housing prices; Black estimates that homebuyers are willing to pay $6,744[15] more for homes that lie in attendance districts in the 75th percentile of her sample than for homes in the 25th percentile (Black, p. 595). Annualizing this valuation using a discount rate of 5% yields an annual value of around $337. Though Black and Bogart and Cromwell's estimates are not entirely comparable (since one measures the estimated value of education due to factors such as exam scores, while the other measures a household's valuation of the switch from an ambiguously "bad" district to a "good" district), it is comforting to see that Black's estimate lies safely within Bogart and Cromwell's range.[16]

Critics of Black's technique suggest that her usage of boundary fixed effects is overly assuming, and they argue that the processes that generate boundaries and the spatial extent of neighborhood effects are likely interdependent. By omitting boundaries that coincide with large natural boundaries, Black creates pairs of neighborhoods that she claims are nearly homogeneous; however, if there exist "bad sides" and "good sides" of these non-natural boundaries, Black's approach does little to help us and may even make estimations less robust by restricting the sample size. Criticism of Black's "innovation" aside, on a more basic level, her results suggest that both per pupil spending and test scores are positively correlated with housing prices. This provides additional empirical evidence to indicate that, on the range examined, increased per pupil expenditure and increased test scores have positive economic value to homebuyers.[17]

[15] Adjusted to $2002 using the Housing Price Index explained below.
[16] As critics such as Stephen Sheppard would point out, this might suggest that Black's "new" approach was not nearly as innovative as some members of the economics community have implied.
[17] Note that not all economists concur with Black's per pupil expenditure finding. This will be discussed in more detail below.

More recent research, such as the work of Crone (2006), implements hedonic regressions that have become standard for estimating how various school characteristics are capitalized into house prices. Crone employs state-mandated test scores from 5th and 11th grade students in Montgomery County, Pennsylvania, and estimates educational capitalization at both the neighborhood and school district levels. Interestingly, he finds that "intra-district differences in elementary school scores do not affect house prices in our sample" and ultimately concludes that home buyers "evaluate the quality of public education at the district level rather than at the level of the local school" (Crone, p. 15).[18] Thus, Crone's finding lends empirical support to the decision to analyze educational capitalization at only the district level in this research.[19] In Crone's main regressions, he finds that once student achievement and the property tax rate are accounted for, class size at the elementary level and per pupil expenditures do not have statistically significant coefficients. This contradicts Black's per pupil expenditure findings, but is perhaps more convincing as it is supported by a stronger rationale. Crone suggests that "including per pupil expenditures in the hedonic equation renders the coefficient on test scores a measure of efficiency" (Crone, p. 16). Assuming a fixed tax rate, increased per pupil expenditure without benefit would be valueless to a homebuyer. Crone argues that, despite the statistical insignificance of the per pupil expenditure coefficient, its inclusion is important so that the model reflects a district's efficiency. Unlike Black and Bogart and Cromwell, Crone does not estimate the implied economic impact of education.

VALUE-ADDED MODEL

It is important to note that there has been contention regarding the standard use of hedonic modeling to determine educational value. Beginning in the 1980s and gaining momentum in the 1990s, many economists and educators advocated an alternative to the models described above: the implementation of a value-added approach. The argument behind the value-added approach is based on the idea that schools are unable to change the initial endowments of

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[18] Crone is unable to determine intra-district influences at the high school level because his sample only contains one district with multiple high schools.

[19] This finding lies in contradiction to Black, however, whose results were based on presumed intra-district differences. Given the likelihood that Black's technique is based on ill-founded assumptions, as described above, the author finds herself more closely aligned with Crone on this (and other) points of contention.

their pupils: innate intelligence, parents' educational attainment, and socio-economic status. Because schools have no control over these rather substantial determinants, value-added proponents contend that the only means to effectively measure educational value is to measure the differential knowledge that a school imparts on its pupils. As Meyer (1997) writes, "The value-added indicator measures school performance using a statistical model that includes, to the extent possible, all of the non-school factors that contribute to growth in student achievement. The objective is to statistically isolate the contribution of schools to student achievement growth from these other factors." The value-added model would then suggest that "high quality" schools are not necessarily the schools that consistently record high examination scores, since this may simply be reflective of the students' innate endowments, but are instead the ones that have been shown to increase each pupil's individual level of performance over time. The value-added model has been adapted by many researchers, including Hanushek and Taylor (1990), Hunt-McCool and Bishop (1998), and Figlio (1999). As Brasington and Haurin (2005) point out, the educational community has begun to place considerable emphasis on this research, and state governments including South Carolina, Tennessee, California, Texas and Kentucky have begun to incorporate measures that evaluate schools based on their estimated value-adding capabilities.[20] These value-added models suggest that only non-intrinsic educational inputs are capitalized into housing prices, directly contradicting the assumptions of the aforementioned hedonic models which do not capture schools' value-adding ability in the form of *growth* of individual student achievement levels. Thus, before proceeding, it is necessary to examine the accuracy of value-added theories.

Beginning with their 2005 research, Brasington and Haurin have challenged value-added proponents, arguing that homebuyers care more about absolute levels of school achievement and not un-tethered value-added measures. Brasington and Haurin (2005) consider student achievement to be separable into three components: parental, peer, and school input influence. Note that the value-added model would suggest that home buyers would not capitalize parental effects on student achievement into house prices, since the value-added model argues that

[20] These value-add evaluations are occurring on multiple scales of specificity. For instance, Brasington and Haurin (2005, p. 32) write that "Some states' accountability for improvement lies at the school level, such as Kentucky, while other states such as Tennessee hold individual teachers and students accountable for improvement."

parental effects are independent of the degree to which each school can improve a student (Brasington and Haurin, 2005, p. 12). Using 1991 housing sales from urban areas of Ohio, Brasington and Haurin run hedonic house price regressions that include these three components. Their findings indicate that parental characteristics have the largest impact on prices and, to a lesser degree, peer effects are also capitalized.[21] In addition, their results signify that "variations in purchased inputs across school districts have little impact on student performance and we find, correspondingly, that they have little effect on house prices" (p. 4). These results lead Brasington and Haurin to conclude that there is little basis for value-added models (p. 4).

Brasington and Haurin's economic estimates for the capitalization of education fit comfortably within the range predicted by most of the aforementioned authors. Brasington and Haurin find that, when comparing houses in districts with student achievement one standard deviation below the mean to districts with student achievement one standard deviation above the mean, house prices vary by around 20% (p. 3). Based on the average house value of around $130,000, they conclude that this increase implies a rough economic value of $26,000.[22] Annualizing this valuation using a mortgage rate of 5% yields an annual value of around $1,300; this valuation lies right in the middle of Bogart and Cromwell's $209 to $2,403 total valuation range, and is far above Black's assessment of $337, though we must remember that Black's valuation only considers an intra-district school quality move of about 1.4 standard deviations, rather than two.

RESIDENTS VS. NON-RESIDENTS

Not all house buyers intend to use their newly purchased homes year-round. The U.S. census defines homes that are used seasonally, recreationally, or only occasionally as "vacation homes" (U.S. Census Website). According to the Bureau, in 2000 roughly 3.1% of housing units in both New York State and the U.S. as a whole were classified as vacation homes (2000 Census). To the extent that all homes are in one market, economic theory suggests that local public goods

[21] Note that this is not exclusive of test scores; rather, "the impact of the component of test scores attributable to parental characteristics is much larger than that of school inputs or peer effects" (Brasington and Haurin, 2005, p. 16).
[22] All numbers converted into $2002.

will be capitalized into home values at levels that reflect the valuation of the marginal buyer. In most areas, as observed in previous studies, that marginal buyer is one who has an interest in local educational quality, although it is possible that regions exist where the marginal buyer is a person who is indifferent to educational quality. Importantly, traditional economic theory suggests that education will be capitalized equally by all homes in a unified market, regardless of whether buyers intended to use them as a year-round residency or as a vacation home. Until this past year, by omitting data that would distinguish between residents and non-residents, all researchers have made this assumption. That is, they have implicitly assumed that residents and non-residents would capitalize education uniformly, *ceteris paribus*. Given that most previous studies have drawn their data from large urban areas or suburbs, such as those outside of Boston and Chicago, this implicit notion has likely left economists unhindered. However, in rural areas such as the Adirondack Mountains where, in some towns, non-residents comprise upwards of 40%[23] of the home-owning population, it would be shortsighted to operate under traditional assumptions.

The degree to which educational capitalization into housing prices is affected by a homebuyer's residency status is as-of-yet uncharted territory. However, in December of 2006, Nathan Anderson authored a *National Tax Journal* piece that is, to this author's knowledge, groundbreaking research at the intersection of property taxation and the economic implications of second-homeownership. Anderson's study focuses on taxation and government spending at the municipal and township levels, and thus does not concern itself with educational services provided by school districts, yet the concerns his work raises remain highly relevant. His data are based on a one-time change in Minnesota legislature that reduced the assessment rate on vacation properties, thereby reducing the tax income local governments could receive from non-resident homes (Anderson, 2006). Anderson's interest is in determining the price elasticity of demand for local public services; he seeks to calculate: given a one percent increase in the tax base that is derived from non-residents, what is the associated percent increase in local per-resident spending?

[23] Estimated from RPS data.

Before the intuition behind observed values of price elasticity of demand for local public services can be constructed, it is important to consider the inherent differences between residents and non-residents. In Minnesota, as in New York, non-resident property owners "pay local property taxes, yet cannot vote on local referenda" (Anderson, p. 757). Considering that around 70% percent of non-residents spend less than a quarter of every year at their secondary residence, and over three-quarters of owners never rent out their vacation homes, non-resident households simply do not consume public goods to the same extent as residents[24] (National Association of Realtors, 2002; Anderson). Combining these facts, Anderson suggests that economic theory would predict a phenomenon of "tax exportation," where residents "impose a tax burden on non–residents (i.e., taxpayers [who] cannot vote), thereby lowering the tax price" that they themselves face (Anderson, p. 758). If it were the case that non-residents consumed less local goods than residents, which indeed seems plausible, then, when the percentage of non-resident homes in a community increases by one percent, theory predicts that per-community member public expenditure would *decrease* by some amount between zero and one percent in the absence of tax exportation.[25] Anderson's results indicate that the price elasticity of demand for local public services is 1.5, suggesting that tax-exportation does occur in communities with a significant proportion of disenfranchised non-residents (Anderson, 2006, p. 759).

The recognition of residency status and Anderson's work are relevant to this research in multiple ways. First, the private value of education can only be estimated properly if homes that exist in a pure non-resident market[26] are removed from hedonic regressions; if they are not, education valuation estimates risk being biased downwards. Secondly, to the degree that taxation

[24] Although some services, such as fire protection, must be provided to vacation homeowners even in their absence, Anderson suggests that non-residents "likely use fewer health, library, sanitation, transit, and street services than do permanent residents" (Anderson, p. 758).
[25] Note the difference between my terminology and Anderson's. Anderson determines price elasticity of demand for local public services using calculations of increases in local per-*resident* spending. Given that the relative constituencies (ratio of residents : non-residents) in his sample is likely variable, a measure that focuses on subsequent spending increases per-*community* member would avoid possible biases occurring from radically different constituencies.
[26] In other words, homes that, realistically, will only ever be bought and sold by non-residents due to certain unmeasurable housing or neighborhood characteristics. For example, homes located on seasonal roads are likely to only be part-year residences. To the extent that positive externalities associated with good school districts are not confined to those districts, homebuyers of permanently part-time residences will not capitalize education into house prices.

exportation exists in a community, we expect to observe per pupil expenditures that are inflated above the level that residents, without *de facto* non-resident subsidies, would have chosen.

Consider the following example: prior to the rise of non-resident taxpayers, a community votes in school district referenda and selects its per-pupil expenditure levels at the point where the marginal voter determines that the marginal cost of the last tax-dollar paid ($1) equals the subsequent educational benefit of that dollar ($1). However, upon the entrance of a significant number of non-resident community members, the cost of each additional unit of per pupil expenditure is now subsidized: non-residents pay a fraction of each new budget increase. This is equivalent to local public education being less expensive at any non-zero chosen level. At the new market equilibrium, the amount of education "purchased" by the community will be greater, but the cost "per unit of education" will be lowered for residents. The figure below illustrates this change.

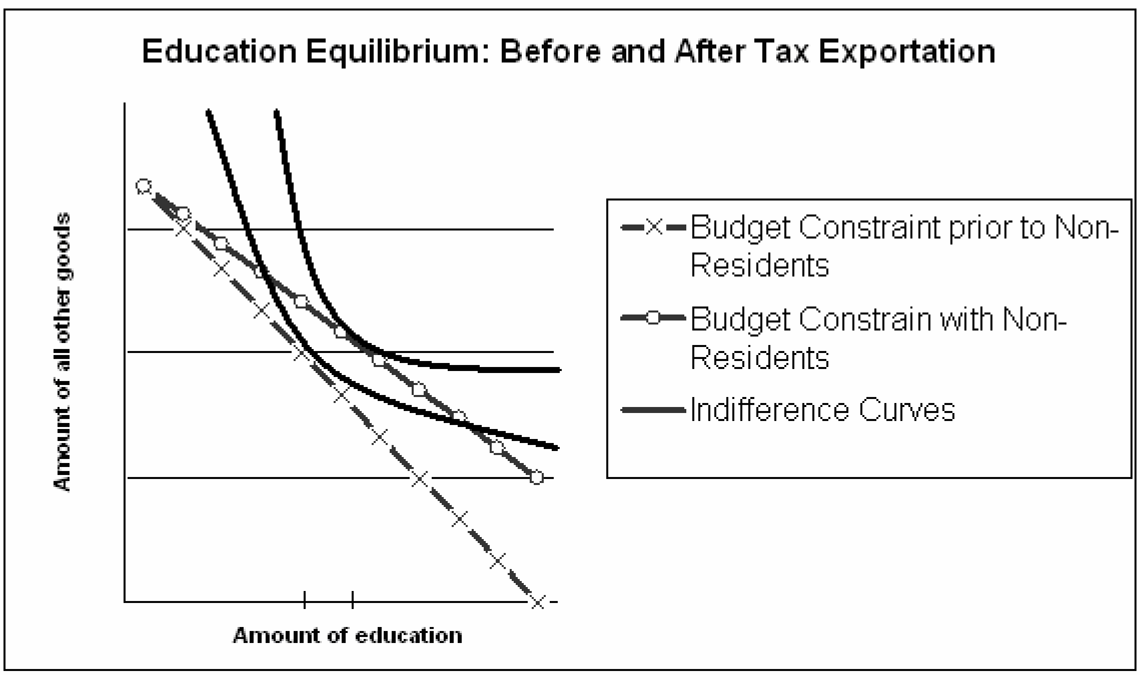

Figure 1: Illustration of new equilibrium implied by tax exportation

One might predict that the ways in which residents and non-residents value education in a community with restricted enfranchisement could be drastically different. In the case where non-resident homes and resident homes constitute two separate housing markets, economic theory would predict that non-residents would capitalize education at a significantly decreased rate (reflecting only the district-specific externalities), and possibly not capitalize educational factors at all. In the communities where resident and non-resident homes are interchangeable in the home market, we might expect to find disparities of economic capitalization when compared to traditional communities. For example, economic theory might suggest that residents would be willing to pay premiums to live in a community with a high non-resident constituency. To the extent that this premium is correlated with a school district's educational variables, and to the extent that the marginal buyer capitalizes this premium, we will expect our results to be biased estimates that exaggerate the value of education.

If the data suggests that it is appropriate to assume a unified housing market, there is an additional, highly probable possibility. Suppose that a unified housing market exists in our sample and assume that the marginal buyer is a resident who values education. Assume also that some percentage of homebuyers exist who are non-residents and who do not value education. In the absence of other effects, we would again expect the marginal buyer's educational preferences to determine the overall level of educational capitalization for all homebuyers. Consider an alternative scenario. If non-residents do not value education, it is costless[27] for them to substitute between homes in excellent school districts and homes in less-than-excellent school districts, *ceteris paribus*. Due to this educational quality indifference, <u>non-resident homebuyers maintain a higher degree of bargaining power than their resident, education-valuing, homebuyer counterparts</u> with respect to educational quality. Since this increased bargaining leverage is limited to areas in which non-resident homebuyers can truly be indifferent (for example, education, a municipality's snowplowing services, etc.), we expect the effect to show up in decreased non-resident capitalization rates for public goods provision from which the non-resident buyer does intend to benefit.

[27] Reasonably assuming that schooling externalities are, for the most part, not strictly contained within school districts.

BARGAINING POWER

Although traditional hedonic models assume straightforward equilibrium supply and demand models, it is important to note that houses are composite goods and, consequently, housing markets are more complex. Search costs and asymmetric information create barriers for potential buyers. In addition, given the rural nature of our specific sample, houses are a relatively thinly-traded commodity. As a result, the "true" market value of a home is not readily available. Therefore, sales prices are *de facto* arrived at by bargaining between buyers and sellers, making it necessary to consider the relative bargaining strength of the individuals acting in the market as a possible contributing factor in explaining the observed price.

Previous research suggests that markets with differentiated products are likely to be affected by the relative bargaining power of buyers and sellers. Empirical evidence has found systematic support that strong buyers pay lower prices and weak buyers pay higher prices for homes. Binmore (1992) established that impatience (for example, of sellers of vacant homes[28]) results in lower bargaining power, and later evidence such as Anglin (1999) supports this finding. Much research considers how bargaining power affects the overall sales price, as opposed to how it might affect the price of implicit attributes.[29] Most economists model the effect of bargaining as a shift in the hedonic function: weak sellers cause the function to shift downwards, while weak buyers shift the function upwards, as shown in **Figure 2**.

[28] Since these sellers incur the full cost of owning the home without the benefits of living in it or rental income.

[29] Anglin (1999), for example, estimates that the surplus to be divided by bargaining in his sample is roughly 3.5% of the list price.

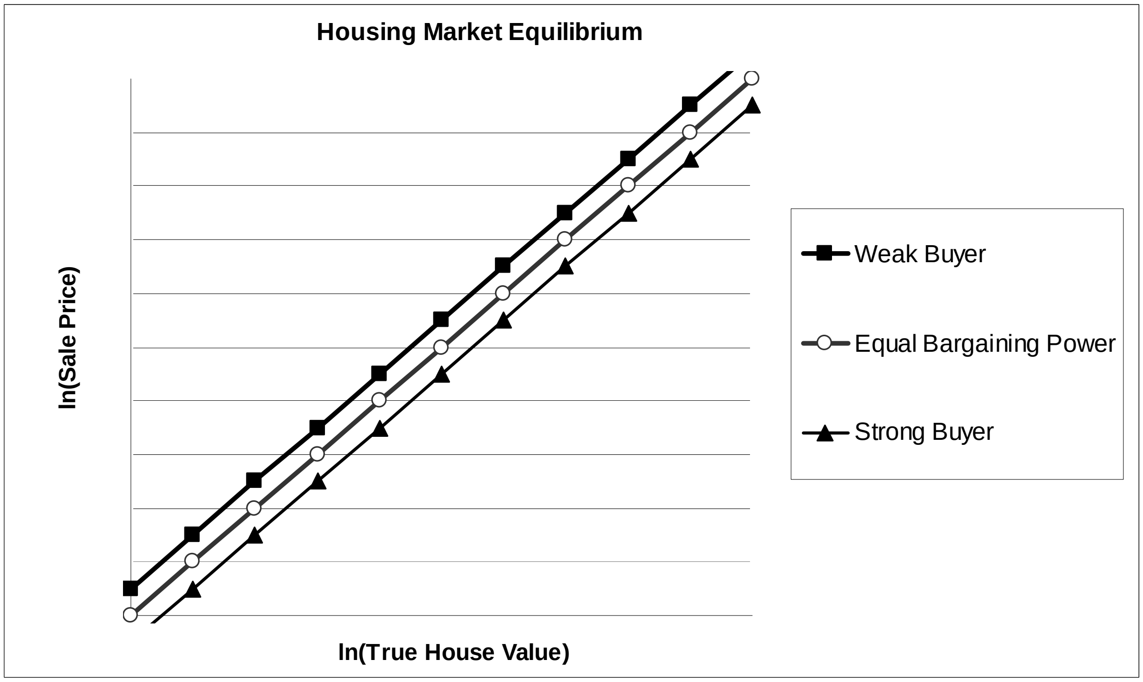

Figure 2: Illustration of differing sales prices due to relative bargaining power

The idea that housing hedonic models ought to allow for heterogeneous buyers and sellers, rather than relying on a model where some version of the law of one price holds, has been common in the literature. Much research has considered the bargaining strength of the seller, and findings have been consistent with intuitive notions that a seller's bargaining power will be driven, in part, by his demand uncertainty and his relative cost of searching for a buyer. For example, Glower, Haurin and Hendershott (1998) find that home sellers in their sample who are highly motivated[31] to sell quickly set lower list prices, have lower reservation prices, and tend to accept earlier, lower offers more frequently than their less motivated counterparts. These findings have since been oft-supported in the literature. In recent research, Herrin, Knight and Sirmans (2004)[32] use a data set that includes the number and value of list price changes that occur before a home is sold. They show that owners whose homes trade in comparatively thin markets

[30] Adapted from Harding, Knight and Sirmans (2003, p. 603).
[31] GHH note that sellers in their sample are quite heterogeneous in their motivations to sell their homes quickly. Highly motivated sellers in their sample are identified as those whose motivation to sell included a change in work location that had already occurred by the time they listed their house and those sellers who had already specified a date by which they wanted their home to be sold.
[32] Closely following and slightly improving the research of Knight (2002).

or who have better information about the value of their homes change their prices less often. Herrin, Knight and Sirmans also show that owners who have relatively high costs of continuing a search for a buyer are more willing to decrease their price, and that these price changes typically occur sooner. Unfortunately, databases like that of Herrin, Knight and Sirmans are relatively unique, and in most cases researchers are not aware of the time pressures and costs that individual sellers face.

Similarly, many studies have also sought to estimate how certain buyer characteristics alter the buyer's bargaining power. The Harding, Rosenthal and Sirmans (2003; HRS) model, as illustrated in **Figure 2**, assumes that bargaining power affects house prices through a multiplicative factor. The research of HRS seeks to identify the influence of bargaining by incorporating the characteristics of the buyer and the seller into the traditional hedonic model. HRS use data from the American Housing Survey to measure the extent to which bargaining strength affects the sale price relative to true value. They find that demographics such as wealth and gender influence bargaining power, and thereby alter negotiated prices.[33]

Interestingly, HRS's findings also indicate that buyer households with school-age children have significantly decreased bargaining power during the summer and increased power during the school year. This seasonal variation in bargaining power likely reflects the seasonal variation in moving costs for families with children. Many agree that changing schools during the school year can be traumatic for children and difficult for parents, and therefore prefer to relocate in the summertime when moving costs associated with their children are lowest. Other studies such as Case and Shiller (1990) and Hosios and Pesando (1991) also reported anomalous seasonal changes in quality-adjusted house prices of around 6%, though unlike HRS they offer no explanation for the seasonal oscillation. HRS suggest that systematic seasonal variations in prices remain prevalent because the transaction costs of buying and selling property preclude speculative investors from profiting from seasonal effects as low as 6%, despite their predictability.

The detrimental effects of discrimination on bargaining power are examined in Bradburd, Sheppard, Bergeron, Engler and Gee (2005). Bradburd et al. utilize agent-based modeling to

[33] Their findings suggest that women, the wealthy and first-time homebuyers have less bargaining power than their respective male, less-wealthy and experienced homebuyer counterparts.

simulate a stylized form of discrimination, namely, being selected to bargain with a lower probability. They find that this form of access discrimination is most likely to affect buyers whose reservation price is slightly below the Walrasian equilibrium price. They estimate that, in some instances, access discrimination imposes a loss of nearly 25% of the surplus the buyer would receive in the absence of discrimination. Bradburd et al. go on to conclude that "a large portion of discrimination's total impact—more than 35% in [their] simulations—comes about because it weakens [renters'] bargaining position in their encounters with landlords" (Bradburd et al., p. 88). Although their model is based on the many generalizations inherent in computer simulation, Bradburd et al.'s research does suggest that seller and buyer values and characteristics are likely to affect the relative balance of bargaining power.

In contrast to models like the multiplicative one HRS implement, Harding, Knight and Sirmans (2003; HKS) test to see if bargaining specifically influences the underlying prices of various parcel characteristics. They identify sellers of vacant homes, who therefore are assumed to have weaker bargaining power, and test to see if differences between occupied and vacant home sales can be accounted for purely by changes in constants in the model (as in the parallel shift as in **Figure 2**). Although their findings suggest that differences in bargaining power do not result solely in parallel shifts in the hedonic function, they are unable to identify a consistent pattern reflecting price depreciation in the value of the underlying characteristics.[34] They conclude that "in most practical applications […], we believe that the Harding, Rosenthal and Sirmans' (2003) assumption of a constant shift is a reasonable approximation" (HKS, 2003, p. 621).

Unfortunately, since most housing sales data do not contain information regarding the personal characteristics of the buyer or the seller, the effect of bargaining power in housing hedonics is often omitted in housing hedonics research. As the conclusion to **Residents vs. Non-Residents** suggests, however, differing degrees of bargaining power between residents and non-residents may be relevant in explaining varying capitalization rates of education. Although we do

[34] One of the main obstacles, as HKS explain, is that the various characteristics of buyers and sellers are often correlated with certain, sometimes unobservable, property characteristics. As Colwell and Munneke succinctly explain, "if important property characteristics that are correlated with buyer and seller attributes are omitted from the regression, the measured effects of buyer and seller attributes on bargaining power are potentially biased," (Colwell and Munneke, 2006).

not have information that captures all of the characteristics of the likely-to-be-heterogeneous buyers and the sellers in our sample, we are able to identify which buyers are non-residents; further, we know that the non-resident group is likely to place little value in increases in local education. Additionally, non-residents may garner increased bargaining power by being less attached to any *particular* region, especially since their homes are almost always vacation homes that are not tied to an occupation. In short, increased buyer bargaining power due to non-valuation of education may be instrumental in conceptualizing observed differences between resident and non-resident education capitalization. A finding of this nature would lend empirical support to Harding, Rosenthal and Sirmans (2003) original intuition that bargaining power might, in some cases, influence the observed price of individual property characteristics rather than simply affecting the model's constant.

More globally, to the extent that information allowing economists to discern between various buyer and seller characteristics has been historically limited, it is important for research to continue to investigate whether bargaining power differences result in significantly different levels of capitalization for individual property characteristics. As Harding, Rosenthal and Sirmans advocate, "much may be missed when bargaining is overlooked in the context of markets for heterogeneous goods, a result that is not surprising given that bargaining is a natural and common feature in such markets," (2003, p. 187).

POSITIONAL GOODS

In the education literature cited above, education is typically discussed as a nonpositional good. In other words, education is perceived to be valued for its absolute components: a school district is thought to be valued for increased exam scores (or other measures) and not for increased relative standing within its geographical location. For some goods, this is not the case. We will briefly discuss the theoretical and empirical evidence that suggests that some goods are valued as positional goods, and we will then consider a simple thought experiment that suggests that education may possess some positional good characteristics.

The term "positional good" was originally coined by Fred Hirsh in 1976; it is meant to describe goods for which consumers value relative or social position most. Housing is a classical positional good example: many people would choose to live in a smaller house rather than a larger one if they are told that, given the neighborhoods of the two houses, the smaller house actually has a much higher position on its local housing scale. Other commonly cited positional goods are social status, income and fancy cars (Easterlin, 1995; Frank, 1995). Positional goods are pursued on the national level as well. As Robert Frank discusses in his 2005 research, military armaments often constitute positional goods on the international stage, since having *more* weaponry than your neighbor is considered vastly more important than a country's absolute arms level. Frank suggests that, due to the literal and figurative arms race ignited by the nature of positional goods, national government spending is drawn toward an equilibrium with "too much expenditure on positional goods, [and] too little on nonpositional goods."

Similarly, it is likely that U.S. institutions of higher education also battle a figurative "arms race" as they cater to rankings, clamor for the "best" faculty and administrators, or add layer upon layer of niche specialties to attract prospective students (Frank and Cook, 1995). This implies that colleges and universities are perceived by prospective students as positional goods. The near-religious following of U.S. News and World Report suggests that high school seniors place a large degree of confidence in what are perceived to be internationally accepted rankings. Williams College, during its present four year coveted reign as the "#1 U.S. College"[35] has seen dramatic increases in application rates; this rise likely would not have been predicted by increases in other measures of educational quality alone, suggesting that to some extent ranking drives higher education valuation.[36]

The current literature does not examine the extent to which American education might be perceived as a positional good. Therefore, to help suggest the possibility that education possesses

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[35] US News and World Report as of April 17, 2007 at http://www.usnews.com/usnews/edu/college/rankings/brief/t1libartco_brief.php

[36] The applicant pool has been steadily rising during this five year period. Applications have risen on average 5% annually, representing a 21% increase in applicants since 2003. Specifically, the number of applications from individuals of Asian origin has skyrocketed 86% since 2003 (representing an average annual increase of 18%). Comparable colleges such as Amherst, Davidson and Bowdoin have seen applications increase annually since 2003 at average rates of 4.3%, 3.93%, and 4.65%, respectively. Davidson, the only college besides Williams to respond to my request for applicants' racial breakdown, has only seen applications from individuals of Asian origin increase by 50.71% since 2003. Though these numbers are *suggestive* that Williams College's U.S. News ranking of #1 has propelled a surge in applicants, further research ought to test this theory by creating accurate difference-in-difference estimates that incorporate changes in various colleges' offerings, endowments and rankings over a substantial period. [Please note that Dick Nesbitt has asked that the Williams College applicant racial breakdown remain confidential.]

some positional good qualities, consider the following thought experiment. Imagine buying a home in **Neighborhood A** in school district **A**, illustrated below in **Figure 3**, where district **A** and all neighboring districts have average exam scores of 80. Now consider, instead, buying a home in **Neighborhood B** in school district **B**, where school district **B** has an average exam score of 80, but all neighboring districts have an exam score of 75. A nonpositional good model would suggest that the homebuyer would value education in school districts **A** and **B** equally. However, it might make sense that the marginal homebuyer moving into **Neighborhood B** would be willing to pay a premium over the general educational value of "80" to ensure that their home is in the best school district in its neighborhood. To the extent that this "premium" exists, we expect that education valuation has some positional good characteristics.[37]

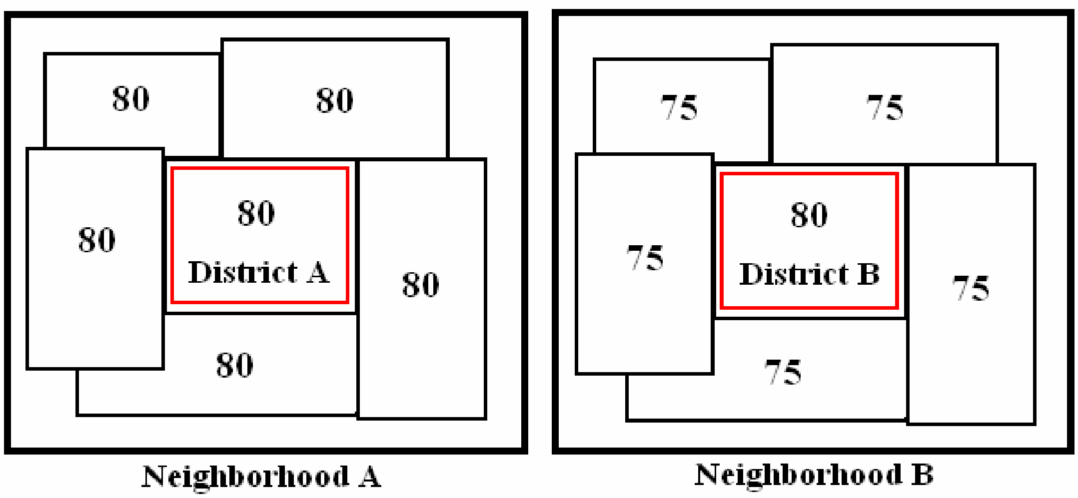

Figure 3: Example of education as a positional good

[37] Additionally, if there is a large premium paid to the district with the highest test scores, then this might show up in the regression as a non-linear hedonic price of test scores. Future research may be able to estimate the extent of the positional nature of education by testing for strong non-linearities in the hedonic price function.

CAPITALIZATION[38]

Before moving on to a discussion of the data, we will briefly examine some of the intuition behind capitalization. As described above, capitalization of some characteristic is the degree to which that characteristic affects the price of a house. In this study, we will mainly refer to educational capitalization, though parameters such as service capitalization and tax capitalization are frequently considered in the literature.[39] The sale price of a house is, mathematically, the discounted present value of the expected benefits that a property confers to current and all future owners. Therefore, when analyzing hedonic regressions it seems natural to interpret the estimated effect of a school quality index on house price as a dollar estimate of the present value of all expected future benefits from that measure of school quality.

This intuitive interpretation is slightly misleading. It is only true under the assumption that the capitalization *rate* of each particular characteristic is 100%. For example, if the marginal buyer were not entirely confident that a school quality index would remain at a particular level, he[40] might effectively discount the extent to which he capitalizes that index into the purchase price of a house. To take an extreme example, assume we know that a buyer capitalizes the school quality index at 50% and, after regressing house price on some set of characteristics, we find that the coefficient on the school quality index is $100,000. However, since the buyer was only capitalizing at a rate of 50%, we know that the *actual* present value of that attribute is $200,000. Unfortunately, we have no way of knowing the extent to which the marginal buyer discounts or inflates the rate at which he capitalizes goods.

Throughout this paper we will assume full educational capitalization, which implies that our estimates may be biased if expected future service delivery differs from current levels. That is to say, depending on whether homebuyers expect quality to increase or decrease, our estimates

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[38] If this were a math text book, this footnote might read: "This section is given for completeness, but is rather involved; if you decide to omit it, at least for the present, you will still be able to continue with the text. If you do read it, the best way to understand it is to work through the specific example." (Hill, p. 61, 2000)

[39] Our regressions incorporate service level (exam scores, PPE and student-teacher ratio) and service cost (school property tax) of education. Therefore, the net benefit of education capitalized into homes can be approximated by multiplying the estimated education coefficients, including the negative tax rate coefficient, by their respective levels and calculating the subsequent summation.

[40] Non-specific usage of the pronoun "he" throughout this paper ought to be interpreted by the reader as gender neutral.

may be upward or downward biased from the marginal homebuyer's actual valuation of each characteristic level at the time of sale.[41] In addition, as Hilber and Mayer (2004) show in their research, uncertainty regarding future foundation rates and state redistribution legislation affects the expected future degree of Tiebout sorting. To the extent that sorting is limited, Hilber and Mayer (2004) find that households decrease their capitalization of education. Therefore, the degree to which homebuyers capitalize certain goods, such as education, may also depend on who households expect the future marginal buyer will be.

Future research could improve upon this study by estimating the actual *rates* at which homebuyers in our region capitalize property characteristics. Recent econometric studies suggest that supply elasticity is a crucial factor in determining capitalization rates of various neighborhood variables into housing prices. For example, Hilber and Mayer (2002) show that the percentage of elderly residents in a community is negatively associated with school spending in regions where developable land is freely available. Also in a 2002 paper, Brasington argues that there is an inverse relationship between housing supply inelasticity and capitalization rates. Brasington tests for capitalization in jurisdictions on the edge of an urban area and at the interior, representing elastic and inelastic housing supplies, respectively. The graphs in **Figure 4**, below, represent the effect of a shift in demand in these two markets. We could imagine that this decreased demand shock could be the result of an increase in school quality, all else constant. Therefore, we see that having $\frac{\partial P}{\partial Q_S} > 0$ would imply that school quality has been capitalized into housing prices. This model predicts that education capitalization rates would be higher in areas of relatively inelastic supply, such as the interior of Brasington's study.[42]

[41] It is also important to note that, except where specified, all valuations will be the present value of the future stream of benefits associated with each characteristic. If one wanted to annualize this value, it would suffice to multiply the estimations by the discount rate associated with buying a home, such as the after-tax mortgage rate.

[42] Honor code footnote: parts of this paragraph and the proceeding image have been augmented from an earlier paper that I wrote for Sheppard about tax capitalization.

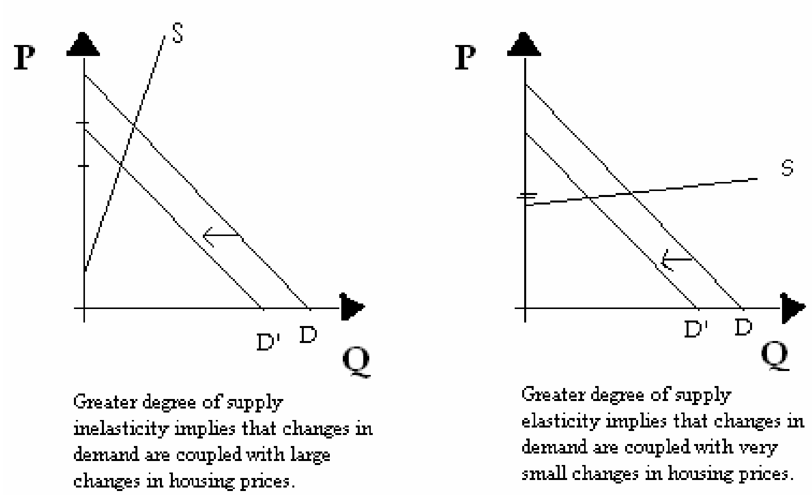

Figure 4: The effects of a demand shock in markets with relatively inelastic versus elastic supply

Brasington found evidence of stronger school quality capitalization in the data from the interior region, supporting the theory of the effects of supply inelasticity. At about the same time as Brasington, Cheshire and Sheppard (2002) successfully showed that planning regulations in Reading, England created local variation in the implicit valuation of school quality by decreasing land supply elasticity. Given the strict, unchanging land use regulations in the Adirondack Park, in-Park land and housing supply is likely more inelastic than supply outside of the Park; thus, based on Brasington and Cheshire and Sheppard (2002), one might expect to find higher *rates* of educational capitalization within the Park than outside of it.[43] Future researchers would be advised to estimate the percentage of developable land within certain distances of homes, use these numbers to approximate supply elasticity, and then further extrapolate capitalization rates for certain regions. Due to limitations of time and experience, we will assume a capitalization rate of 100% for all houses in the sample.

[43] To clarify, this does not necessarily imply higher underlying valuations of education in the Park.

CONCLUSION

Education is valuable. We know this instinctively by simply considering the magnitude of annual investment funneled at both government and individual levels into education; these investments suggest that education's benefits accrue both publicly and privately. A review of the literature reveals that researchers in the fields of education and economics are continually refining our understanding of the economic benefits associated with various indicators of educational quality. In the economics literature, traditional housing hedonic models have helped quantify the private value of education by estimating the degree to which education is capitalized into housing values.

At the same time, we recognize that research to date, though valuable, has left much work to be accomplished in order sharpen our understanding of how and why education is valuable. The first step in optimizing educational policy requires a thorough understanding of the cost-benefit function underlying education. Empirical research has not sufficiently determined which components of education are most capitalized into housing prices (i.e., which components are best reflected in the predominantly private value of education), or which aspects of schooling best measure the value that education contributes to society. However, research and intuition make us aware that the impact of increased education is substantial both socially and economically. Lastly, we note that varying degrees of bargaining power are likely to distort observed capitalization rates in thinly traded markets; to this end, we plan to incorporate a non-resident indicator variable and a resident-education interaction variable into our models. Given the wide-reaching effects of education, contributing to the body of economic empirical evidence that clarifies and sharpens our understanding of the origins and value of educational benefits is a necessary and worthy endeavor.

III. DATA AND SUMMARY STATISTICS

HOUSING DATA

The Adirondack Park encompasses 92 towns and 6.1 million acres; for comparison, the Park embraces more land than Massachusetts, New Hampshire or New Jersey.[44] The housing price data used for this study cover sales occurring in Essex, Hamilton, Saratoga and Warren Counties between January 2001 and July 2006. Significant proportions of these four counties lie within the Adirondacks, and combined they comprise over 53%[45] of the Adirondack Park's area, as indicated in **Figure 5a** and **Figure 5b**.

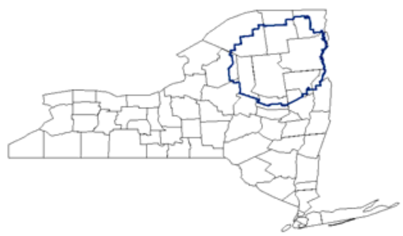

FIGURE 5A: New York State, counties in gray, Adirondack Park boundary outlined in blue

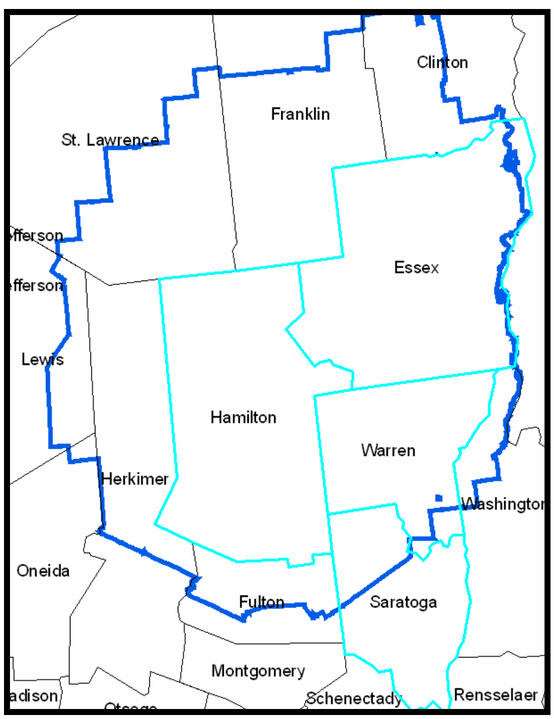

FIGURE 5B: Close-up of Adirondack Park
with Essex, Hamilton, Saratoga and Warren Counties highlighted in turquoise

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[44] Preserving Scenic Areas: The Adirondack Land Use Program, *The Yale Law Journal*, Vol. 84, No. 8. (Jul., 1975), p. 1705.

[45] Calculated using data published by the New York State Adirondack Park Agency data from March, 2003, accessible at http://www.apa.state.ny.us/gis/colc0303.htm

The housing price data were obtained from each county's Office of Real Property Services, which maintain databases used for annual real property taxation purposes.[46] The data used for this study was limited to single family residential home sales. By specifying that all sales involve single family homes, properties that contain no square footage living space, no buildings, or no inhabitable buildings were removed from the data set. The NYS Office of Real Property Services, hereafter ORPS, requires individuals who are selling their home to classify whether or not that sale occurred on the open market by declaring whether the sale was "at arm's length."[47] ORPS defines an arm's length sale as any "real estate transaction in the open market freely arrived at by normal negotiations without undue pressure on either the buyer or the seller."[48] The ability of this self-identification to weed out non-open-market sales, however, is not entirely credible, since the original data contains "arm's length" sales with prices recorded at $100. In addition to self-identified non-arm's length sales, assessors are required to determine whether they believe each sale to be valid. The qualifications for a "valid" sale are more rigorous than the arm's length identification method, and are listed in **Appendix A**. Both non-arm's length sales and invalid sales have been removed from our dataset, since presumably their sales values do not reflect actual homebuyer valuations. In addition, for the purpose of this research all parcels that sold for less than $5,000 and all parcels with assessed values in 2005 that were below $5,000 have been excluded from the data set, since these data are also likely to include sales that did not occur on the open market.

Before elimination of households that did not meet these criteria, there were approximately 149,674 property sales in the data set. From this original database, nearly 33,800 parcels were removed for being commercial or multi-family dwelling sales; 54,281 were omitted for having sales prices less than $5,000; approximately 20,013 were removed for having assessed values less than $5,000; 10,248 sales were removed because they were recorded as being

[46] While these data are *de jure* public information, the interested reader should note that they are *de facto* quite difficult to obtain. A good site that details your right to access assessment information as it applies to ORPS and the Freedom of Information Act is http://www.orps.state.ny.us/legal/rules/part185/sub185-2.htm A more practical site is NY's Department of State (DOS) Committee on Open Government, where one can access previous decisions with respect to what information must be provided, limitations on fees, etc.: http://www.dos.state.ny.us/coog/coogwww.html The Committee can also be contacted directly.
[47] ORPS website as of April 15, 2007 at http://www.orps.state.ny.us/sales/salescriteria.htm#armslength
[48] *Ibid.*

"invalid" or non-arm's length sales; 9,463 were removed for having zero square foot living area; and roughly 3,755 were removed from Warren County when the sales occurred prior to 2001.[49]

The resulting sample consists of 18,182 single family home sales. Over 80% of the sales occurred between 2003 and 2005, as shown below in the breakdown of **Table 1a.** The adjusted sales prices range between approximately $5,400 and $9.25 million, with a mean sales price of $159,139 and a large standard deviation of $139,848. Meanwhile, the mean assessed property value[50] was $130,034.[51] Note that, unless otherwise specified, all prices are in 2002 dollars as explained in the **Housing Price Index Data** section. The breakdown of sales per county is listed below in **Table 1b.**

Table 1a: Breakdown of Sales per Year

Year	Number of Sales	Percent of Sales
Sale Year - 2001	954	4.36%
Sale Year - 2002	1,597	7.29%
Sale Year - 2003	5,955	27.18%
Sale Year - 2004	5,884	26.86%
Sale Year - 2005	5,820	26.56%
Sale Year - 2006	1,699	7.75%

Table 1a: Breakdown of Sales per Year

[49] These numbers may be slightly off since some parcels likely exhibited multiple characteristics (i.e.: non-arm's length sale recorded for less than $5,000); thus, the numbers listed here are likely lower than the number of properties in the original sample that embodied each of these characteristics, since the count is based on the order in which parcels were removed. Additionally, some parcels were removed due to missing data.

[50] Property value will always refer to the combination of land value and structure value. Land value will refer to the pure land tax assessment. All assessment values are pre-exemptions, as clarified below.

[51] There is a slight discrepancy with the Warren County information, which only contains assessed values for 2005. Warren County sales were left in the data set under the condition that the house had not undergone significant renovations since the time of sale; since assessed value does not enter any of the models, this inclusion will not affect results. Warren County's limitations imply that, for Warren County only, if a house was sold multiple times during the 2001-2006 period only the most recent sale is listed in the data.

Table 1b: Breakdown of Sales per County		
County Name	**Number of Sales**	**Percent of Sales**
Essex County	1,776	9.77%
Hamilton County	526	2.05%
Saratoga County	10,643	58.46%
Warren County	8,964	29.72%

Table 1b: Breakdown of Sales per County

Table 2 gives the variable names and definitions for the main 19 parcel variables that will be used throughout the paper. As can be noted in the definitions, though there are many continuous variables, there are also many variables in binary form. The interpretation of the categorical variables can be found in **Appendix B**; for the other binary variables, generally 1 implies "yes" and 0 implies "no," as described in **Table 2**. **Table 3** gives the subsequent summary statistics for the parcel variables. Note that, for the binary variables, means may be interpreted as the fraction of parcels in the sample for which that variable was a "yes" as defined in the descriptions.

Variable Name	Variable label	Variable Description
STAR	star	Binary, 1 indicates owner owns home, uses as primary residence and thus qualifies for a STAR exemption
STAR Change	star_change	Binary, 1 indicates that Duplicates=1 and STAR value has changed with ownership change
Adirondacks	adks	Binary, 1 indicates the parcel is located in the Adirondacks
Duplicates	duplicates	Binary, 1 indicates that parcel entry is at least the second sale during the examined timeframe
Acres	acres	Total number of acres in the parcel
Acres - Capped 100	acres_ca~100	The minimum of the Acres and 100
Front	front	The front footage dimension of the parcel
Depth	depth	The depth dimension of the parcel in feet
Waterfront	waterfront	Binary, 1 indicates assessor qualified parcel as "waterfront" land
Waterfront - 300	waterfro~300	Binary, 1 indicates parcel center is within 300 feet of waterfront
Total Waterfront	tot_waterf~t	Binary, 1 indicates parcel center is within 300 feet of waterfront, indicated by assessor to be waterfront property, or both
Land AV	land_av	Land Assessment value, prior to exemptions
Land AV ($2002)	_02_land_av	Land Assessment value, prior to exemptions, in $2002
Total AV	total_av	Land plus Buildings Assessment value, prior to exemptions
Total AV ($2002)	_02_total_av	Land plus Buildings Assessment value, prior to exemptions, in $2002
Sale Month	sale_month	Month house was sold
Sale Year	sale_yr	Year house was sold
Sale Price ($2002)	_02_sale_p~e	Price at which house was sold, ($2002)
Ratio assmt to sale	ratio_assm~e	Ratio of the Total Assessed value (prior to exemptions) to the total sale value

Table 2: Description of Parcel Variables

Table 3: Summary of Parcel Data Statistics

Variable	Number of Observations	Mean	Standard Deviation	Minimum value	Maximum value
STAR	18,182	0.69	0.46	0	1
Adks	18,182	0.25	0.43	0	1
Duplicates	18,182	0.37	0.48	0	1
Roll Year	12,778	2004	1	2001	2006
Acres	18,182	174.27	709.21	0	22,637
Acres - Capped 100	18,182	20.80	36.08	0	100
Front	18,182	704.32	3,170.13	0	165,000
Depth	18,182	1078	3,928	0	55000
Waterfront	18,182	0.04	0.19	0	1
Waterfront - 300	18,182	0.04	0.19	0	1
Total Waterfront	18,182	0.05	0.22	0	1
Land AV ($2002)	18,182	32,994	62,049	0	1,677,223
Total AV ($2002)	18,182	130,034	111,491	5,163	2,667,337
Sale month	18,182	6.67	3.27	1	12
Sale Year	18,182	2004	1.23	2001	2006
Sale price ($2002)	18,182	159,139	139,848	5,400	9,254,560
Ratio Assmt/Sale	18,182	0.81	1.03	0	21.0

Table 3: Summary Statistics of Parcel Variables

The majority of the variables in the dataset were contained in the original RPS databases; the remaining variables were calculated using the ORPS databases, relevant tax information, and ArcGIS, a geographical mapping software. Less than 5 percent of missing *Acres* variables were calculated when the relevant parcel frontage and depth (*Front* and *Depth*) information was available. The *Total Waterfront* indicator variable was created by assigning a 1 to any parcel that either has a center located within 300 feet of a lake, as calculated using ArcGIS, or if the assessor indicated that the property adjoins a waterfront. ArcGIS was also used to generate the dummy variable *Adirondacks,* wherein a "1" represents that the center of the parcel lies within the Adirondack Park boundary.

As the reader familiarizes himself with the data, he may instinctively feel that some of the numbers are inaccurate. Though precision is always a concern when large data sets are compiled, many of these variables can be better contextualized by considering the unique nature of the Adirondack Park. For instance, it is interesting to note that approximately 5% of homes in the sample have waterfront property, and that the mean parcel contains over 174 acres.[52] For some individual counties this number is considerably higher: in Warren County over 10% of the sales involved waterfront property, while Hamilton County boasts 27%. The acreage means and maximums of the sample are even more surprising, but given the vast amounts of open, privately owned land in the Adirondacks, and due to extreme upper limit outliers, it *is* possible that mean acreage could be such a large number. In order to capture the value that the median homebuyer might be considering, however, we have chosen to create a second acreage variable, *Acres – Capped 100*, which is the minimum of (a) the actual parcel size and (b) 100 acres. This new variable truncated the acreage of 2,399 parcels, or 13.2% of the sample; we also created a dummy variable to indicate when a parcel has had its acreage truncated by *Acres – Capped 100*.

The variable *STAR* contained in the RPS database is an indicator that the homeowner is eligible for New York State's School Tax Relief Program, which provides for a "partial exemption from school property taxes. All New Yorkers who own and live in their [own] home

[52] The fact that the minimum parcel acreage is 0 is questionable, but it may be the case that some single family homes are built on land that they do not own. Therefore, these parcels have not been removed from the data.

[…] are eligible for a STAR exemption on their *primary residence*."[53,54] Basic STAR exempts the first $30,000 of the full value of a home from school taxes, so it is reasonable to assume that all eligible homeowners seek to claim this exemption. Thus, because of the financial incentives for qualified homeowners to claim a STAR exemption, this variable provides a good proxy for each homeowner's residency status. As mentioned above, individuals who are classified as non-residents are denied the right to vote in local, county and state elections, and are also less likely to consume local public goods. The *STAR* variable is binary, where a 1 indicates eligibility. The *STAR* variable was calculated by determining which exemptions individuals claimed on their school district taxes. Thus, based on the mean observed value listed in **Table 3**, we expect that around 69% of the single family homes sold in the four counties in our sample were bought by individuals who subsequently became full-time residents; conversely, around 31% of these purchases are currently owned by individuals who are either non-residents or are not currently residing in that home. Contrasting this number with other regions reveals that the Adirondacks possess a naturally high percentage of non-residents. For example, the percentage of housing units in New York State that are considered vacation homes is only 3.1%, while in Maine, the state with the highest percentage of vacation homes, this number is still only 15.6% (Census, 2000).[55]

It not unreasonable to posit that there may be a higher (or lower) sales rate during the 2001-2006 period for homes bought by non-residents, and therefore any hedonic regression estimates might be biased toward (or away from) non-resident preferences to the extent that the marginal buyer in our sample is actually different from the marginal community member. To check for this we use 2000 Census block group data to calculate the percentage of homes in the

[53] Emphasis added. Taken from the NYS ORPS website on November 15, 2006 at http://www.orps.state.ny.us/star/faq.htm

[54] Of course, this begs the question, "how is primary residency defined?" While this definition is not black and white, ORPS sheds some light on the issue: "There is no single factor or definition that determines primary residence. However, the most important factor is the length of time the person resides on the property. Generally, it can be expected that the person would reside on the property more than six months of the year. Other factors include a person's voting residence, driver's license, filing status for purposes of state income taxes, and other conduct and behavior that provides evidence as to which property the applicant considers to be his or her primary residence." ORPS adds that "The applicants must certify that the property is their primary residence," and provides the necessary paperwork and red tape through which the prospective primary resident might wade. http://www.orps.state.ny.us/star/2004_guide.htm#reside

[55] Of course, the denominators of these percentages contain rental units, which our data does not necessarily contain in the same proportions, so it is likely that the Census numbers are relatively biased downward. For our purposes, however, they provide an instructive comparison.

four counties classified as owner occupied, which is 56.3%. If we exclude renter-occupied housing units, however, the percentage of owner occupied structures estimated by the Census is much higher, at 83%. Since estimates suggest that three-quarters of owners never rent out their vacation homes, the second number is more likely to be comparable to our estimate[56] (National Association of Realtors, 2002). Further, if it were the case that a certain percentage of vacation home owners in this region rented their homes, we would expect the percentage of owner-occupied structures estimated by Census to be lower than 83%, but perhaps not as low as 69%. Calculating the percentage of residents contained in the unrestricted[57] ORPS database yields similar results. In Warren County, for example, nearly 72% of single-family residences are actually owned by residents, contrasted with 62% in our sample. Therefore, our statistics suggest that non-residents were slightly more likely to buy homes than non-residents during the sample period, since our sample mean of 69% seems to lie below the true resident percentage.[58] Despite this near concurrence, the reader must be cautious throughout the paper to note that all estimates provide information on the Essex, Hamilton, Saratoga and Warren County housing market in this period, and are *not* necessarily indicative of a universal value structure.

Hedonic models operate under the assumption that the sample being used contains goods that exist in a unified market. If this is not the case – if a sample contains multiple markets – then there are as many marginal buyers as there are distinct markets; without a unified market, it is incorrect to estimate valuations using a single hedonic. Therefore, an important question to address before estimating our hedonic regressions remains: is the housing market in this region divided along residency lines? That is to say, are there houses that exist in *only* the non-resident market, such that the marginal buyer of a "seasonal" home is necessarily a non-resident and, thus, would be unlikely to capitalize education? To answer this question, we begin with the null hypothesis that all homes in our sample exist in a unified market. We use three methods to test this hypothesis, and find that we are unable to reject it.

[56] Since some owners do rent their homes, this number is upward biased: the actual number is likely closer to our estimate.
[57] That is, the original ORPS database for the 2005 tax roll that also contains non-sold homes.
[58] If the percentage of vacation home owners that rent their homes is negligible, a comparison to the Census figures suggests that perhaps a higher degree households in our sample were sold or resold to non-residents than the distribution of the general population might suggest. Calculating the percentage of residents contained in the unrestricted (the original ORPS database containing non-sold homes) ORPS database yields opposite results.

To determine whether or not our data exists in a unified market, we first construct the dummy variable *Duplicates*, which registers as a "1" for all parcel sales that represent the second or third sale of the same property within our dataset.[59] Roughly 6,762 entries, or 37% of the parcels in our sample, represent second or third sales.[60] Within the subset of homes in our sample that have been resold, we calculate the number of times that residency status has changed with a home sale: 1,857 times, or 27.46% of the time. Given the distribution of residents and non-residents in our sample, if all homes existed in one unified market we would expect that homes would change residency status 42.64% of the time. **Table 4** below shows the expected (under the hypothesis of a unified market) and actual percentages of residency changes based on the duplicate sales. The estimated standard errors suggest that all of the observed probabilities are statistically different from the expected probabilities at the 1% level.

Expected percentage if all parcels exist in one market:		**Reality:**
Probability of 2 residents in a row	47.86%	49.91%
Probability that 2 non-residents in a row	9.50%	25.54%
Probability STAR to non-STAR	21.32%	12.93%
Probability non-STAR to STAR	21.32%	11.62%

TABLE 4: Expected and Actual Probabilities of Property Residency Changes

The table illustrates that the lower than expected change in a parcel's residency status is largely driven by the observed increased probability that non-resident homes sell to non-residents. This could suggest that roughly 16% of our sample exist in an exclusive non-resident market. However, it is important to note that these estimates are being driven by homes that have been sold multiple times during a five year period. Though it is possible that a subset of the homes exist in a pure non-resident market, it may be that these homes are over-represented in the *Duplicate* sample, since the cost of buying and re-selling a secondary home is likely lower than the cost of moving into and out of a primary home in such a short time period. Therefore, it is necessary to consider evidence drawn from the entire sample before we can reject that null hypothesis that the majority of homes exist in a unified market.

[59] No property in our sample was sold more than thrice.
[60] While this number is quite large, it may suggest high real estate speculation during our sample period.

Returning to the entire sample of 18,182 parcel sales, we next determine whether or not the observed means of the resident and non-resident sub-samples are more than one standard deviation apart. Testing for statistically significant differences between the resident and non-resident means for 162 property, housing, education, and neighborhood characteristics, we find that the means of the two sub-samples lie farther than one standard deviation apart for only one variable: the mean school property tax rate.[61] The 162 means and standard deviations for the resident and non-resident sub-groups are listed in **Appendix C**. The fact that the means of resident and non-resident parcel characteristics in our sample are not statistically different suggests that we are likely to be justified in assuming that the means of non-observed or immeasurable characteristics are similarly equivalent across the two samples. This provides strong evidence that the homes in our sample exist in a unified market, and we are therefore reasonable in our decision to regress our hedonic models over the entire sample. In the **Results** section, we will show that the differences between observed prices of non-educational goods for the marginal resident and non-resident are statistically insignificant across the majority of estimated values. This further solidifies the claim that the homes in our sample exist in a unified market, and therefore use of a single hedonic function is appropriate for making valuation estimates.

Table 5 gives the variable names and definitions for the 33 housing characteristics variables and is followed by **Table 6**, which contains the subsequent summary statistics. For each parcel, each county's RPS has provided detailed physical information that captures measures such as internal square footage, number of bedrooms, number of bathrooms, and age of the building in years. In addition, coordinates are provided for each parcel's exact location, which allow parcel information to be merged with various neighborhood characteristics, as explained below.

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[61] Under the assumption of normally distributed characteristics, observed means separated by exactly 1 standard deviation could represent samples whose true means were equal nearly 34% of the time. Thus, even allowing for drastically liberal conditions, we are unable to reject the null-hypothesis that the means of parcel, housing, and neighborhood characteristics are identical for the resident and non-resident sub-samples.

Table 5 - Description of Housing Characteristics Variables		
Variable Name	**Variable label**	**Variable Description**
Year Built	yr_built	Records the year in which the building was constructed
Age	age	Records the effective age of the building on site
Age sq	age_sq	Records the effective age of the building on site, squared
New construction	new_constr~n	Binary, 1 indicated parcel purchased as new constructuion
Overall condition	overall_cond	The overall physical condition of the inside and the outside of the residence.
Grade	grade	The overall construction grade and quality of worksmanship found in the residence
Kitchen quality	kitchen_qu~y	The overall quality of the kitchen on a 1-5 scale, where 5 is best
Interior condition	interior_c~d	The overall interior quality of the home on a 1-5 scale, where 5 is best
Exterior condition	exterior_c~d	The overall exterior quality of the home on a 1-5 scale, where 5 is best
Bathroom quality	bath_quality	The overall bathroom quality of the home on a 1-5 scale, where 5 is best
Exterior wall material	ext_wall_m~l	Wall material used, out of 7 possibilities
Building style	bldg_style	Classifies the architectural style of the residence. More detail on Building Style Data Statistics sheet
SFLA	sfla	The total square footage of finished living area.
NBR_Rooms	nbr_rooms	The number of rooms in the residence
NBR_Kitchens	nbr_kitchens	Number of complete kitchens existing in the residence
NBR_Full Baths	nbr_full_b~s	The number of full bathrooms existing in the residence
NBR_Half Baths	nbr_half_b~s	The number of half bathrooms existing in the residence
NBR_Bedrooms	nbr_bedrooms	The number of rooms in a residence that were designed to be used primarily as bedrooms
NBR_Fireplaces	nbr_firepl~s	The actual number of openings for functional fireplaces which exist in the residence
NBR_Stories	nbr_stories	Number of stories in the building
Basement/Garage Capacity	bsmnt_gar_~p	The actual number of cars which a basement garage has been designed to hold
FirstStorySqFt	first_story	Records the total square footage of all first floor area including finished and unfinished areas.
SecondStorySqFt	second_story	The total square footage of all second floor area including finished and unfinished areas.
AdditionalStorySqFt	addl_story	Total square footage, finished and unfinished, of all areas above the second floor which are not attic, half-story, or three-quarter story
HalfStorySqFt	half_story	The total square footage of all half-story floor area including finished and unfinished areas.
ThreeQuarterStorySqFt	three_qtr_~y	Total floor area (measured from eave to eave) of a three quarter story, including all finished and unfinished area
Finished Over Garage SqFt	fin_over_g~e	Records the usuable interior floor area of finished space above garage
Finished Attic SqFt	fin_attic	Records the usuable interior floor area of finished attic
Finished Basement SqFt	fin_basement	Finished Basement Area records the square footage of basement area that has been finished consistent with the quality of the main living area
Finished RecRoom SqFt	fin_rec_room	Records the usuable interior floor area of finished recreational room
Unifinished HalfBath SqFt	unfin_half~y	Records the interior floor area of unfinished Half Bath
Unfinished 3qtr SqFt	unfin_3_qt~y	Records the interior floor area of unfinished Three Quarter Story
Unfinished Room SqFt	unfin_room	Records the interior floor area of unfinished rooms

TABLE 5: Description of Housing Characteristic Variables

Table 6: Summary of Housing Characteristics Statistics

Year Built	18,182	1970	37	1750	2006
Age	18,182	34	37	0	254
Age sq	18,182	2,562	5,238	0	64,516
Sale Year	18,182	2004	1	2001	2006
New construction	10,630	0.09	0.28	0.00	1.00
Overall condition	18,180	3.1	0.4	1.0	5.0
Kitchen quality	1,021	3.0	0.3	1.0	5.0
Interior condition	763	3.0	0.3	2.0	5.0
Exterior condition	776	3.0	0.3	2.0	5.0
Bathroom quality	1,023	3.0	0.3	2.0	5.0
Exterior wall material	12,694	2.4	1.0	1.0	7.0
Building style	18,182	6.1	4.2	1.0	17.0
SFLA	18,182	1,749	686	200	8,349
NBR_Rooms	12,778	0.8	2.4	0.0	17.0
NBR_Kitchens	18,182	1.0	0.2	0.0	3.0
NBR_Full Baths	18,182	1.7	0.7	0.0	10.0
NBR_Half Baths	12,778	0.6	0.5	0.0	2.0
NBR_Bedrooms	18,182	3.1	0.9	1.0	13.0
NBR_Fireplaces	18,182	0.6	0.6	0.0	8.0
NBR_Stories	18,182	1.6	0.5	1.0	4.5
Basement/Garage Capacity	18,182	0.1	0.5	0.0	4.0
FirstStorySqFt	18,182	1,141	405	100	8,349
SecondStorySqFt	18,182	458	495	0	3,238
AdditionalStorySqFt	18,182	1.1	30.1	0.0	2104.0
HalfStorySqFt	18,182	66.8	202.9	0.0	2610.0
ThreeQuarterStorySqFt	18,182	34.9	164.6	0.0	2942.0
Finished Over Garage SqFt	18,182	24.9	92.1	0.0	1158.0
Finished Attic SqFt	18,182	4.3	35.6	0.0	750.0
Finished Basement SqFt	12,778	58.9	200.2	0.0	2468.0
Finished RecRoom SqFt	18,182	41.0	180.5	0.0	3464.0
Unifinished HalfBath SqFt	12,778	3.2	39.2	0.0	1129.0
Unfinished 3qtr SqFt	12,778	0.3	12.9	0.0	924.0
Unfinished Room SqFt	12,778	3.4	45.0	0.0	1478.0

Table 6: Summary Statistics of Housing Characteristics Variables

The housing characteristic statistics are fairly normal by most American standards. The mean number of bedrooms is 3.1, the mean number of bathrooms is 1.7, and the average structure age is about 34 years. Comparing these numbers with the means in Crone's (2006) or Kane et al.'s (2003) samples, we see that they are roughly similar: 3.35 / 3.28 bedrooms, 2.09 / 1.96 bathrooms, and 40.83 / 16.4 years.[62] Thus, the majority of the differences that we observe in the data stem from the uniqueness of the Adirondack region's remoteness, increased property-use regulations, and incomparable facilities, such as decreased levels of public service (explained

[62] Here there is a large discrepancy between Crone's and Kane et al.'s house age means. Kane et al.'s lower housing age may reflect a housing boom in Mecklenburg County, North Carolina in the mid-1980s.

below) and increased natural amenities. These similarities suggest that differences in our results from the literature are not capturing abnormal or immeasurable housing characteristics, but rather other qualities and value structures that are intrinsic to the region.

The RPS databases also try to quantify some of the qualitative housing characteristics: the overall condition of the house and the construction grade are ranked on a scale from 1 to 5, where 5 is the best quality. Many characteristic measures are available for all homes in the sample, but, due to assessor omissions, condition and quality variables are often omitted from regressions. Their inclusion above, then, is largely made available so that the reader can develop a better feel for the data. For example, for the homes where quality and condition characteristics are listed, the means of 3.0 suggest that the sample is very evenly centered around "average" homes. There is also a great deal of detailed information on the infrastructure of the various homes, such as building style characteristics, type of sewage system, type of utility, and type of water supply.[63] Detailed summary statistics and descriptions for the categorical breakdowns of sewer, water and utilities data (**Table 7**), fuel type, heat type and central air characteristics (**Table 8**), land type classifications (**Table 9**), and building style characteristics (**Table 10**) are all located in **Appendix B**.

Note that there is no *a priori* reason to believe that the relationship between sales prices and assessed housing values is uniform.[64] According to ORPS, the assessor's job in constructing the total assessed value is "to determine the market value of the property."[65,66] However, this

[63] For instance, the curious reader might be interested to learn that approximately 7.8% of homes sold in our sample do not have sewers. Meanwhile, roughly 67% utilize private sewers, while about 25% utilize public sewer systems. See **Appendix B** for a table of utility, sewage and water source summary statistics. Some of this information is applied to hedonic models, and is influential in absorbing variance due to variations in remoteness and accessibility to modern conveniences. For instance, it would not be unreasonable to assume that buyers value a public sewage system more than they would value maintaining their own leech field, *ceteris paribus*.

[64] Though this may seem trivial at this point, it is important to understand whether or not the relationship between sales prices and assessed housing values varies uniformly for all houses. If the variation is not uniform, and specifically if it varies systematically at the municipality level, taxes and subsequent tax capitalization estimates could be biased. This will be explained in more detail below.

[65] ORPS: http://www.orps.state.ny.us/assessor/value_analysis/value_analysis.cfm

[66] Homes are reassessed yearly. Assessors are required to sign an oath annually to attest that all parcels under their jurisdiction have been assessed at a uniform percentage of (current use) market value. This means that the sale price of a home will affect that home's assessed value in the following year only to the extent that it signifies a change in the market values for that area: a high or low sale price will not be followed by high or low assessed values if these changes are not indicative of shifts in the housing market. Therefore, homes that have been recently sold are no more likely to be assessed at market value than similar homes that have not been recently sold. http://www.orps.state.ny.us/pamphlet/fairassessments.htm

assessment is calculated based on the current use of a property, whereas actual sales oftentimes consider the "highest and best use" of a property; this explains why observed sales prices might exceed assessment values.[67] Other differences might come from the degree to which homebuyers capitalize taxation, and the expected volatility of the level of taxation or of the expected stream of future benefits.[68] Since the assessed value is calculated *before* exemptions are applied, it may be the case that the assessment is an overestimate of a parcel's value. This would explain why observed sales prices might fall short of assessment values.[69]

A more straightforward explanation of the difference between sales prices and assessed housing values derives from the fact that both the assessment process and the housing market are marred by information asymmetries. Additionally, though we try to control for off-market sales by removing homeowner and assessor identified non-open-market sales, as described above this may not have been sufficient to limit the sample to pure open-market data. A simple plot of assessment value to sales price, below in **Chart 1** and **Chart 2**, shows us that this relationship is largely linear and 1-to-1.[70] There are a few homes that appear to be grossly over-assessed, circled below in green, but it is likely that these are non-open market sales that were not identified during the selection process, or properties that qualify for large exemptions that were not capitalized into the purchase price, as cited above.[71] The small unmarked lope of apparently under-assessed

[67] The terminology here can be confusing at first glance, but it need not be. Consider this example: a golf course might be assessed at $1 million, since an assessor determines that it might be sold to another golf course operator for $1 million. However, a contractor might decide to buy the property for $20 million, knowing that he will eventually develop the land into residential real-estate. Thus, the observed sales price would be far greater than the assessment value.

[68] Property tax capitalization is the degree to which buyers capitalize their expected tax burden into the price they are willing to pay for the home. Refer to the **Relevant Literature and Conceptual Framework** section.

[69] For instance, assume a property is assessed at $1 million. However, due to the fact that it is surrounded by wetlands, it receives large exemptions as if there were an easement due to Title 9, Section 24 of NY State's Environmental Conservation Laws. Though this is not reflected in the assessment, it will be reflected in the property's tax bill. If the marginal prospective buyer has a low degree of tax capitalization or if the exemption is not really sufficient to alleviate the burden imposed on the property, however, the detriments of the wetland restrictions will *not* be balanced by the decrease in taxes, and the property might sell for under $1 million. (Title 9, Section 24, available as of November 16, 2006 at: http://caselaw.lp.findlaw.com/scripts/getcode.pl?frame=right2&code=NY&ls=claws&law=37&art=110)

[70] Because of a shortcoming of Excel, logarithmic charts can only range between multiples of 10. Therefore, these charts are missing data below $10,000 and above $1 million, since adding that data would have decreased the detail of the chart. A chart containing the entire range of the sample is located in **Appendix D**.

[71] Properties that qualify for large exemptions that were not capitalized into the purchase price may often be large properties that are entered, for example, into 480A forestry exemption programs or that contain undevelopable, unjustly over-assessed land (e.g.: wetland) for which buyers are unwilling to pay large

parcels is likely reflecting the fact that assessed value is an estimate of current use while sales prices for developable properties may sell at a price that reflects highest-and-best use. For the most part, however, it does not appear that over-assessment or under-assessment is dependent on actual house value, though there is also the potential for two-way causality between the variables, which is discussed in detail below. The important thing to note is that assessment, for the most part, seems to vary linearly with the market's valuation, suggesting that we do not need to worry about unevenly distributed tax capitalization affecting our regression estimates.

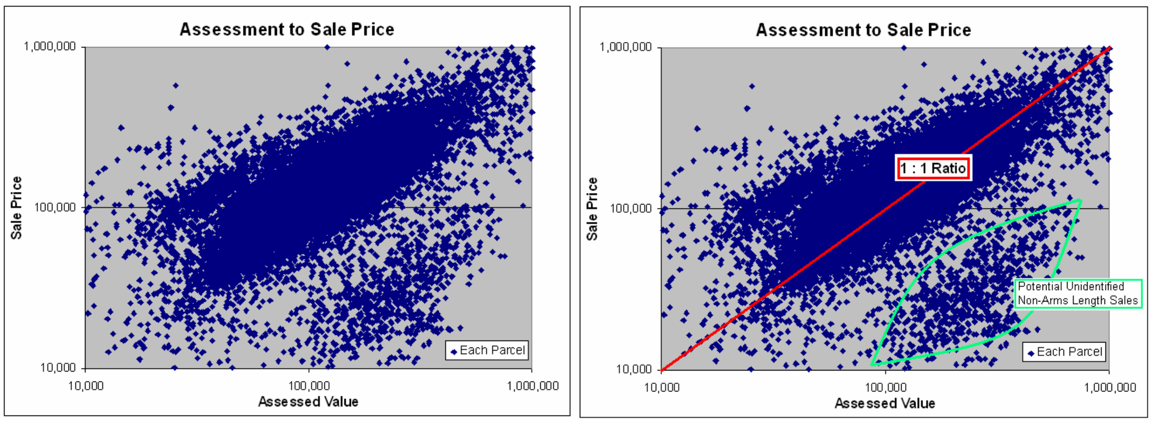

CHART 1 and **CHART 2**: Assessment value vs. sales prices in $2002
viewed on a logarithmic scale, with and without visual aids

amounts. Assessment-to-Sale price charts for various sub-groups confirm that larger properties are likely to be over-assessed (See **Appendix E**). These charts also show that residents and non-residents appear relatively more likely to be over-assessed, while residents are slightly more likely to be under-assessed.

NEIGHBORHOOD CHARACTERISTICS DATA

Neighborhood data were compiled by merging each parcel with Census 2000 block group data. Census block groups are geographically smaller than census tracts and generally follow natural boundaries, "such as roads, rivers, canals, railroads, and above-ground high-tension power lines" (Census website). Typically the Census aims for census block groups to have a minimum population of 600, a maximum of 3000, and an optimum size of 1,500. The four counties in our sample have a minimum block group population of 1, greatly violating the target range; the mean is again lower than the optimum, at 1,020. Below, in **Figure 6,** is a map representing the parcels in our data set and the census block group boundaries.

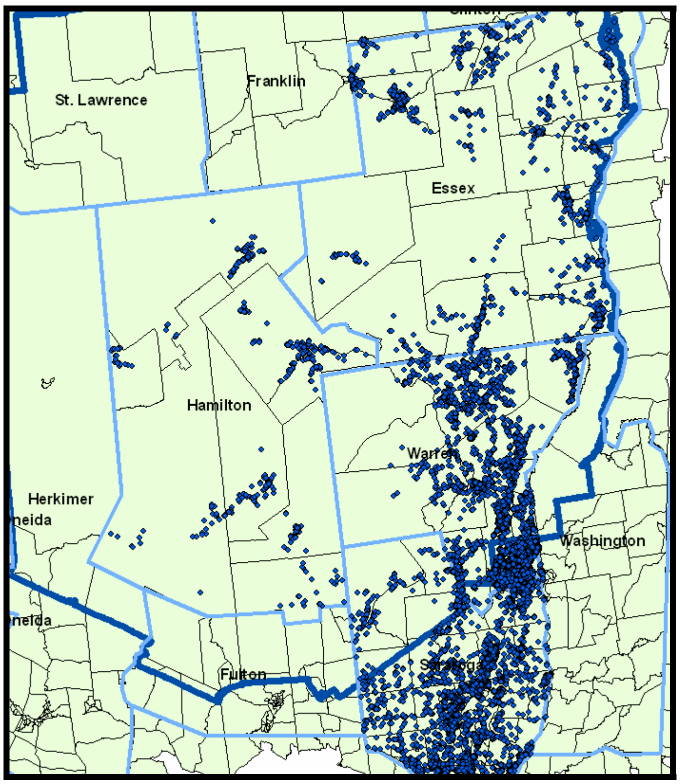

FIGURE 6: Census block group boundaries in thin black, county boundaries in light blue, and Park boundary and parcels in dark blue

The neighborhood data contributed by the 2000 Census block group data includes each block group's racial, gender, and age breakdown, in addition to measures of average household and family size. **Table 10** gives the description of the neighborhood variables, while **Table 11** and **Table 12** give the summary statistics for neighborhood variables for the subset of the parcels lying outside of the Park and the subset of the sample that lies only within the Adirondack Park, respectively.

Table 11 - Description of Neighborhood Variables		
Variable Name	**Variable label**	**Variable Description**
2000 Population	pop2000	The 2000 population in the parcel's census block group
2000 Population per Square Mile	pop00_sqmi	The 2000 population in the parcel's census block group per square mile
Percent Non-White	pctnw	Percentage of Population in census block group that identifies as non-white
Percent Male	pct_male	Percentage of parcel's census block group that is male
Percent 21 and under	pct_21_and~r	Percentage of parcel's census block group that is 21 and younger
Percent 65 and older	pct_over_64	Percentage of parcel's census block group that is 65 and older
Median Age	med_age	Median Age in census block group
Median Age Male	med_age_m	Median Age Male in census block group
Median Age Female	med_age_f	Median Age Female in census block group
Average HH size	ave_hh_sz	Average Household size in census block group
Avg Family Size	ave_fam_sz	Average family size in census block group
Percent Owner Occupied	pct_owneroc	Percent of household units (excluding rental units) that were owner
Percent Popn Below Poverty	perc_blw_pov	Percent of population with income in 1999 below poverty level

TABLE 11: Description of Neighborhood Variables, data taken from 2000 Census

Table 12a: Summary of Neighborhood Data Statistics outside of Adirondacks					
Variable	**Number of Observations**	**Mean**	**Standard Deviation**	**Minimum value**	**Maximum value**
2000 Population	13,587	2,615	1,336	428	6,104
2000 Population per Square Mile	13,587	1,294	1,611	22	11,729
Percent Non-White	13,587	5.2	3.6	0.8	33.7
Percent Male	13,587	49.1	2.0	34.2	63.1
Percent 21 and under	13,587	29.8	4.2	5.5	74.0
Percent 65 and older	13,587	13.1	8.1	3.8	247.9
Median Age	13,587	37.6	3.3	20.2	79.1
Median Age Male	13,587	36.7	3.1	20.3	71.5
Median Age Female	13,587	38.4	3.8	20.1	81.7
Average HH size	13,587	2.6	0.3	1.4	3.1
Avg Family Size	13,587	3.0	0.1	2.4	3.3
Percent Owner Occupied	13,587	91.8	7.0	22.1	99.6
Percent Popn Below Poverty	13,587	5.0	4.3	0.0	61.3

TABLE 12A: Summary Statistics of Neighborhood Variables from outside the Adirondack Park

Table 12b: Summary of Neighborhood Data Statistics within the Adirondacks					
Variable	Number of Observations	Mean	Standard Deviation	Minimum value	Maximum value
2000 Population	4,595	1,313	590	266	3,834
2000 Population per Square Mile	4,595	211	534	1	2,863
Percent Non-White	4,595	4.0	8.7	0.4	75.4
Percent Male	4,595	49.8	3.9	43.8	79.5
Percent 21 and under	4,595	26.7	4.7	10.6	43.5
Percent 65 and older	4,595	20.7	6.0	6.6	41.0
Median Age	4,595	41.6	4.5	28.3	51.4
Median Age Male	4,595	40.9	4.7	29.2	51.8
Median Age Female	4,595	42.4	4.6	26.8	52.2
Average HH size	4,595	2.4	0.2	1.8	3.0
Avg Family Size	4,595	2.9	0.1	2.6	3.3
Percent Owner Occupied	4,595	54.0	18.6	15.5	98.1
Percent Popn Below Poverty	4,595	10.5	4.6	1.2	20.6

TABLE 12B: Summary Statistics of Neighborhood Variables from inside the Adirondack Park

The population density differences between the data outside of and within the Park are noticeable. Based on the composition of parcels bought, each square mile within the Park is, on average, less populated by about 1,083 individuals. Specifically, Hamilton County has, on average, 3 people per square mile while Essex County has, on average, 20.3 people per square mile, suggesting a with-in Park[72] atmosphere that borders on isolation (Census 2000). Adirondack homebuyers in our sample buy into slightly more populated neighborhood than true Park averages:[73] the in-Park population per square mile in our sample is 211. In contrast, out-of-Park homebuyers in our sample enter neighborhoods with, on average, 1,294 individuals per square mile, suggesting that Adirondack homebuyers, among other differences, buy homes with decreased population density.

Racial diversity and average age are fairly similar across Park boundaries, but the percentage of households living at or below the poverty level in our sample is twice as much within the Park. The percentage of owner occupied households in our sample swings drastically from 91.8% outside of the Park to 54.0% within the Park, suggesting that these homebuyers are buying into vastly different constituencies. These characteristics will be included in most of the models; however, they do suggest that the data within and without of the Park might vary in other

[72] Recall that Hamilton County lies entirely within the Park boundary, while Essex County lies almost entirely within the Park.
[73] This could reflect a preference away from extremely unpopulated regions, or it may simply be reflecting that there is a greater supply of housing in relatively more populated areas.

significant, unobservable ways. To this end, the Adirondack indicator variable will be included in most regressions to absorb the excess differences that vary systematically across the Park boundary. A more complete solution would seek to quantify the other ways in which neighborhoods within and without of the park differ. To account for potentially large differences in local public services between the more populated outer fringes of the Park and the remote inner sections, most models will also include municipality dummy variables.

EDUCATION DATA

Each parcel is matched to its respective school district data from the year prior to the sale; for example, a home bought in 2004 would be matched with school district performance data from 2002-2003. This matching ensures that the relevant school district performance information would have been available to the buyer. The school district data are compiled from NYS Education Department (NYSED) data from 2000 to 2005, which covers the sales from 2001 to 2006. Forty-five school districts are represented in the sample, and the data include annual expenditure per pupil, as well as mean statewide standardized examination scores from fourth and eighth grade in English and Math, NYS Regents exam scores, and the percentage of each district's graduating class that earned a Regents diploma. All of these variables have been associated with data at the school district level, as opposed to at the school level. While this decision was mainly motivated by practicality, it is also consistent with the findings of Crone (2006), as cited above. Furthermore, within the Park, the majority of the school district boundaries coincide with school attendance boundaries, since each district has at most one school serving each grade level.[74]

Some Adirondack school districts educate only as far as ninth grade, and in some cases sixth grade. In these instances, districts have a pre-determined post-graduation attendance district into which students are automatically enrolled. Parents that choose to enroll their children in a school other than the designated district school are not exempt from taxes, and are obligated to pay the tuition at the alternate district of their choosing. Thus, designated districts are *de facto*

[74] For example, Hamilton County has seven districts with one school each. Essex County has eleven districts with fifteen schools, but school enrollment is determined by grade and not by intra-district parcel location, so the difference is minimal.

extensions of the district in which a parcel is located. By telephoning all districts in my sample that do not educate their constituents from kindergarten through twelfth grade, I compiled a data set of all designated districts. Thus, each parcel is paired with the relevant school district examination scores based on their designated district at each grade level. To take a complex example, homes located in Piseco Central School District are matched with the 4th grade scores of Piseco, the 8th grade scores of Lake Pleasant Central School District, and the high school scores of Wells Central School District, reflecting their designated district pattern. This matching is based on the reasonable assumption that, in the event that a district does not educate through high school, potential homebuyers are equally knowledgeable about a home's actual districts and, when applicable, its subsequent designated district(s).[75]

The cost of education is captured by the tax rate, which has been compiled using data available from the NYS Office of the State Comptroller and from NYS ORPS Municipal Profiles databases. Combining this information yields the actual tax rates paid by all parcels for the required time period. Since homebuyers likely base tax expectations on the most recent tax rate at the time of sale, these rates have been matched with parcel sales for the subsequent year. For example, a parcel sold in 2003 is matched with that parcel's tax rate from 2002. Secondly, these rates have been adjusted using NYS ORPS equalization rates to reflect the actual burden of the tax for each respective property.[76] **Table 13** and **Table 14** give the definitions and summary statistics for the education data associated with parcels in our sample.

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[75] To the extent that exam scores are perceived as good instruments for predicting positive local externalities due to education, this model will also capture these benefits.

[76] For those readers unfamiliar with taxation policy and curious to better understand the terminology, read on. For the others, the important fact is that using the equalized tax rate is the most accurate means of capturing the actual educational tax burden that a parcel faces.

A school tax is a value-added property tax. Each municipality-district decides at what constant rate it will tax all of its constituents. This rate is applied to the total assessed value (AV) of the property owner's parcel, as calculated by the assessor, and the subsequent value is the taxpayer's school tax bill. Now comes the complex part. Not all assessors choose to assess homes at 100% of their market value, since in NYS each municipality is entitled to assess their jurisdiction at any uniform fraction of market value. Differing assessment levels only become an issue when school districts (or any other public taxable good) cross municipality boundaries; in these instances, equalization is necessary to ensure that property owners in all municipalities pay an appropriate share of the tax burden. Consider the following extreme example: two homes are located in the same school district but in different municipalities, and they happen to be assessed at differing assessment rates. The *market value*, or the sale value were the homes to remain in their current use, is $100,000 for both home **A** and **B**. Municipality **1** assesses home **A** at $100,000. Municipality **2**, having resolved to uniformly assess properties at 50%, assesses home **B** at $50,000. The school district that they share in common decides to tax at a rate of .001%. For home **A**, then, the tax bill is calculated to be $100,000*.001 = $1,000. For home **B**, however, NYS's ORPS determines that an

Table 13 - Description of School District Variables

Variable Name	Variable Label	Variable Definition
Year	year	The year in which data was gathered (for year assessment administered, ex: 2001 = 2000-2001 school year)
Enrolled	enr	The number of students enrolled in the district as of September of Year
Student-Teacher Ratio	stu_teach_~o	Ratio of students to teachers in the school district; part-time teachers count as half
% Regents diplomas	__regdipl	The percent of students receiving HS diplomas who also received a Regents diploma
St. Dev's %RegDipl	sd_regsdip	Number of standard deviations the parcels assigned district is from the mean of the % Regents diplomas for the districts within 25 road-miles
Average Percent Level 4	avg_per_l4	The percentage of students scoring at Level for on the Grade 4 Math and English Exams
PPEXP	ppexp	District Expenditure per pupil
PPEXP $2002	ppexp__2002	District Expenditure per pupil in $2002
%4 Year College	%4 Year College	Number of high school graduates who enrolled in four-year colleges as a percentage of Total number of graduates
%2 Year College	%2 Year College	Number of high school graduates who enrolled in two-year colleges as a percentage of Total number of graduates
%Other Post Secondary	%Other Post Secondary	Number of high school graduates who enrolled in other post-secondary institutions as a percentage of Total number of graduates
%Military	%Military	Number of high school graduates who enlisted in the military as a percentage of Total number of graduates
%Employment	%Employment	Number of high school graduates who plan to pursue employment as a percentage of Total number of graduates
Needs Index	Needs Index	The need/resource capacity category to which the district is assigned
Percent Poverty	PCNT_FL_K_12	Percentage of students enrolled in K-12 program eligible for the free-lunch program (proxy for poverty)
Percent English Proficient	PCNT_LEP_STUDENTS	Percent of district enrollment identified as limited English proficient
School Tax Rate	sch_tax_rate	Tax rate per $1 of assessed value for each district/town combination, equalized but unadjusted for exemptions

TABLE 13: Description of Education Variables

equalization rate of 200% should be applied. If home **B** were to pay a tax bill of $50,000*.001 = $500, the inhabitants in Municipality **1** would be paying a disproportionately large share of the school district budget. Instead, home **B** will pay $50,000*.001* 2 = $1,000, making their tax burden equal to home **A**, since both homes have the same market value. Thus, the actual rate that home **B** pays is .002, but for our purposes the equalized rate of .001 will enter the regressions.

Variable	Number of Observations	Mean	Standard Deviation	Minimum value	Maximum value
Year	18,182	2003	1	2000	2005
Enrolled	2,771	2,121	2,882	67	9,535
Student-teacher ratio	18,182	13.3	2.1	1.5	16.1
% Regents diplomas	18,142	69.62	12.36	1.64	100.00
St. Dev's %RegDipl	18,142	0.37	0.70	-2.88	2.96
Avg_Per_I4	16,002	25.61	8.63	0.00	47.83
PPEXP $2002	18,065	10,018	2,049	5,393	26,631
%4 Year College	16,671	50.4	14.5	0.0	95.7
%2 Year College	16,671	32.4	9.2	0.0	100.0
%Other Post Secondary	16,671	1.3	2.3	0.0	38.4
%Military	16,671	2.9	3.2	0.0	31.3
%Employment	16,671	8.2	6.1	0.0	40.0
Needs Index	8,175	5.0	0.6	3.0	6.0
PCNT_FL_K_12	2,707	17.5	11.6	0.0	42.6
PCNT_LEP_STUDENTS	2,707	1.2	4.9	0.0	78.0
School Tax Rate	18,168	0.017	0.005	0.000	0.027

Table 14 - Summary of School District Data Statistics

TABLE 14: Summary Statistics of Education Variables

Though the educational data represent districts that are in some ways different from NYS and national averages, for the most part these numbers represent well-defined norms. Some interesting features of the data include the fact that the average per pupil expenditure at the district level for the homebuyers in our sample is $10,018. To put this in context, average annual expenditure per pupil nationwide for the 2002-2003 school year was $8,287, suggesting that these districts spend more money to educate children in this region than nationally (U.S. Census website). Meanwhile, the average school tax rate is 0.017.[77] The average district student-to-teacher ratio, at 13.3 students per teacher, is slightly lower than the average student-to-teacher ratio in NYS during the 1999-2000 school year, which was about 15.0, or the national median in 2000-2001, which was 16.0.[78] The percentage of graduates continuing on to four year colleges in our sample is 50.4%; the highest NYS average percentage recorded in the 2001 – 2005 period at the public school level is 52.9%, again suggesting homebuyers in this region have, on average, chosen districts that are relatively comparable to statewide norms. As the table in **Appendix F** shows, high school graduates in the four counties in our sample are about as likely as graduates

[77] Which seems to be a standard taxation rate, though no firm national or statewide averages have been located.

[78] Taken from the NCES on April 15, 2007 at http://nces.ed.gov/pubs2001/overview/table06.asp and http://nces.ed.gov/pubs2002/overview/table6.asp

statewide to continue on to some form of college. Therefore, though we note that this region captures many unique features, the summary statistics of public education means are fairly typical.

After experimenting with multiple educational variables, I have chosen to create three main indices by which school districts are measured. One index is *%_Regdipl*, where the numerator is the number of students who attained a Regents diploma and the denominator is the number of students who received high school diplomas,[79] as shown in equation *(1)*.

$$(1) \qquad \%\_Regdipl = \frac{\text{\# of Students Graduating with Regents Diplomas}}{\text{\# of Students Graduating with District's High School Diploma}}$$

The *%_Regdipl* variable is meant to capture the *absolute* component of educational quality. Regents diplomas are earned if a student receives above 65% in the English, Math A, Global History and Geography, U.S. History and Government, and Biology exams. Regents diplomas are not required by state law, but are looked upon favorably by future employers. Opportunities to obtain a Regents diploma are available in most public educational programs in NYS, including the districts in our sample. For perspective homebuyers, the Regents Diploma graduation rate presents intuitive number that allows for easy comparison across districts. The *%_Regdipl* variable captures both the extent to which district education has enabled students to meet statewide standards (the numerator), and the rigor of local district standards (the denominator).[80] Given the legibility and widespread availability of the *%_Regdipl* index, it is not surprising that it fits the data well.

The second principle measure used in our models describes the percentage of high achieving fourth graders at the district level. Recall that all fourth graders in New York school

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[79] The choice of graduates for the denominator, rather than graduates plus dropouts, is driven by data limitations. Possibly due to uncertainty (whether students have dropped out or simply moved away), the number of dropouts has been omitted from many districts in our sample. To the extent that certain districts may have effectively encouraged weaker students to drop out, *%_Regdipl* is likely an upward biased estimate of the true percentage of students who have attained state recognized levels of educational attainment. For reference, estimates indicate that about 5.7% of students dropped out of high school statewide during the 2001-2002 school year. (NYS Kids' Well-Being Indicators Clearinghouse)

[80] In other words, districts will fare well by this index if they: (a) have a number of students who qualify for Regents diplomas (numerator) and (b) have a relatively low number of students who do *not* qualify for Regents diplomas to whom they still grant high school diplomas (denominator).

districts take standardized exams in English and math, and that a district's percentage of students scoring in the state-defined highest performance bracket is *perc_l4_4e* and *perc_l4_4m*, respectively. Our composite measure, *Avg_per_l4*, is simply the average of these two percentages. We note that the correlation between *%_Regdipl* and *Avg_per_l4* is 0.4172; though positive, this low correlation suggests that parents concerned with educational quality throughout grade school would do well to consider school district quality at both the primary and secondary level.[81]

The third main index is *SD_Regsdipl*, which has been calculated to proxy the positional good aspect, or *relative* component, of educational quality. We recognize that there are many possible ways to capture the positional good aspect of educational quality, and future research ought to consider alternative specifications in addition to the one we have created. The variable specification process is as follows: first, the road-distance between each parcel's assigned school district and all other districts in NYS was calculated using ArcGIS. Employing a cut-off of 25 road-miles, we then created a "relevant universe" for each school district in our sample. *SD_Regsdipl* reflects the number of standard deviations each district is above or below the mean of its relevant universe. Equation *(2)* shows the formula for calculating *SD_Regsdipl* for district i in relevant universe j, where σ_j is one standard deviation from μ_j, the relevant universe *%_Regdipl* mean.

$$SD\_Regsdipl_i = \frac{\%\_Regdipl_i - \mu_j}{\sigma_j} \tag{2}$$

Figure 7 illustrates an example of how *SD_Regsdipl* is calculated for each district. The blue outline delineates the perimeter of the districts located in **District A**'s "relevant universe," which includes **District A** itself. The mean of *%_Regdipl* for this relevant universe is 60, and the standard deviation is approximately 14.4. Since the **District A**'s mean is 80, this implies that the

[81] Though districts that are high performers at the primary level are more likely to be high performers at the secondary level, the low correlation suggests both measures should enter our regressions. That is to say, to the extent that parents care about both primary and secondary school quality, it will be necessary for them to consider district performance at both of these levels.

percentage of Regents graduates in **District A** is 1.4 standard deviations above the mean. Therefore, **District A**'s *SD_Regsdipl* score is 1.4.

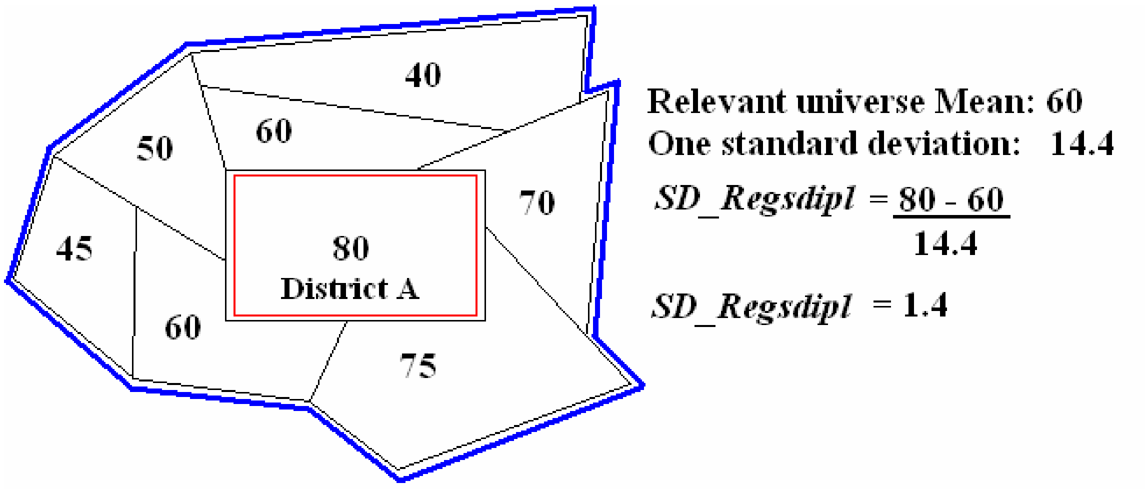

Figure 7: Demonstrating the calculation behind *SD_Regsdipl*

Intuitively, it makes sense that education may be, to some extent, a positional good. As described above, positional goods are goods that are valued largely based on their desirability in comparison to substitutes. In this case, a positional good model would suggest that homebuyers not only value the perceived educational strength of a school district, they also care about how that district ranks compared to other nearby districts.[82] By choosing a 25 road-mile cut off perimeter, the model effectively allows for a ranking of the school districts that a homebuyer could, realistically, choose to live in while still being able to commute to his place of work.[83] Incorporating this variable into our regressions yields coefficients that should be conceptualized

[82] I like to imagine this as the Garrison Keeler model: if you are buying a home in a region where "all the children are above average," you would actually place a negative valuation on being in a district that is *worst* than the others, despite its being a good performer at the state level.

[83] Ideally, we would know where each homebuyer would like to live if all school districts were identical. We would then calculate which school districts lie within a 25 road-mile radius of this location, and create "relevant universes" for each individual homebuyer. Since this is not possible, the next best solution might be to calculate relevant universes based on each individual parcel location. If it were the case that all homeowners' preferred living locations were randomly distributed around their actual locations, errors incurred by this approximation would be biased toward zero for the sample as a whole, and these results would likely reflect the school district cost-benefit decision that each homeowner made when choosing to purchase their parcel. However, given the enormity of computer processing that a parcel-centric model would entail, we must compromise one last time and calculate relevant universes for each school district. It is an appropriate trade-off to calculate the standard deviations at the district level.

as the economic value a marginal homebuyer attributes to buying property in a district that is *relatively* better than the other districts that, conceivably, he could have also chosen. **Figure 8** illustrates the "relevant universe" for Indian Lake Central School District. The inner orange reflects the area that is within the district, while the blue represents the outermost fringes of the district's relevant universe. The perimeter lies 25 road-miles away from the Indian Lake Central School District boundary.

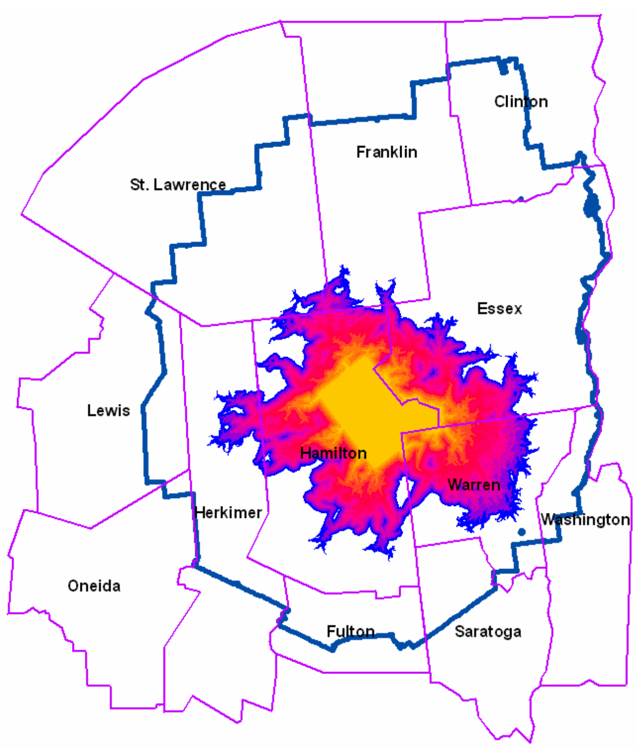

FIGURE 8: Map of Adirondack Park depicting the
Defined "relevant universe" for parcels located in Indian Lake Central School District

Although we test for result sensitivity using various combinations of the education variables as indicators of school quality, we realize that, given the breadth of school quality determinants, these particular indicator choices may appear subjective. Recall, however, that our motivation for determining each district's educational quality is to determine how much value the marginal homebuyer is willing to pay for quantities of that variable, given the other variables included in the regression. It is important to note, then, that homebuyers do not have complete information regarding the school districts they are evaluating, and therefore must rely on the public information that is readily available and easily interpretable. Therefore, buyers will likely rely on the same public information that we have access to for this research: standardized test scores, Regents diploma rates, perceived school quality relative to nearby districts, student-to-teacher ratios, per pupil expenditure and real school tax rates. Lastly, statistical significance and post-estimation tests justify the inclusion of these variables in our models. Therefore, though our educational quality estimates may not be perfect indicators, they do correlate highly with measures evaluated by home purchasers.

HOUSING PRICE INDEX DATA

All regressions account for variations in the price level by incorporating sale year variables, thereby generating a price level that is internal to the hedonic model. For ease of descriptive legibility, however, all dollar values stated in estimates and summary statistics have been converted into 2002 dollars using Office of Federal Housing Enterprise Oversight (OFHEO) data. The Office of Federal Housing Enterprise Oversight provides quarterly price indexes for single family homes in New York State. This index is a weighted, repeat-sales index, so the data it uses are based on average price changes of repeatedly sold or refinanced properties. For summary statistics, we standardized all of the data into an index where the average annual price level for 2002 is the basis. To clarify, the decision to standardize all prices was motivated by the need for dollar values to be intuitively comparable for all summary statistics. Year dummies are included in all significant regressions to account for time-fixed effects, allowing the unaltered versions of all price data to enter the regressions.

IV. MODEL SPECIFICATION

My basic model assumes that housing sales in the four relevant counties reflect the market values of the parcels' housing, land, neighborhood and public service attributes (Brasington and Haurin, 2006; Rosen, 1974). Following the standard empirical housing price hedonic function, my main regressions will take the form:

$$\ln P_i = \beta_X \ln X_i + \beta_N \ln N_i + \beta_R R_i + \beta_E \ln E_i + \beta_T \ln\left(1 - \frac{t_i}{r}\right) + \varepsilon_i$$

where:

$\ln P_i$	=	The natural logarithm of house sale price for the *i*-th household.
$\ln X_i$	=	The natural logarithm of the housing and land characteristics for the *i*-th household at time of sale.
$\ln N_i$	=	The natural logarithm of the neighborhood characteristics for the *i*-th house.
R_i	=	The binary variable for the homebuyer's residency status.
$\ln E_i$	=	The natural logarithm of the educational characteristics for the school district(s) associated with the *i*-th household in the year prior to the sale.
$\ln\left(1 - \frac{t_i}{r}\right)$	=	The natural logarithm of one minus the school property tax rate associated with the school district-municipality combination of the *i*-th household in the year prior to the sale divided by discount rate *r*.[84][85]

[84] This tax rate is the same for all homes in the same municipality-district level; that is, it is the school property tax rate that a property owner faces prior to any exemptions or deductions. Thus, it is the equalized tax rate and not the pure tax rate. Because the rate does not include exemptions or deductions, expectations aside, we see that we have incorporated the maximum rate that each homebuyer would face. Therefore, since the true cost of education is likely to be less for many homebuyers, we can expect that our estimation of the value of education is likely to be biased downward.

[85] We set $r = .05$ for all parcels in the sample. As discussed in the **Capitalization** section, actual discount rates may be heterogeneous across parcels.

All coefficient vectors are interpreted as the percent increase in house value associated with a percent increase[86] of the relevant characteristic.

Candidates for measures of X_i include number of bedrooms, number of bathrooms, number of fireplaces, the square foot living area, the capped measure of property acres, the waterfront indicator variable, and the age of the home. Candidates for measures of N_i include characteristics at the house, census block group, municipality, census tract, and county levels. Census block group and census tract data are taken from Census 2000 information for all households, regardless of sale year. The main neighborhood variable candidates are the Adirondacks indicator variable, the percentage of non-whites, the percentage of males, the percentage of individuals under 21, the percentage of senior citizens, the percentage of individuals living at the poverty level, as well as municipality and county dummy variables. Time fixed effects in the form of the sale year are included in all regressions unless otherwise indicated.

As supported by the majority of previous literature in these fields, and as discussed above, I will use standard examination performance as the main indicator of school quality. The applicability of my research to determinations about the value of educational quality, then, is dependent on the assumption that examinations are a good proxy for a large component of school quality, both in reality and in the eyes of home purchasers. This has been well justified in previous literature, and is now widely assumed in the field. In addition, findings that parents base quality judgments on factors largely correlated with test scores are supportive of this method, since our actual goal is not to estimate what makes education valuable, but to estimate how homebuyers perceive education to be valuable (Hoxby, 1998). Therefore, to the extent that the data available here is generally the data referenced by future homebuyers, it is an accurate measure for our purposes. To clarify, the reader ought to be aware that my estimation of the economic value of higher test scores is actually an estimation of the value of benefits that are

[86] In the case of binary or dummy variables, the coefficients should be interpreted as the percent increase associated with that variable. For example, consider the simple regression $\ln P_i = \beta_W W_i + \varepsilon_i$, where $W_i = 1$ implies a household has waterfront and $W_i = 0$ implies that it does not. In this case, $\beta_W = .80$ suggests that a household with waterfront is associated with sales prices that are 80% higher than homes without.

perceived by homebuyers to be strongly correlated with higher test scores, lower student-to-teacher ratios and higher per pupil expenditures, given their known school tax bills. Further, these estimations will be supported by statistically significant coefficients on each index. Therefore, candidates for measures of E_i include student-to-teacher ratios, per pupil expenditures, grade 4 and 8 English and math scores, the absolute measure of percent Regents diplomas (*%_Regdipl*) and the relative measure (*SD_Regsdipl*).

Since the cost of education (the school district property tax rate) is accounted for, we see that when estimating the value homebuyers place on educational inputs and outputs, we are estimating the *net* value capitalized into home prices given a discrete combination of student-teacher ratios, per pupil expenditures, test scores, and absolute and relative measures of the Regents graduation rate. Thus, in cost-benefit analysis terms, we see that the homebuyer is not making a decision between increased quality and per pupil expenditure, but instead between increased quality and school district property tax rates (Crone, 2006).[87] Lastly, note that each characteristic's coefficient estimates the present value increase associated with a percent increase of that characteristic *given* the other characteristics in the regression. In the **Results** section below, we will discuss how our interpretation of specific coefficients contained in regressions will differ based on the combination of variables for which each regression controls. For now, **Table 15** provides the preliminary intuition behind expected coefficients signs.

[87] That is, the coefficients on the education variables in our regressions ought to be conceptualized as the effect on house price of changes in school characteristics holding tax rates constant, but the homebuyer who faces various school quality-school tax rate combinations will consider the net value of (or tradeoff between) educational quality and school property tax rates.

TABLE 15: EXPECTED REGRESSION SIGNS AND RATIONALE

COEFFICIENT	SIGN	RATIONALE
Star	+	Being a resident implies decreased taxes and, in large non-resident communities, increased subsidization of local public goods
tot_waterfront	+	*Ceteris paribus*, proximity to waterfront is an asset
ln_sfla	+	Large homes are worth more than small homes
ln_nbr_bedrooms	–	Given a set square foot living area, increasing the number of bedrooms makes a house less luxurious and implies that bedroom size is smaller
ln_nbr_stories	+	More stories reflects a potentially more sophisticated style of dwelling; all else equal, homes are more likely to be heat efficient if their area is stacked vertically (ie: majority of heat escapes through roof)
ln_age	+/–	Older homes have character and history that many people value; old age may be a proxy for construction and material durability / Newer houses have undergone less depreciation and require less maintenance
ln_acres_capped	+	More land is an asset
adks	+/–	The ADKS provide a beautiful setting that is fiercely protected by the APA / ADKS are remote, far from many modern conveniences, and property owners are heavily restrained by the APA from improving their property
ln_stu_teach_ratio	+/–	On the range examined, increased students per teacher may imply increased positive externalities due to peer effects, increased diversity, and increased competition; reflects indivisibilites / Increasing students per teacher is conventionally thought to be a negative educational influence
ln_ppexp	+/–	Note that this coefficient reflects the effects of an increase in per pupil expenditure while keeping our measures of other educational inputs and outputs constant and without increasing the tax rate. More per pupil expenditure may go toward programs like music, art or athletics that are not reflected in regents performance / increased *PPExp* without increases measured school inputs or school outputs (such as *%Regents* graduates) suggests increased school district inefficiency. Alternatively, if all measures of educational costs and benefits could be captured by the model, we might expect buyer indifference to ineffectual increases in per pupil spending

TABLE 15: EXPECTED REGRESSION SIGNS AND RATIONALE (CONTINUED)

COEFFICIENT	SIGN	RATIONALE
ln_%regdipl	+	Increased percentages of the senior class graduating with regents diplomas reflects better quality school districts
ln_ Avg_per_l4	+	Increased percentages high performers in forth grade English and math exams reflects better quality school districts
sd_regsdip	+	Living in a school district that is better than nearby districts is valued: school quality is a positional good
Star ln_%RegDipl*	+	Interaction of residency and *ln_%RegDipl* reflects the degree to which residents value *absolute* school quality more than non-residents. Given that residents have more to benefit from absolute increases in school quality, lack of one unified market or lack of purely rational economic actors would imply that this number should be positive
*Star*RegentsSD*	+	Interaction of residency and regents diplomas SD reflects the degree to which residents value *relative* school quality more than non-residents. Given that residents have more to benefit from increases in relative school quality, lack of one unified market or lack of purely rational economic actors would imply that this number should be positive
$\ln\left(1-\frac{t_i}{r}\right)$	+	Higher tax rates without increased benefits are clearly perceived as bad: since we are taking the log of 1 minus the tax rate divided by the discount rate, this means that we expect the coefficient to be negative
pct_non_white	+/–	Increased diversity is valued by many individuals / Traditionally, biases tend to make whites (the vast majority of homebuyers in our sample) prefer to live near other whites; may be correlated with other unobserved neighborhood characteristics
pct_male	+/–	This would depend on the range examined: too few or too many males are likely to be a negative for a perspective homebuyer. Given that the mean percentage male of neighborhoods in our sample is 49.3%, we might expect the net effect to be that neighborhood gender ratios are not capitalized into home values
pct_21_and_under	+/–	Given that expenses associated with increased youth are, to some degree, accounted for, the marginal homebuyer could either enjoy or dislike increases in the percentage of the population that is 21 and under

Augmenting the standard hedonic regression to control for levels of public service, neighborhood effects and schooling differences has brought economists toward clearer and less biased estimations of the value of public education. The intricacies of regional characteristics in the Adirondacks offer a different view into educational capitalization than previous studies have offered. Though my research, like that of Bogart and Cromwell (1997), does not currently control sufficiently for neighborhood effects, non-school taxation or levels of public service, the inclusion of town dummies ought to absorb much of the unaccounted for variation due to these differences. The innovations of allowing for increased resident valuation of education and accounting for the positional good aspects of education are incorporated into the more complex versions of the model. This research is a beginning step toward using residency status as an identifying strategy, toward determining the value of local public education in this remote region, and toward developing measures that incorporate both the absolute and the relative nature of education valuation.

V. RESULTS

We run seven sets of regressions. The regressions begin with minimum specifications and systematically increase in complexity to incorporate the appropriate breadth of available parcel, neighborhood and education characteristics data. This is done both to illustrate the model specification process and to aid in developing an intuition behind the expected valuations of the variables. While this section will walk the interested reader through al the models, the ultimate results are synthesized in **Tables 21** and **23**. Throughout, we highlight statistically significant coefficients whose sign is the opposite of what may have been expected. We take time before and after each model to discuss interpretations and summarize the ways in which we conceptualize these implications.

Our first set of regressions is quite basic and only includes parcel characteristic variables. As shown in **Table 16**, regression **(2)**, we find that 42% of the variation in the data can be accounted for using three variables - waterfront, square foot living area, and the residency indicator - in addition to time fixed effects. We note that the signs of the coefficients in our first three regressions are as predicted: being on the waterfront nearly doubles a property's value, doubling the square foot living area of a house nearly doubles value, and increasing the number of bedrooms, while holding interior footage constant, decreases value.

The residency indicator is positive and significant, suggesting that, *ceteris paribus*, homebuyers planning to use their property as their main residence pay more.[88] Since this result remains in later models, even once various location, parcel, housing, school district and neighborhood characteristics are accounting for, we will pause to address the implications of the positive, statistically significant coefficient on STAR.. The most obvious explanation is that homes owned by residents and homes owned by non-residents exist in separate markets, and thus the positive coefficient is capturing intrinsic differences between the two markets, or simply capturing the fact that the marginal buyers in the two markets value their parcels and adjoining benefits differently. As discussed above, however, data from duplicate sales suggest that homes in our sample are not clearly divided into two markets along residency lines. Further, with the

[88] A model showing log of house price regressed on only *STAR* can be found in **Appendix G**. The coefficient on STAR without other controls is 0.0913, which is significant at the 1% level.

exception of school tax rates, the resident and non-resident means of all observed variables are not statistically different, further strengthening the evidence that these homes sell exist in a single market (**Appendix C**). If we believe that resident and non-resident homes exist in unified market, the finding of a statistically significant coefficient on *STAR* is contrary to expectations: traditional economic theory would attest that if the marginal homebuyer is a resident then valuations capitalized by the marginal resident would be capitalized into *all* homes. Since resident and non-resident homes appear to exist in a unified market, it is likely the case that information asymmetries and thinly traded markets allow for heterogeneous homebuyers to have varying degrees of bargaining power. To the extent that residency status captures consistent differences between two groups of heterogeneous buyers, positive residency status capitalization reflects the fact that residents tend to have a lesser degree of bargaining power.

Given that residents appear to have less overall bargaining leverage when purchasing homes, how much do residents effectively capitalize their residency into home values, and why? The result that resident homebuyers systematically pay more for their homes once other parcel characteristics have been accounted could likely reflect a combination of higher willingness to pay and weaker bargaining power. The weaker bargaining power of residents could stem from a need to be near a place of work, other non-nuclear family members, and specific communities;[89] conceptually, we could imagine that non-resident vacation home owners may merely want a home in a particular region (such as the Adirondacks) and are quite indifferent between locations once waterfront, mountains and other locational amenities are accounted for. This difference is then reflected in differing demand elasticities, which allows for weaker resident bargaining power.

Increased willingness to pay, coupled with weaker bargaining power and the uncertainties of a thin market, would further accentuate systematic valuation differences between resident and non-resident sales. This increased willingness to pay, following Anderson's (2006) findings, could reflect residents' capitalization of the extent to which expected future benefits will be

[89] Or from their increased valuation of educational quality. Decreased resident bargaining power due to high school quality is discussed below, where its effect is separated out from overall *STAR* in the interaction model.

subsidized by non-residents.[90] Increased willingness to pay may also arise from lower expected property taxes; at the average home price of $160,000, the *Star* coefficient of 0.015 implies that a resident would be willing to pay $2,400 more for a home at the margin. The STAR tax exemption benefits only residents; at the mean home price of $160,000 and the mean school tax rate of 0.0174, a resident would expect to pay $521 less in school taxes than a non-resident. The capitalization rate of 0.015 implies that a resident capitalizes their residency into home prices at an annualized value of $120.[91] These numbers would suggest that about a quarter of the residency capitalization could be attributable to the STAR school tax exemption. Before we can fully interpret these results, we need to include other variables that will absorb more variation of the data, particularly systematic variation.

[90] It would be interesting, here, to calculate the percentage of each municipality that is non-resident, and then create a star x % non-resident interaction variable. This would create a variation on Anderson's price elasticity of demand for local public services; if positive, it would suggest that individuals capitalize residency into home prices even *more* when they expect a higher degree of non-resident subsidies to exist.

[91] Using a depreciation rate of 5%.

Table 16: Effects of Housing Characteristics and Adirondack Location On the Natural Logarithm of Housing Prices

COEFFICIENT	(1)	(2)	(3)	(4)	(5)	(6)
tot_waterfront	0.662***	0.734***	0.731***	0.743***	0.827***	0.816***
	(0.019)	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)
ln_sfla	0.914***	0.895***	0.935***	0.942***	0.913***	0.906***
	(0.010)	(0.0097)	(0.013)	(0.013)	(0.012)	(0.012)
STAR	0.0510***	0.0541***	0.0558***	0.0344***	-0.0241***	-0.0324***
	(0.0088)	(0.0083)	(0.0083)	(0.0083)	(0.0085)	(0.0084)
ln_nbr_bedrooms			-0.0799***	-0.0702***	-0.0902***	-0.0862***
			(0.016)	(0.016)	(0.016)	(0.016)
ln_acres_capped				-0.0291***	-0.0249***	0.000124
				(0.0016)	(0.0016)	(0.0020)
Adks					-0.236***	-0.236***
					(0.0096)	(0.0095)
acres_capped Dummy						-0.287***
						(0.014)
Constant	5.190***	4.846***	4.639***	4.695***	5.049***	5.117***
	(0.076)	(0.073)	(0.085)	(0.084)	(0.084)	(0.083)
Year Dummies	No	Yes	Yes	Yes	Yes	
Observations	18182	18182	18182	18182	18182	18182
R-squared	0.33	0.42	0.42	0.43	0.45	0.46

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Examining regressions **(4)** and **(5)** in **Table 16**, we note that the signs of the acres variable and Adirondack indicator variable are not necessarily what was expected. Examination of the data suggests that the negative capitalization of increased acres is due to the fact that many of the large parcels are either used for farming or foresting, suggesting that this coefficient is revealing a link between large acreage properties and municipalities that are less wealthy. In regression **(6)** we account for the parcels whose acreage variables were truncated, which absorbs the negative, statistically significant coefficient on *acres*, but does not render that new, positive coefficient statistically significant. The negative coefficient on *Adks* is likely capturing the fact that the Adirondacks, on average, are farther from modern conveniences and often lack the public services that benefit out-of-park residences. Further, the addition of the Adirondack indicator variable renders the coefficient on *Star* negative, suggesting that, once we account for whether or not a parcel is located in the Park, residents actually pay less for their homes. As more locational dummy variables enter the regression, however, the sign of the *Star* coefficient changes yet again, suggesting that (non-)resident house prices may vary systematically across town or county boundaries. This may reflect varying amenities, attitudes and policies that affect residents differently than non-residents across these government lines. Once we have accounted for location dummy variables and neighborhood characteristics in **Table 17**, we see that the *acres*, *Adks* and *STAR* effects all have more intuitive, significant coefficients.

After considering the various other candidates for measures of X_i, our second set of models displays regressions that more thoroughly capture housing characteristics and valuation due to parcel location. By including county and town dummy variables, we are able to incorporate the net economic valuation of location and unmeasured public service benefits. As shown in **Table 17**, specifically in regression **(4)**, the addition of these location dummies has returned most coefficients to their expected sign.

Table 17: Effects of Housing and Location Characteristics On the Natural Logarithm of Housing Prices

COEFFICIENT	(1)	(2)	(3)	(4)
tot_waterfront	0.824***	0.822***	0.799***	0.807***
	(0.017)	(0.017)	(0.017)	(0.016)
ln_sfla	0.932***	0.955***	0.924***	0.788***
	(0.013)	(0.014)	(0.014)	(0.013)
STAR	-0.0234***	-0.0257***	-0.0362***	0.0145*
	(0.0085)	(0.0085)	(0.0084)	(0.0082)
ln_nbr_bedrooms	-0.101***	-0.0983***	-0.104***	-0.0366**
	(0.016)	(0.016)	(0.016)	(0.014)
ln_acres_capped	-0.0243***	-0.0252***	0.00593*	0.0347***
	(0.0016)	(0.0016)	(0.0035)	(0.0035)
Adks	-0.238***	-0.240***	-0.0741***	0.197***
	(0.0096)	(0.0096)	(0.013)	(0.027)
ln_age	0.00606***	0.00602***	0.00859***	0.0125***
	(0.0012)	(0.0012)	(0.0012)	(0.0011)
ln_nbr_stories		-0.0621***	-0.0412***	-0.00318
		(0.013)	(0.013)	(0.012)
Essex County			-0.155***	
			(0.028)	
Hamilton County			(Dropped)	
Saratoga County			0.202***	
			(0.029)	
Warren County			-0.0876***	
			(0.031)	
Constant	4.907***	4.767***	4.893***	4.651***
	(0.088)	(0.093)	(0.098)	(0.23)
Year Dummies	Yes	Yes	Yes	Yes
Town Dummies	No	No	No	Yes
Observations	18182	18182	18182	18182
R-squared	0.45	0.45	0.46	0.57

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The most consistently highlighted result is the house age coefficient. Generally, previous studies have found house age to be negatively capitalized into home values.[92] However, others, such as Bogart and Cromwell (2000) and Brasington and Haurin[93] (2007), have found age to be positively associated with house prices. As described in **Table 15**, if older houses in our sample

[92] For example, Crone (2006) and Kane et al. (1995), to name only two.
[93] Specifically, Brasington and Haurin (2007) find the coefficient on house age to be positive and statistically significant in their Cincinnati, Cleveland, Dayton and Toledo samples.

have more character, embody greater degrees of workmanship, or are valued for authenticity or historical reasons, and if these benefits are not outweighed by trends that imply that younger houses are built more efficiently or require less maintenance, then to the extent that these characteristics are not captured by the model we would actually expect the coefficient on age to be positive. Given the presence of older, well-respected Adirondack camps and classic Victorian Saratogian homes in our sample, the positive age coefficient is not shocking. Due to the consistency of the result, we will cease to highlight positive age coefficients in future regression tables.

The finding that number of stories is negatively capitalized may reflect the fact that retirees view increased stories as a disadvantage, while other homebuyers are largely indifferent, creating more demand for single story homes. This is, perhaps, the most difficult story to tell, since heat and land efficiency argue for the increased value of multiple story dwellings. However, the significance of this variable fades once location dummies are accounted for and, once it no longer passes Chi-squared inclusion tests, it is removed from future regressions.

As expected, inclusion of location dummies leads to more logical findings: increased acreage and Adirondack location are positively and significantly capitalized. Specifically, these coefficients suggest that, once local public amenities at the county, and eventually the town, level are accounted for, a house lying within the Adirondack Park would be valued nearly 20% more than a house located outside of the blue line.[94] The intuition behind this valuation is that, once individuals have chosen a property that suits them, they actually value tight land use and zoning legislation, since these restrictions imply that the forests/rivers/lakes/views that surround them are likely to remain "forever"[95] unchanged.

Building upon **Table 17**, regression **(4)**, we remove *ln_nbr_stories* and then consider candidates for neighborhood characteristics. The percent of block group individuals that are not white and the percent that are aged 21 and under contribute to the subsequent models, as shown in **Table 18**. Though a neighborhood's racial composition is not initially significant, once percentage of youth is taken into account, a higher percentages of white individuals in a

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[94] Since no towns cross county boundaries, we omit counties from the regression once we account for each parcel's town.
[95] "Forever wild" is one of the official APA slogans.

neighborhood is associated with increased house prices. During the specification process we included other neighborhood variable candidates such as the percentage of males, the percentage of senior citizens and the percentage of individuals living under the poverty level. Percentage of males entered the equations with a significant, positive coefficient, but was removed as explained in the footnote.[96] The percentage of senior citizens was not statistically significant in any of the trial combinations of neighborhood candidates. Ultimately, the percentage of individuals living under the poverty level was omitted from the model because it is directly related to neighborhood income, and therefore absorbs nearly all of the variation due to various housing characteristics. For future research, it would be convenient to identify alternative means of measuring a neighborhood's level of social maladies that are not so closely related to income, such as the crime rate or the teen pregnancy rate.

[96] This finding suggests, perhaps, a large, state, maximum-security all-female prison is dragging down real estate prices in some municipality and subsequently biasing our results. To my knowledge, however, there are not any. Another possibility would be that communities with a large percentage of women are actually representing older communities where widows are more prevalent and the economy is stagnating. Inclusion of block group data representing the percentage of senior citizens is not statistically significant and does not change the gender coefficient, refuting this possibility. After applying Hadi's (1992, 1994) test, we found that 244 parcels in our sample contained gender percentages that were outliers. Temporarily removing these parcels from the regression, we found that gender percentages and percentage of senior citizens remained statistically insignificant. Given that the gender mean of the sub-sample was essentially unchanged (see **Appendix H**) and that no combination of variables explained the apparent capitalization of males in the full sample, we have chosen to retain the full sample and exclude percentage of males from the model.

Table 18: Effects of Housing and Neighborhood Characteristics On the Natural Logarithm of Housing Prices

COEFFICIENT	(1)	(2)	(3)
tot_waterfront	0.798***	0.797***	0.794***
	(0.016)	(0.016)	(0.016)
ln_sfla	0.797***	0.796***	0.795***
	(0.012)	(0.012)	(0.012)
STAR	0.0145*	0.0148*	0.0152*
	(0.0082)	(0.0082)	(0.0082)
ln_nbr_bedrooms	-0.0464***	-0.0467***	-0.0446***
	(0.014)	(0.014)	(0.014)
ln_acres_capped	0.0459***	0.0461***	0.0469***
	(0.0035)	(0.0035)	(0.0036)
Adks	0.224***	0.223***	0.212***
	(0.027)	(0.027)	(0.027)
ln_age	0.0121***	0.0121***	0.0119***
	(0.0011)	(0.0011)	(0.0011)
pctnw		-0.00106	-0.00175***
		(0.00065)	(0.00067)
pct_21_and_under			-0.00362***
			(0.00085)
Constant	4.566***	4.572***	4.680***
	(0.23)	(0.23)	(0.23)
Year Dummies	Yes	Yes	Yes
Town Dummies	Yes	Yes	Yes
Acreage Capped Dummies	Yes	Yes	Yes
Observations	18182	18182	18182
R-squared	0.58	0.58	0.58

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Before continuing onward, we re-consider the regression **(3)** of **Table 18** by running the regression on the sub-samples of residents and non-residents. We use Chebyshev's rule to estimate whether or not the subsequent coefficients of the two sub-samples are statistically different at least 3.6% of the time. We find that most of the differences between the coefficients are statistically insignificant at that level. The three exceptions are *tot_waterfront*, *Adks* and *ln_age*, all of which non-residents capitalize more. The subsequent table can be found in **Appendix I**. These findings suggest that, while we are not unjustified in our decision to include residents and non-residents in a unified model, there is a possibility that search costs, locational needs, time restraints, and other intrinsic differences between residents and non-residents allow for systematically different degrees of bargaining power between these two groups when considering different variables. Therefore, we continue to incorporate both residents and non-residents into the model.

Next, we account for school districts. If no educational data were available to us, we could calculate the value of "good" school districts by simply adding school district dummy variables to our regression. To the extent that "good" school districts coincide with areas that tend to provide all-round spectacular public service, or to the extent that these areas are populated by super-conscientious citizens, our education valuation estimates would be biased upwards.[97] Furthermore, this methodology would not help to clarify *which* inputs and *which* outputs homebuyers capitalize. The use of this oversimplified model and the subsequent imprecision of education estimates comprise the essential shortcomings of Bogart and Cromwell (1997). Using our data and again recalling the mean house price of roughly $160,000, the district-dummy model suggests that, at the margin, homebuyers would chip in an extra $58,080 to be in the "best district"[98] rather than be in the median district, or $388,000 to move from the worst district to the best district. Annualized at a rate of 5%, these valuations translate to yearly values of $2,904 and $19,400, respectively, lying far beyond even Bogart and Cromwell's (1997) generous range.[99] Interestingly, these numbers are still reasonable if we consider that parents in the Saratoga region often choose send their children to private schools with even higher price tags. For example, Emma Willard School, a private all-girls high school in Troy, NY, matriculates many girls from Saratoga County, whose parents pay over $22,000 annually in tuition.[100] Adding up the cost of privately educating two children from kindergarten through twelfth grade is likely to come close to the best-district-to-worst-district capitalization of $388,000. Thus, though this model does not help us toward our goal of understanding *how* education is valued, it does put upper limits on the

[97] And similarly, to the extent that "bad" districts represent areas that are all-round just plain bad, our estimation of the negative impact of "bad" districts would be biased downward (away from zero).
[98] Which happens to be Ausable Valley Central School District, for all you eager parents.
[99] Bogart and Cromwell (1997) estimated that the value of being in a "good" district rather than a "bad" district ranged from $209 to $2,403.
[100] Emma Willard School website as of April 17, 2007 at http://www.emmawillard.org/admissions/discover/index.php

value of school district improvement. The underlying regression can be found in **Table 19** located in **Appendix J**.

Instead, we build a model that incorporates each district's average percentage of high performers at the fourth grade level, percentage of Regent's diploma graduates, student-to-teacher ratio and effective tax rate. These models are below in **Table 20**.

Table 20: The Effects of Housing, Neighborhood and Education Characteristics On the Natural Logarithm of Housing Prices

COEFFICIENT	(1)	(2)	(3)	(4)
tot_waterfront	0.798***	0.786***	0.778***	0.781***
	(0.016)	(0.017)	(0.017)	(0.017)
ln_sfla	0.793***	0.789***	0.785***	0.784***
	(0.012)	(0.013)	(0.013)	(0.013)
STAR	0.0144*	0.0131	0.0165*	0.0148*
	(0.0082)	(0.0089)	(0.0089)	(0.0089)
ln_nbr_bedrooms	-0.0433***	-0.0233	-0.0214	-0.0209
	(0.014)	(0.015)	(0.015)	(0.015)
ln_acres_capped	0.0464***	0.0495***	0.0506***	0.0503***
	(0.0035)	(0.0038)	(0.0038)	(0.0038)
Adks	0.220***	0.211***	0.154***	0.183***
	(0.027)	(0.028)	(0.028)	(0.029)
ln_age	0.0121***	0.0149***	0.0152***	0.0154***
	(0.0011)	(0.0012)	(0.0012)	(0.0012)
pctnw	-0.00189***	-0.00164**	-0.00148**	-0.00156**
	(0.00067)	(0.00073)	(0.00073)	(0.00073)
pct_21_and_under	-0.00367***	-0.00335***	-0.00300***	-0.00317***
	(0.00084)	(0.00090)	(0.00090)	(0.00090)
ln_%Regdipl	0.0913***	0.0949***	0.0818***	0.0576***
	(0.014)	(0.014)	(0.014)	(0.015)
ln_Avg_per_L4		0.00668**	0.00604**	0.00512*
		(0.0027)	(0.0027)	(0.0027)
$\ln\left(1-\frac{t_i}{.05}\right)$			0.556***	0.616***
			(0.059)	(0.061)
ln_stu_teach_ratio				0.283***
				(0.065)
Constant	5.411***	5.219***	5.371***	4.651***
	(0.23)	(0.32)	(0.32)	(0.35)
Year, Acreage Capped and Town Dummies	Yes	Yes	Yes	Yes
Observations	18142	15962	15962	15962
R-squared	0.58	0.57	0.58	0.58

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The coefficients on both the high school and primary school quality indicators are positive and statistically significant, as expected. The correlation between $\ln\left(1 - \frac{t_i}{.05}\right)$ and *ln_Avg_per_L4* is a mere -0.1818, and the correlation between tax rate and *ln_%Regdipl* is even lower at -0.0805. Interestingly, however, the addition of the tax rate variable actually slightly lowered the capitalization of both *%Regdipl* and *Avg_per_L4*. This pattern likely suggests that there is non-systematic variation between district exam scores and tax rates, as one might expect. The breakdown of education into cost-benefit components reveals that, in model **(2)**, the higher coefficients on the education components were also reflecting capitalization of low tax rates.

Defying expectations, *ln_stu_teach_ratio* enters the regression with a wildly positive and statistically significant coefficient. This result is not the effect of outliers, since these regressions (due to limited *Avg_per_L4* data) exclude all 20 Hadi-identified student-to-teacher ratio outliers.[101] Most educators believe that *lower* student-to-teacher ratios provide more effective learning environments. Recall, however, that in this sample student-to-teacher ratios range from a near-unheard of 3.5 to a standard 16.1. When common convention teaches that low student-to-teacher ratios are "a good thing," the range generally does not dip as low as 3.5, and often the upper end will extend past 40.[102] Therefore, the results suggest that the positive returns to decreased student-to-teacher ratios occur at a much higher range than the incredibly low collection in our sample. Further, the positive and significant coefficient implies that adding more students per teacher is considered beneficial. At rock-bottom student-to-teacher ratios, increasing class size is likely to increase exposure to positive peer effects, diversity and competition, and thereby provide a more rewarding educational experience. Additionally, this may be picking up the fact decreased student to teacher ratios affect economies of scale in ways that are not observed in the data, such as a lack of extra-curricular offerings, honors classes, sports teams, etc.[103]

[101] The 20 Hadi-identified outliers all lie below the student-to-teacher ratio mean; specifically, they are the parcels associated with school districts that have student-to-teacher ratios less than 3.5.
[102] Based on NYSDE data sets.
[103] Future research might include variable such as the school district enrollment to help consider this hypothesis; unfortunately, our current database only includes district enrollment for 2,771 of the parcels in our sample.

Interestingly, the extent to which the percentage of youths in a community is negatively capitalized into housing prices decreases steadily as more educational characteristics are taken into account. This trend could be interpreted as indicative of the externalities of education. In harsh terms, more children in a neighborhood may be considered a nuisance and an expense. It seems plausible that, once the nuisance level[104] and the cost level (school tax rates) are taken into consideration, higher levels of children are not quite as abhorrent to homebuyers.

The capitalization of the school tax rate variable, $\ln\left(1-\frac{t_i}{.05}\right)$, at 0.616 suggests that individuals in our sample do not fully capitalize the school tax burden. Consider the following scenario: a homebuyer, expecting to pay the mean school tax rate of 0.0174 finds out that, with all else remaining equal, he can purchase a house where the school tax rate will be 2 standard deviations lower, or 0.00767 (this is equivalent to a 0.558% drop in taxes). Given the capitalization rate in **(4)** of 0.616, we would expect the house value to increase by $11,250. If we choose to annualize this at a rate of 5%, we get an annual increased value of $563. If the marginal homebuyer had fully capitalized the school tax bill, we would instead expect home value to increase by $913.

Before we proceed, we pause to consider the educational value implications of the preceding regressions. Using the lower coefficients in regression **(4)**, we see that increasing the percentage of Regents diploma graduates from the current mean of 70% up to 95% (a 2 standard deviation increase, or a *ln_%Regdipl* increase of nearly .36) would imply a house price increase of almost 2.1%. This capitalization translates to an anticipated stream of benefits of $3,318,[105] which can be annualized to $166. If we also consider a 2 standard deviation increase in *ln_Avg_per_L4* from 25.61% to 43% (or a .67 increase in *ln_Avg_per_L4*), we see that the associated increase in house value is roughly $550. Annualized, this yields a value of $28. The combined annual economic value of a two standard deviation increase in these combined

[104] Implying that the inconveniences due to youth (perhaps anticipated as vandalism, disturbance of the peace and crime) are perceived to be inversely related to the quality of education. If this is the case, then maybe these anti-uneducated-children homebuyers have read Lochner and Moretti (2004).

[105] Unless otherwise specified, all estimations will be based off of the mean house value of $160,000 and annualized using an assumed mortgage rate of 5%.

measures of school district quality is $193. If we instead rely upon the slightly higher coefficients in regression **(2)**, we calculate an annual economic value of $309.

These results suggest that education is, perhaps, less valued by the homebuyers in our sample than by homebuyers in the more urban neighborhoods of previous studies.[106] Although these estimates lie on the low end of Bogart and Cromwell's $209 to $2,403 district valuation range, we note that the models in **Tables 16 - 20** do not account for *relative* valuation of education or for residency-education interactions, which would help to control for low non-resident educational capitalization. Therefore, we next examine two more variations on our main model: interactions between the residency variable and *ln_%Regdipl* and models that incorporate relative educational quality.[107] **Table 21** below shows two models that incorporate the residency-education interaction variable.

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[106] However, it is important to note that a two standard deviations shift in Regents diploma rates may suggest different degrees of change that the exam score changes utilized in other studies.

[107] We choose not to interact *ln_Avg_per_L4* with *STAR* because the data are not robust enough to estimate both interactions simultaneously. We focus instead on the interaction of *ln_%Regdipl* and *STAR* since, as the above models illustrated, the magnitude of the high school educational variable's capitalization is over seven times larger than the fourth grade capitalization. If we instead omit the high school interaction, we find that the interaction of the fourth grade variable and the STAR variable is positively capitalized and significant at the 1% level. These results are listed below in **Appendix K**.

Table 21: The Effects of Housing, Neighborhood and Education Characteristics On the Natural Logarithm of Housing Prices

COEFFICIENT	(1)
tot_waterfront	0.779***
	(0.017)
ln_sfla	0.784***
	(0.013)
STAR	0.0452**
	(0.019)
ln_nbr_bedrooms	-0.0206
	(0.015)
ln_acres_capped	0.0504***
	(0.0038)
Adks	0.180***
	(0.029)
ln_age	0.0154***
	(0.0012)
pctnw	-0.00153**
	(0.00073)
pct_21_and_under	-0.00311***
	(0.00090)
$\ln\left(1-\frac{t_i}{.05}\right)$	0.613***
	(0.061)
ln_stu_teach_ratio	0.278***
	(0.065)
ln_Avg_per_L4	0.00473*
	(0.0027)
ln_%Regdipl	-0.00767
	(0.039)
STAR x ln_%Regdipl	0.0701*
	(0.038)
Constant	4.590***
	(0.35)
Year, Acreage Capped and Town Dummies	Yes
Observations	15962
R-squared	0.58

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The preceding model has a slightly different interpretation from the earlier ones. The regression considers the inclusion of *STAR x ln_%Regdipl* to the model. This addition renders the sum of the coefficients of *ln_%Regdipl* and *STAR x ln_%Regdipl* the net benefit of increases in *ln_%Regdipl* to residents. Given the lack of statistical significance of *ln_%Regdipl*, we cannot reject the null hypothesis that non-residents place no value on increases in Regents diploma graduation rates. Combining the two coefficients, the results imply that residents value each percent increase of *ln_%Regdipl* at 0.06243% of home value, whereas non-residents may actually get dis-value[108] from increases in *ln_%Regdipl*. Given that the coefficient on *ln_%Regdipl* is not significant, the coefficient on *Star x ln_%Regdipl* likely indicates an upper bound on residents' valuation of increases in *ln_%Regdipl*. If the coefficient on *ln_%Regdipl* is indeed zero, then the 0.0732 coefficient on the interaction variable suggests that residents value 2 standard deviation increases in *ln_%Regdipl* up to $376 a year *more* than non-residents.

Though the magnitude of this result is not large, the significance of the difference between resident and non-resident educational valuation is important. These findings suggest that we cannot reject the null hypothesis that non-residents do not capitalize education. The difference between even the large estimates of **Table 20 (2)** and **Table 21**, marks a 21.7% increase in the valuation of a 2 standard deviation increase in Regents graduation rates. This suggests that models that do not identify non-residency in samples with significant non-resident populations yield education valuations that are biased downwards. Therefore, residency status considerations ought to be considered throughout the literature.

Before considering our last set of models, we bring the reader's attention to **Table 22**, which shows the correlations between the school quality variables. Correlations whose magnitude is greater than .7 are red. Though none of the previous models have contained education variables that are highly correlated, colinearity will be a limiting factor in the models we are about to consider. Particularly, the correlation between the absolute and relative education variables suggests that caution is apposite when interpreting the estimates. **Table 22** will be referred to in the following paragraph.

[108] Or in any event, we cannot reject the null-hypothesis that non-residents place no value on increases in Regents diploma graduation rates.

Table 22: Correlation matrix of select education variables

	ln_%regdipl	ln_SD Regdipl	ln_Avg_ Per_L4	STAR	STAR X %_Regdipl	Star x SD_regsdip	Ln(1-t/.05)	ln_PPExp	ln_Stu to Teacher
ln_%regdipl	1.000								
SD_regdipl	**0.746**	1.000							
ln_Avg_Per_L4	0.162	0.219	1.000						
STAR	0.111	0.159	0.091	1.000					
STAR X %_Regdipl	**0.713**	0.402	0.033	-0.536	1.000				
Star x SD_regsdip	0.663	**0.804**	0.182	0.326	0.404	1.000			
Ln(1-t/.05)	-0.079	-0.076	-0.173	-0.209	0.100	-0.096	1.000		
ln_PPExp	-0.143	-0.307	-0.198	-0.255	0.059	-0.313	-0.032	1.000	
ln_Stu_teach_ratio	0.342	0.423	0.301	0.286	0.064	0.435	-0.402	**-0.762**	1.000

Lastly, we consider a model that incorporates the variable designed to capture the relativity component of education: *SD_Regdipl*. To confirm, the goal of this last set of models is to test the theory that education is, to some extent, a positional good. For clarity, parcel characteristic variables that have not changed significantly from earlier models are omitted from the table, though they continue to be included in the model. In **Table 23**, regression **(2)** we see that the coefficient on *SD_Regdipl* is 0.0299, and this is significant at the 1% level. This coefficient implies that homebuyers would be willing to pay $9,568 more for a home at the margin if it were to move from a school district 1 standard deviations below the sample mean of 0.37 standard deviations to 1 standard deviation above.[109] Therefore, homebuyers place a yearly value of $478 on living in a district that is two standard deviations better[110] than the other districts in its "relevant universe." At the same time, we note that the coefficient on *ln_%Regdipl* loses its statistical significance once *SD_Regdipl* is added to the regression. Glancing back at **Table 22**, it is immediately evident that *ln_%Regdipl* and *SD_Regsdip* are highly correlated, suggesting that, geographically, school district variation of *%Regdipl* in our sample is limited.[111] This is mirrored in the high correlation rates between *ln_%Regdipl* and *Star x ln_%Regdipl* and between *SD_Regsdip* and *Star x ln_%Regdipl*. Therefore, we must be cautious to note that, given this data set, we are unable to calculate the proportional value that resident and non-resident homebuyers place on the "absolute" and "relative" components of education.

[109] In other words, the capitalization of increasing a district's relative standing from -0.63 standard deviations better than the surrounding districts to 1.37 standard deviations better.
[110] In terms of Regents graduation rates.
[111] This finding is a predicted outcome of the Tiebout equilibrium (i.e. sorting) process.

Table 23: The Effects of Housing, Neighborhood, and Absolute and Relative Education Characteristics On the Natural Logarithm of Housing Prices

COEFFICIENT[112]	(1)	(2)	(3)	(4)
tot_waterfront	0.792***	0.793***	0.791***	0.791***
	(0.016)	(0.016)	(0.016)	(0.016)
star	0.0151*	0.0151*	0.0391**	0.0193
	(0.0081)	(0.0081)	(0.016)	(0.031)
$\ln\left(1-\frac{t_i}{.05}\right)$	0.643***	0.640***	0.637***	0.637***
	(0.055)	(0.055)	(0.055)	(0.055)
ln_stu_teach_ratio	0.307***	0.270***	0.259***	0.256***
	(0.050)	(0.051)	(0.051)	(0.052)
ln_%Regdipl	0.0528***	0.0145	-0.0446	-0.00953
	(0.015)	(0.018)	(0.040)	(0.061)
SD_Regdipl		0.0299***	0.0347***	0.0240
		(0.0089)	(0.0094)	(0.017)
Star x ln_%Regdipl			0.0586*	0.0202
			(0.035)	(0.062)
Star x SD_Regdipl				0.0140
				(0.019)
Constant	4.814***	4.892***	4.892***	4.915***
	(0.26)	(0.26)	(0.26)	(0.26)
Year, Acreage Capped and Town Dummies	Yes	Yes	Yes	Yes
Observations	18142	18142	18142	18142
R-squared	0.58	0.58	0.58	0.58

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The difficulty constituted in using hedonic models to impute the economic value of absolute and relative educational quality is that these two variables are highly correlated. In our sample, most school districts with higher absolute levels of exam scores also happen to be relatively better than neighboring districts as well. Examining regressions **(3)** and **(4)** in **Table 23** reveals that our data are not sufficiently robust to estimate models that include all four combinations of relativity and interaction variables. Statistical post-estimation tests confirm the

[112] Omitted here, but included in the model, are *ln_sfla, ln_nbr_bedrooms, ln_acres_capped, adks, ln_age, pctnw*, and *pct_21_and_under*. Their signs and statistical significance remain almost entirely unchanged from the previous table.

notion that *ln_%Regdipl* is highly correlated with the relativity variable: once the relative education quality variable is included, the variance inflation factor for *ln_%Regdipl* is 32.59 and 32.59 in regressions **(3)** and **(4)**, respectively. Similarly, the variance inflation factor for *Star x ln_%Regdipl* in regression **(3)** is 38.32, and 38.32 in regression **(4)**.

Despite the fact that there is insufficient variation between school districts absolute and relative scores across our sample, it is still likely that education is perceived as a semi-positional good. Considering equation **(3)**, we see that a move from a district whose percentage of Regents graduates is 1 standard deviation below its relative universe to one that is 1 standard deviate above is capitalized at $555 annually. This valuation is in addition to the upper bound on a marginal resident's valuation of a two standard deviation increase in *ln_%Regdipl*: $186.[113] The coefficients on both *SD_Regdipl* and *Star x ln_%Regdipl* are statistically significant at the 1% and 5% level, respectively. Although these results are not conclusive, they do suggest that homebuyers consider education to be, to some degree, a positional good. Future studies are encouraged to test this hypothesis using data sets that contain less consistent variation across school district boundaries.

[113] If we incorporate the statistically insignificant coefficient on *ln_%Regdipl* of -0.0446, the resident valuation of a 2 standard deviation increase in *ln_%Regdipl* is **negative** $53, suggesting we must be cautious when interpreting these results.

VI. CONCLUSION

We have employed hedonic techniques to quantify the extent that educational quality is capitalized into housing values in and around the Adirondack Park. Using models that are roughly comparable to previous studies, we estimate that a two standard deviation increase in primary and secondary school quality translates into a private annual economic value that lies roughly between $200 and $300. While we note that a two standard deviation increase in a school quality indicator is likely to be different across studies, given previous research, this value is certainly credible. However, this finding does suggest that homebuyers in the Adirondacks do not value education quite as much as homebuyers in other studies, such as Brasington and Haurin's (2005) annual estimate of $1,820. Further research, using consistent educational quality indicators, ought to consider whether rural regions tend to capitalize education less than their more urban counterparts.

Further, we note that secondary school quality is capitalized over six times as much as primary school quality, supporting Cheshire and Sheppard's (2002) finding that high school quality is valued more than grade school quality. Per pupil expenditure coefficients were insignificant from zero in all tested regressions, and were thus omitted. The lack of significance supports Crone's suggestion that, once school quality and education's cost-to-household are accounted for, households have little incentive to value per pupil expenditure. In light of this, we also question the inclusion of per pupil expenditure throughout the literature, since any finding of per pupil expenditure significance is likely capturing unaccounted for educational quality. To reemphasize, since we do not expect that any rational economic actors would value increases is schooling expenditures without subsequent increases in educational provision, we ought to question the inclusion of per pupil expenditure in any housing hedonic models.

When we expand our model to account for the valuation of education as a positional good, we meet with mixed results. While the regressions do indicate that high school education is partially a positional good, we note that absolute and relative measures are highly correlated. Essentially, we find that there is insufficient variation between school districts in our sample to confidently estimate the degree to which educational capitalization is due to relative versus absolute school quality. In addition, the data are not sufficiently robust to simultaneously estimate the resident and non-resident marginal homebuyers' absolute and relative valuation of education. These results do little to clarify whether or not education is valued in excess of standard predictions due to a district's perceived rank. If it were the case that school districts are additionally valued due to perceptions that they are the best in their regions, then we could not rely on models in the form of Bogart and Cromwell's (1997) to praise or condemn districts. Just as Frank (2005) predicts that over-reliance on valuations driven by relativity will result in inefficient equilibrium, we would expect that reliance on Bogart and Cromwell-type models would result in over-magnification and undue emphasis of school district performances that are the best or worst in their relevant neighborhoods. Therefore, we recommend that future research examine the extent to which public education is a positional good.

Our most significant finding suggests that real and significant differences exist between resident and non-resident education capitalization. We conceptualize this finding by considering that, though resident and non-resident homes appear to be in a unified housing market, non-residents may have relatively stronger bargaining power than residents over certain housing inputs. We have shown that residents are willing to pay more than non-residents to live in school districts that are perceived to be of higher quality, and that it is quite possible that the marginal non-resident does not value increases in school quality at all. If it is the case that the marginal non-resident does not value increases in school quality, this lends empirical evidence[114] in support of the widespread disenfranchisement of non-residents. In other words, this evidence predicts that, if given the right to vote, non-residents would be likely to support significant school district budget decreases. Therefore, the moral and political implication is that, though unpleasant, non-residents must be disenfranchised to preclude disadvantaging youths in communities with significant second homeowner populations. In addition, these findings provide empirical support for Harding, Knight and Sirmans' (2003) unconfirmed suspicion that varying degrees of bargaining power do not result solely in parallel shift in the hedonic function, but can in fact arise in differing capitalizations of only some underlying characteristics.

The finding that non-residents do not capitalize education suggests that other studies that do not correct for residency status in locations with significant proportions of non-residents may

[114] And it is the first empirical evidence of which I am aware.

be calculating education estimates that are downward biased. In our sample, we found that the marginal resident's valuation of education increased at least 20% once non-residents were accounted for; in regions with smaller non-resident populations or less thinly traded markets, this increase is likely to be smaller, but may still be statistically significant. Based on this finding, we recommend that future research consider homebuyer residency status.

Lastly, on a minor note, we observe that waterfront property is consistently and significantly capitalized, suggesting that, *ceteris paribus*, waterfront homes are valued about 80% more than their non-waterfront counterparts. Though some previous research has included waterfront indicators, the inclusion of this variable is not standard in the literature. Our findings imply that housing hedonics research ought to consistently account for waterfront location.

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DATA SOURCES

Adirondack Park Agency: http://www.apa.state.ny.us/

Amherst College Office of Admissions

Bowdoin College Office of Admissions

Davidson College Office of Admissions

Digest of Educational Statistics: http://nces.ed.gov/programs/digest/

ESRI Data and Maps: http://oit.williams.edu/gis/Data_resources.htm

Essex County Office of Real Property Services

Geospatial & Statistical Data Center, University of Virginia: http://fisher.lib.virginia.edu/collections/stats/ccdb/county2000.html

Hamilton County Office of Real Property Services

National Association of Realtors: http://www.realtor.org/

National Geographic Topo™ data for NY: http://oit.williams.edu/gis/Data_resources.htm

New York State Kids' Well-being Indicators Clearinghouse (KWIC): http://www.nyskwic.org/

New York State Office of the State Comptroller: http://www.osc.state.ny.us/localgov/

New York State's Office of Real Property Services: http://www.orps.state.ny.us/

Office of Federal Housing Enterprise Oversight (OFHEO): http://www.ofheo.gov/

Saratoga County Office of Real Property Services

The Nation's Report Card: http://nationsreportcard.gov/science_2005/

The State of New York's State Education Department: http://www.emsc.nysed.gov/parents/qa7.shtml

U.S. Census, http://www.census.gov/hhes/www/housing/hvs/annual06/ann06t12.html ; http://www2.census.gov/govs/school/04f33pub.pdf

U.S. Department of Education, National Center for Education Statistics (NCES): http://nces.ed.gov/. Includes statistics from: U.S. Department of Commerce; Census Bureau; Governmental Finances Digest of Education Statistics (2005); and Organization for Economic Cooperation and Development (OECD) (2003). *Education at a Glance: OECD Indicators 2003*; OECD Education Database.

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Warren County Office of Real Property Services

Williams College Office of Admissions

APPENDIX A: ORPS instructions to assessors for recording a sale as invalid

"The following conditions should be reasons to invalidate the sale:

a. More than one parcel was included in the sale.
b. One or both parties involved in the sale were not fully aware of the present or potential purposes for which the property could be used.
c. One or both parties in the sale were acting under duress or coercion.
d. Construction and/or demolition of improvements has taken place since the sale and **these changes cannot be adequately reflected in the inventory.**
e. The sale involved related individuals or corporations.
f. The sale was a result of a liquidation of assets, a mortgage foreclosure, a tax sale, or a quit claim.
g. The sale involved a land contract: a contract given to a purchaser of real property who pays a portion of the purchase price when the contract is signed, and agrees to pay additional sums, at intervals, in the amount specified in the contract until the total purchase price is paid and the seller gives the deed.
h. The sale included an excessive amount of personal property such as equipment, vehicles, etc., and the value of these **cannot** be separated from the total price paid.

If one or more of the above conditions apply, the sale should be considered invalid. If the data collector has determined that the sale is invalid for any reason, a brief description of why it was invalidated must be written in the notes area."

Taken from: http://www.orps.state.ny.us/assessor/manuals/vol6/rfv/sect05.htm#valid

APPENDIX B: Detailed descriptions and summary statistics for the binary breakdowns of sewer, water and utilities data, land type classifications and building style characteristics.

Summary of Sewer, Water and Utilites Data Statistics

SEWER CODE DEFINITIONS This item is used to record the presence and type of sewage facilities available to site.

Sewer type 0 - This indicates that no sewer system has been recorded

Sewer type 1 - This indicates that no provision is made for the disposal of sewage on the site.

Sewer type 2 - This indicates the presence of a septic tank or cesspool on the site.

Sewer type 3 - This indicates that a sanitary sewer system is provided by a commercial company or the local

WATER CODE DEFINITIONS This item is used to record the type of water supply available to the site.

Water supply 0 - This indicates that water supply was not recorded

Water supply 1 - This indicates that no water is available for domestic use on the site. Use this code even if water is available from a neighboring site.

Water supply 2 - This indicates the water supply on the site is a well, spring, lake, river, or stream.

Water supply 3 - This indicates that a water supply from a municipal or commercial water company is connected or is readily available to the site.

UTILITIES CODE DEFINITION: This item is used to record the presence or availability of natural gas and/or electric utility services to the site. Bottled gas or a generator operated by the property owner are not considered utility services. Services are considered to be present if available to the site, even though they may not be connected.

Utilities 0 - This indicates that the sites available utilities have not been recorded

Utilities 1 - This indicates that no natural gas or electric utilities are available to the site.

Utilities 2 - This indicates natural gas service, but no electric service, is available to the site.

Utilities 3 - This indicates that electric service, but no natural gas service, is available to the site.

Utilities 4 - This indicates that public utilities make both electric and natural gas service available to the site.

Taken from the ORPS website at: http://www.orps.state.ny.us/assessor/manuals/vol6/rfv/sect06.htm

Variable	Number of Observations	Mean	Standard Deviation	Minimum value	Maximum value
Sewer type 0	18,182	0.00	0.01	0.00	1.00
Sewer type 1	18,182	0.01	0.09	0.00	1.00
Sewer type 2	18,182	0.43	0.50	0.00	1.00
Sewer type 3	18,182	0.56	0.50	0.00	1.00
Water supply 0	18,182	0.00	0.01	0.00	1.00
Water supply 1	18,182	0.01	0.09	0.00	1.00
Water supply 2	18,182	0.26	0.44	0.00	1.00
Water supply 3	18,182	0.73	0.44	0.00	1.00
Utilities 0	18,182	0.00	0.01	0.00	1.00
Utilities 1	18,182	0.00	0.04	0.00	1.00
Utilities 2	18,182	0.00	0.05	0.00	1.00
Utilities 3	18,182	0.50	0.50	0.00	1.00
Utilities 4	18,182	0.50	0.50	0.00	1.00

Table 7 - Summary of Sewer, Water and Utilites Data Statistics

TABLE 7: The fraction of sample utilizing each type of sewer, water and utilities

Summary of Fuel Type, Heating, and Central Air Data Statistics

FUEL TYPE CODE DEFINITIONS This item is used to indicate the primary fuel source. If a combination of fuel types is used, the predominant fuel source is indicated.

Fuel type 1	None
Fuel type 2	Gas (natural or LP)
Fuel type 3	Electric
Fuel type 4	Oil
Fuel type 5	Wood
Fuel type 6	Solar
Fuel type 7	Coal

HEATING CODE DEFINITIONS This item is used to record whether or not the residence has central heat (e.g., a heating unit which supplies heat to most or all of the living area in the residence).

Heat type 1	No Central Heat- This indicates that there is no heat source, or heat is primarily provided by stoves or space heaters.
Heat type 2	Hot Air - This indicates that heat is primarily provided through a central forced air system.
Heat type 3	Hot Water/Steam - This indicates that heat is provided primarily though a central hot water or steam system.
Heat type 4	Electric - This indicates that heat is primarily provided through an electric baseboard heating system.

CENTRAL AIR CODE DEFINITION This item is used to indicate whether or not the residence has central air conditioning.

Central Air	Binary, 1 implies that there is central air conditioning in the residence.

Taken from the ORPS website at: http://www.orps.state.ny.us/assessor/manuals/vol6/rfv/sect08.htm#heattype

Table 8 - Summary of Fuel Type, Heating, and Central Air Data Statistics

Variable	Number of Observations	Mean	Standard Deviation	Minimum value	Maximum value
Fuel type 0	17,215	0.00	0.02	0	1
Fuel type 1	17,215	0.02	0.13	0	1
Fuel type 2	17,215	0.59	0.49	0	1
Fuel type 3	17,215	0.16	0.36	0	1
Fuel type 4	17,215	0.23	0.42	0	1
Fuel type 5	17,215	0.00	0.06	0	1
Fuel type 6	17,215	0.00	0.02	0	1
Fuel type 7	17,215	0.00	0.01	0	1
Fuel type 8	17,215	0.00	0.02	0	1
Heat type 0	18,172	0.00	0.02	0	1
Heat type 1	18,172	0.02	0.14	0	1
Heat type 2	18,172	0.62	0.49	0	1
Heat type 3	18,172	0.21	0.41	0	1
Heat type 4	18,172	0.15	0.35	0	1
Central air	18,182	0.29	0.45	0	1

TABLE 8: The fraction of sample utilizing each type of fuel and heat; fraction

Land Type Definitions

Land type 0: Land type has not been recorded

Land type 1: Primary* - This describes the main building site for improved or vacant parcels, unless they are waterfront. Improvements to the land such as water, sewer, and utilities are available.

Land type 2: Secondary* - This describes land that is improved with a commercial structure but lacks some of the amenities of the primary land type, such as road frontage or a separate water supply, which results in less value.

Land type 3: Undeveloped - This describes vacant land located in industrial or commercial areas. Water, sewer, and utilities are not available on site.

Land type 4: Residual - This describes all excess land on a site which is not coded as Primary, Secondary, Undeveloped, Waterfront, or Leased Land.

Land type 5: Tillable - This describes farm land other than muck, vineyard, or orchard which is suitable for the cultivation of farm crops. This Land type should be used only if the land is being utilized as part of a farm operation.

Land type 6: Pasture - This describes agricultural land not suitable topographically for row cropping. It is open, or very sparsely treed or shrubbed, and is not usable as tillable land. The land may be used for open grazing and exercising of cattle.

Land type 7: Woodland - This describes areas of trees with or without marketable timber.

Land type 8: Wasteland - This describes land areas of little or no economic value such as swamps, ravines, flood land, etc. It would be very costly and impractical or impossible to improve the land to the point where it could be utilized.

Land type 9: This Land type describes highly organic land of dark color and low mineral content. Muck is used to produce potatoes, onions, and truck garden crops such as lettuce, celery, radishes, etc.

Land type 10: Waterfront - This describes land with any significant water frontage.

Land type 11: Orchard - This describes land planted with fruit-bearing trees such as apples, pears, cherries, etc.

Land type 12: Rear - This describes vacant land presently without access to a public road, e.g., land-locked parcels.

Land type 13: Vineyard - This describes land planted with grapevines.

Land type 14: Wetland - This describes land which has been designated and identified by the Department of Environmental Conservation as being under restrictions and protected as wetland. Do not use this for swampland.

Land type 15: Leased Land - This entry should be used when there is a building or other improvement which has no associated land. This should not be used to describe land which is leased in order to increase the productivity of a farm. An example would be a leased warehouse on railroad property.

Taken from ORPS at: http://www.orps.state.ny.us/assessor/manuals/vol6/comm/sect07.htm

*NOTE: A primary land type will differ from a secondary land type in that a primary land type has road frontage and is separately marketable. A secondary land type usually does not have road frontage and is difficult to market separately.

Table 9 - Summary of Land Type Data Statistics					
Variable	Number of Observations	Mean	Standard Deviation	Minimum value	Maximum value
Land type 1	14,028	0.86	0.34	0	1
Land type 2	14,028	0.01	0.12	0	1
Land type 3	14,028	0.00	0.06	0	1
Land type 4	14,028	0.06	0.24	0	1
Land type 6	14,028	0.00	0.01	0	1
Land type 7	14,028	0.00	0.03	0	1
Land type 8	14,028	0.00	0.03	0	1
Land type 10	14,028	0.03	0.18	0	1
Land type 12	14,028	0.02	0.14	0	1
Land type 14	14,028	0.00	0.03	0	1
Land type 15	14,028	0.00	0.02	0	1

TABLE 9: The fraction of sample with each type of primary land type

General Building Style Characteristics

This is a general guide to building style characteristics. Some residences, although they fit a particular building style, may fall outside of the criteria shown here.

Description	Building Style	Story Height	Year Built	Grade	First Story Living Area	Finished Attic	Finished Basement	Finished Rec Room	Basement Type	Room Size	SFLA
RANCH	Bldg Syle 1	1	>1950	ANY	700-3000	No	No	Y/N	ANY	AVERAGE	700-3000
RAISED RANCH	Bldg Syle 2	1	>1959	B-D	700-2000	No	Yes	No	Full Bsmt w/ Garage	AVERAGE	700-3000
SPLIT LEVEL	Bldg Syle 3	1.0-2.0	>1950	B-D	700-2000	No	Yes	No	Partial-full w/ Bsmt Garage	AVERAGE	700-3000
CAPE COD	Bldg Style 4	1.5-1.7	>1930	B-D	700-2000	No	No	Y/N	ANY	SMALL AVERAGE	700-2000
COLONIAL	Bldg Style 5	2.0-2.5	ANY	A-D	700-2500	Y/N	No	Y/N	ANY	AVERAGE LARGE	1000-4000
CONTEMPORARY	Bldg Style 6	ANY	>1960	A-C	700-3000	Y/N	No	Y/N	ANY	AVERAGE LARGE	700-4000
MANSION	Bldg Style 7	ANY	ANY	A-B	1500-ANY	Y/N	No	Y/N	Partial-Full	AVERAGE LARGE	3000-ANY
OLD STYLE	Bldg Style 8	ANY	<1950	ANY	500-2500	Y/N	No	No	ANY	ANY	700-4000
COTTAGE	Bldg Style 9	1.0-1.5	ANY	C-E	300-800	Y/N	No	No	Slab-Crawl	SMALL	300-1200
ROW	Bldg Style 10	2.0-4.0	<1950	B-D	600-1500	Y/N	No	No	ANY	SMALL AVERAGE	1200-4000
LOG CABIN	Bldg Style 11	1.0-2.0	>1960	B-D	600-1500	Y/N	No	No	ANY	AVERAGE	600-2000
DUPLEX	Bldg Style 12	ANY	>1950	B-D	1000-2000	Y/N	No	Y/N	ANY	AVERAGE	1000-4000
BUNGALOW	Bldg Style 13	1.0-1.5	<1940	C-E	600-1000	Y/N	No	Y/N	ANY	SMALL AVERAGE	600-1200
TOWN HOUSE	Bldg Style 15	2	>1950	B-C	600-1000	No	No	No	FULL	AVERAGE	1200-2000

Note: Currently Building Styles 14 and 16 are unknown to author, though they used in Warren and Saratoga County assessment classifications
Taken from the ORPS website at: http://www.orps.state.ny.us/assessor/manuals/vol6/rfv/buildingstyle/8table1.htm

Table 10 - Summary of Building Style Data Statistics					
Variable	Number of Observations	Mean	Standard Deviation	Minimum value	Maximum value
Bldg Style 1	18,182	0.18	0.38	0.00	1.00
Bldg Style 2	18,182	0.05	0.23	0.00	1.00
Bldg Style 3	18,182	0.02	0.14	0.00	1.00
Bldg Style 4	18,182	0.05	0.22	0.00	1.00
Bldg Style 5	18,182	0.27	0.45	0.00	1.00
Bldg Style 6	18,182	0.07	0.26	0.00	1.00
Bldg Style 7	18,182	0.00	0.03	0.00	1.00
Bldg Style 8	18,182	0.17	0.37	0.00	1.00
Bldg Style 9	18,182	0.04	0.18	0.00	1.00
Bldg Style 10	18,182	0.00	0.04	0.00	1.00
Bldg Style 11	18,182	0.02	0.13	0.00	1.00
Bldg Style 12	18,182	0.00	0.04	0.00	1.00
Bldg Style 13	18,182	0.00	0.06	0.00	1.00
Bldg Style 14	18,182	0.01	0.12	0.00	1.00
Bldg Style 15	18,182	0.11	0.31	0.00	1.00
Bldg Style 16	18,182	0.00	0.01	0.00	1.00
Bldg Style 17	18,182	0.00	0.02	0.00	1.00

TABLE 10: The fraction of sample with each classification of building style

APPENDIX C

Summary of Parcel Data Statistics - Differences

Variable	Mean - STAR	SD - STAR	Mean - Non-STAR	SD - Non-STAR	More than 1 SD different?
Adks	0.15	0.36	0.47	0.50	No
Duplicates	0.33	0.47	0.46	0.50	No
Roll Year	2004	1	2004	1	No
Acres	140.71	581.34	249.59	930.21	No
Acres - Capped 100	17.08	33.23	29.16	40.55	No
Front	588.29	2,850.51	964.76	3,777.95	No
Depth	928	3,560	1415	4,632	No
Waterfront	0.01	0.11	0.10	0.30	No
Waterfront - 300	0.02	0.13	0.08	0.28	No
Total Waterfront	0.02	0.14	0.12	0.32	No
Land AV ($2002)	25,441	25,611	49,945	102,982	No
Total AV ($2002)	121,118	77,476	150,045	162,116	No
Sale month	6.58	3.28	6.86	3.23	No
Sale Year	2004	1.24	2004	1.22	No
Sale price ($2002)	154,757	85,797	168,974	216,329	No
Ratio Assmt/Sale	0.75	1.01	0.93	1.06	No

Summary of Housing Characteristics Statistics					
Variable	**Mean - STAR**	**SD - STAR**	**Mean - Non-STAR**	**SD - Non-STAR**	**More than 1 SD different?**
Age	31	36	41	40	No
Age sq	2,238	5,042	3,289	5,586	No
Sale Year	2004	1.2	2004	1.2	No
New construction	0.09	0.28	0.09	0.28	No
Overall condition	3.1	0.4	3.0	0.5	No
Kitchen quality	3.0	0.3	3.1	0.3	No
Interior condition	3.0	0.3	3.0	0.3	No
Exterior condition	3.0	0.3	3.0	0.3	No
Bathroom quality	3.0	0.3	3.1	0.3	No
Exterior wall material	2.5	1.0	2.1	1.1	No
Building style	5.7	4.0	7.1	4.4	No
SFLA	1,797	666	1,641	716	No
NBR_Rooms	1.0	2.6	0.2	1.2	No
NBR_Kitchens	1.0	0.1	1.1	0.3	No
NBR_Full Baths	1.7	0.6	1.7	0.7	No
NBR_Half Baths	0.6	0.5	0.4	0.5	No
NBR_Bedrooms	3.2	0.8	3.0	1.0	No
NBR_Fireplaces	0.6	0.6	0.5	0.6	No
NBR_Stories	1.6	0.5	1.6	0.5	No
Basement/Garage Capacity	0.1	0.5	0.1	0.4	No
FirstStorySqFt	1,158	391	1,102	432	No
SecondStorySqFt	495	501	376	472	No
AdditionalStorySqFt	0.5	20.3	2.4	45.0	No
HalfStorySqFt	56.6	186.5	89.7	234.0	No
ThreeQuarterStorySqFt	26.3	142.4	54.2	204.6	No
Finished Over Garage SqFt	27.7	93.7	18.5	88.1	No
Finished Attic SqFt	3.4	31.1	6.4	44.0	No
Finished Basement SqFt	60.7	202.3	53.6	193.9	No
Finished RecRoom SqFt	43.6	182.0	35.1	177.2	No
Unifinished HalfBath SqFt	3.4	40.3	2.6	35.9	No
Unfinished 3qtr SqFt	0.2	10.8	0.4	17.9	No
Unfinished Room SqFt	3.8	49.1	2.1	30.1	No

Summary of School District Data Statistics					
Variable	Mean - STAR	SD - STAR	Mean - Non-STAR	SD - Non-STAR	More than 1 SD different?
Year	2003	1	2003	1	No
Enrolled	3,004	3,383	731	453	No
Student-teacher ratio	13.7	1.9	12.4	2.3	No
% Regents diplomas	71.13	11.93	66.21	12.63	No
St. Dev's %RegDipl	0.43	0.66	0.22	0.76	No
Avg_Per_l4	26.25	7.92	24.12	9.95	No
PPEXP $2002	9,720	1,832	10,690	2,334	No
%4 Year College	52.5	13.7	45.3	14.9	No
%2 Year College	31.7	8.8	33.8	9.9	No
%Other Post Secondary	1.2	2.1	1.6	2.7	No
%Military	2.5	2.9	3.7	3.7	No
%Employment	7.5	5.5	9.9	7.1	No
Needs Index	4.9	0.5	5.0	0.7	No
PCNT_FL_K_12	15.0	12.2	21.5	9.1	No
PCNT_LEP_STUDENTS	1.8	6.1	0.2	0.4	No
School Tax Rate	0.018	0.005	0.016	0.005	Yes

Note: Data and definitions taken from the New York State Education Department: http://www.nysed.gov/

Summary of Neighborhood Data Statistics					
Variable	Mean - STAR	SD - STAR	Mean - Non-STAR	Non-STAR	1 SD different?
2000 Population	2,461	1,329	1,891	1,212	No
2000 Population per Square Mile	1,073	1,441	902	1,602	No
Percent Non-White	5.2	5.4	4.4	5.3	No
Percent Male	49.2	2.6	49.3	2.6	No
Percent 21 and under	29.3	4.1	28.3	5.4	No
Percent 65 and older	14.1	7.6	16.9	9.6	No
Median Age	38.2	3.5	39.4	4.9	No
Median Age Male	37.3	3.5	38.7	5.0	No
Median Age Female	39.1	3.9	40.2	5.2	No
Average HH size	2.6	0.2	2.4	0.2	No
Avg Family Size	3.0	0.1	2.9	0.1	No
Percent Owner Occupied	86.8	16.0	71.9	23.4	No
Percent Popn Below Poverty	5.8	4.7	7.9	5.3	No

Summary of Building Style Data Statistics					
Variable	Mean - STAR	SD - STAR	Non-STAR	Non-STAR	Statistically Different?
Bldg Style 1	0.19	0.39	0.16	0.36	No
Bldg Style 2	0.06	0.24	0.04	0.19	No
Bldg Style 3	0.02	0.15	0.01	0.11	No
Bldg Style 4	0.05	0.22	0.05	0.21	No
Bldg Style 5	0.33	0.47	0.14	0.35	No
Bldg Style 6	0.06	0.24	0.09	0.29	No
Bldg Style 7	0.00	0.03	0.00	0.02	No
Bldg Style 8	0.14	0.35	0.23	0.42	No
Bldg Style 9	0.02	0.14	0.07	0.26	No
Bldg Style 10	0.00	0.03	0.00	0.05	No
Bldg Style 11	0.01	0.09	0.04	0.19	No
Bldg Style 12	0.00	0.03	0.00	0.05	No
Bldg Style 13	0.00	0.06	0.01	0.08	No
Bldg Style 14	0.01	0.08	0.03	0.18	No
Bldg Style 15	0.10	0.30	0.13	0.33	No
Bldg Style 16	0.00	0.00	0.00	0.01	No
Bldg Style 17	0.00	0.01	0.00	0.04	No

Summary of Sewer, Water and Utilites Data Statistics					
Variable	Mean - STAR	SD - STAR	Mean - Non-STAR	SD - Non-STAR	Statistically Different?
Sewer type 0	0.00	0.00	0.00	0.01	No
Sewer type 1	0.01	0.08	0.01	0.11	No
Sewer type 2	0.40	0.49	0.52	0.50	No
Sewer type 3	0.60	0.49	0.47	0.50	No
Water supply 0	0.00	0.00	0.00	0.01	No
Water supply 1	0.01	0.08	0.01	0.10	No
Water supply 2	0.22	0.41	0.35	0.48	No
Water supply 3	0.78	0.42	0.64	0.48	No
Utilities 0	0.00	0.00	0.00	0.01	No
Utilities 1	0.00	0.04	0.00	0.06	No
Utilities 2	0.00	0.05	0.00	0.06	No
Utilities 3	0.41	0.49	0.70	0.46	No
Utilities 4	0.58	0.49	0.29	0.46	No

Summary of Fuel Type, Heating, and Central Air Data Statistics

Variable	Mean - STAR	SD - STAR	Mean - Non-STAR	SD - Non-STAR	Statistically Different?
Fuel type 0	0.00	0.00	0.00	0.03	No
Fuel type 1	0.01	0.08	0.04	0.21	No
Fuel type 2	0.67	0.47	0.43	0.50	No
Fuel type 3	0.13	0.33	0.22	0.42	No
Fuel type 4	0.20	0.40	0.29	0.46	No
Fuel type 5	0.00	0.04	0.01	0.09	No
Fuel type 6	0.00	0.02	0.00	0.02	No
Fuel type 7	0.00	0.01	0.00	0.00	No
Fuel type 8	0.00	0.01	0.00	0.03	No
Heat type 0	0.00000	0.00000	0.00089	0.03	No
Heat type 1	0.01	0.09	0.05	0.21	No
Heat type 2	0.67	0.47	0.51	0.50	No
Heat type 3	0.21	0.40	0.23	0.42	No
Heat type 4	0.12	0.33	0.20	0.40	No
Central air	0.33	0.47	0.18	0.38	No

Summary of Land Type Data Statistics

Variable	Mean - STAR	SD - STAR	Mean - Non-STAR	SD - Non-STAR	Statistically Different?
Land type 1	0.89	0.32	0.81	0.39	No
Land type 2	0.01	0.10	0.02	0.14	No
Land type 3	0.00	0.05	0.01	0.08	No
Land type 4	0.06	0.24	0.06	0.24	No
Land type 6	0.00	0.00	0.00	0.02	No
Land type 7	0.00	0.02	0.00	0.03	No
Land type 8	0.00	0.03	0.00	0.02	No
Land type 10 (Waterfront)	0.01	0.08	0.09	0.29	No
Land type 12	0.03	0.16	0.01	0.07	No
Land type 14	0.00	0.04	0.00	0.02	No
Land type 15	0.00	0.01	0.00	0.03	No

APPENDIX D

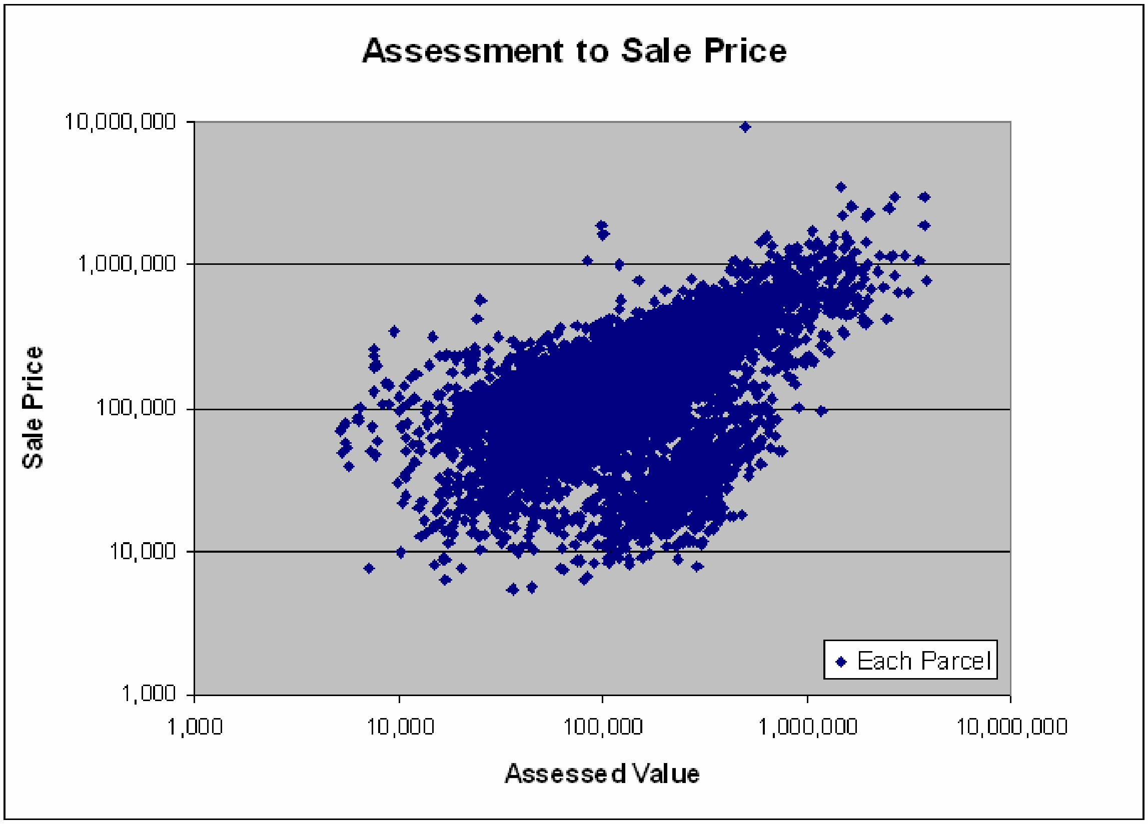
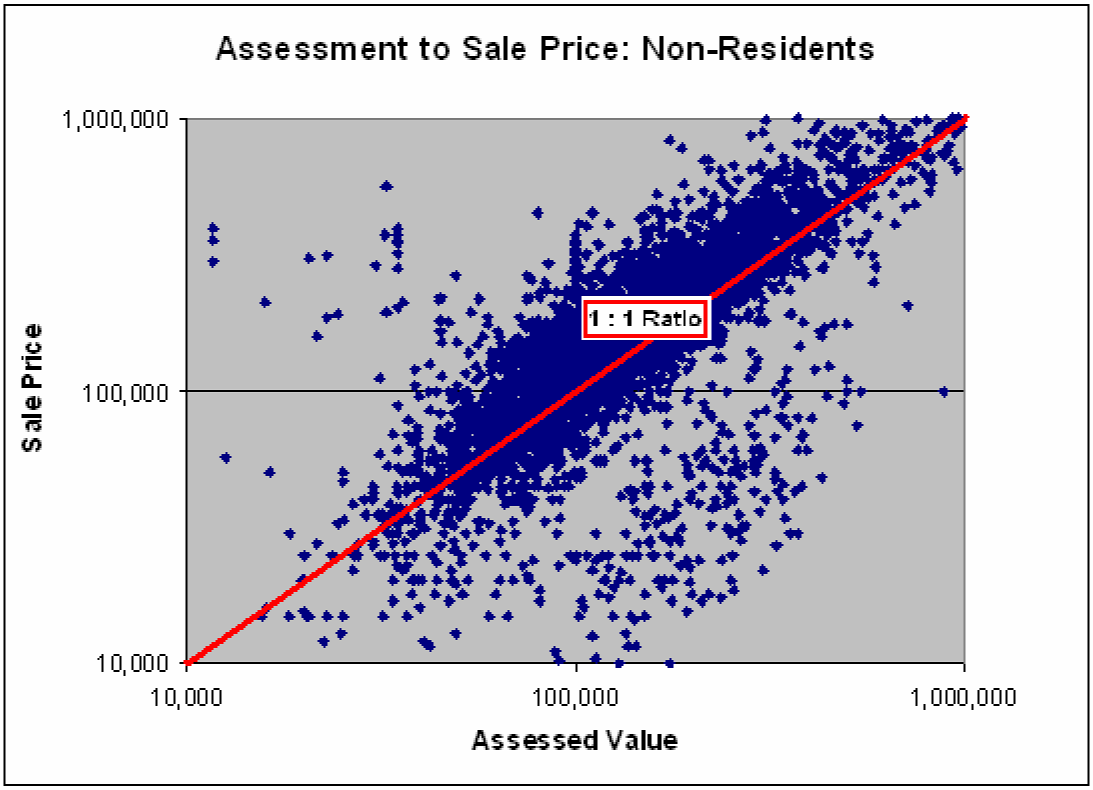
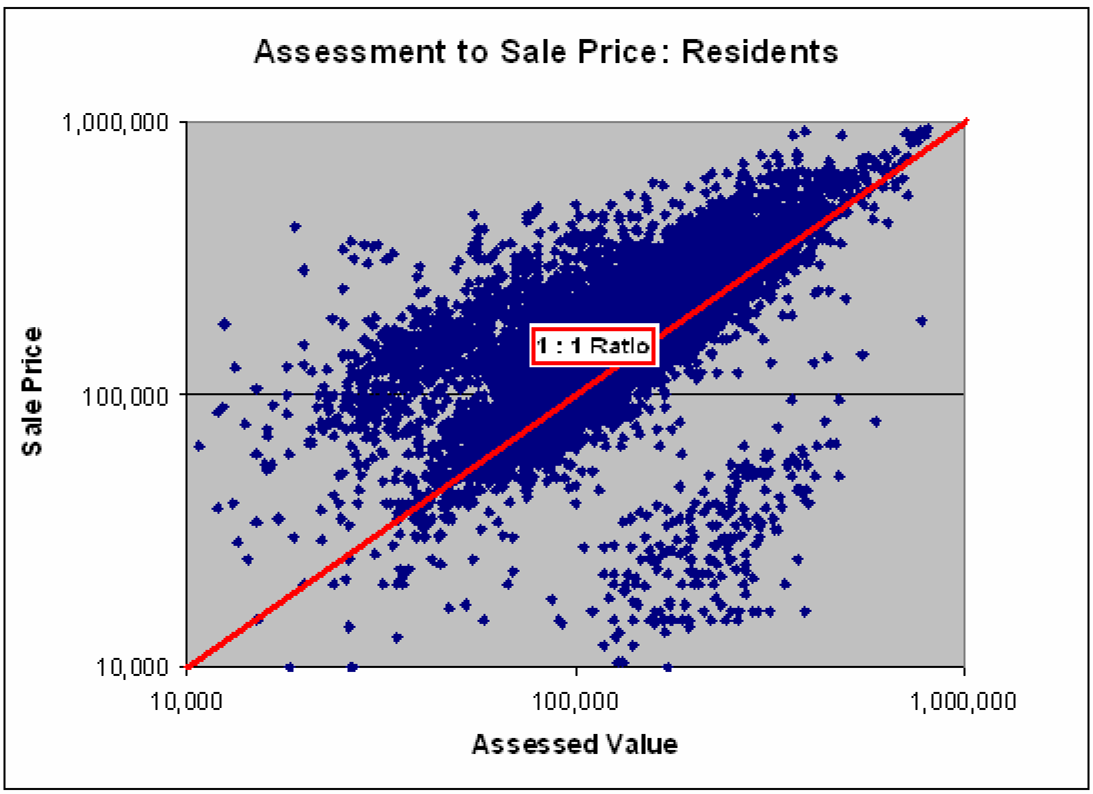


CHART 2.5: Assessment vs. Sales price on a larger scale, all data included

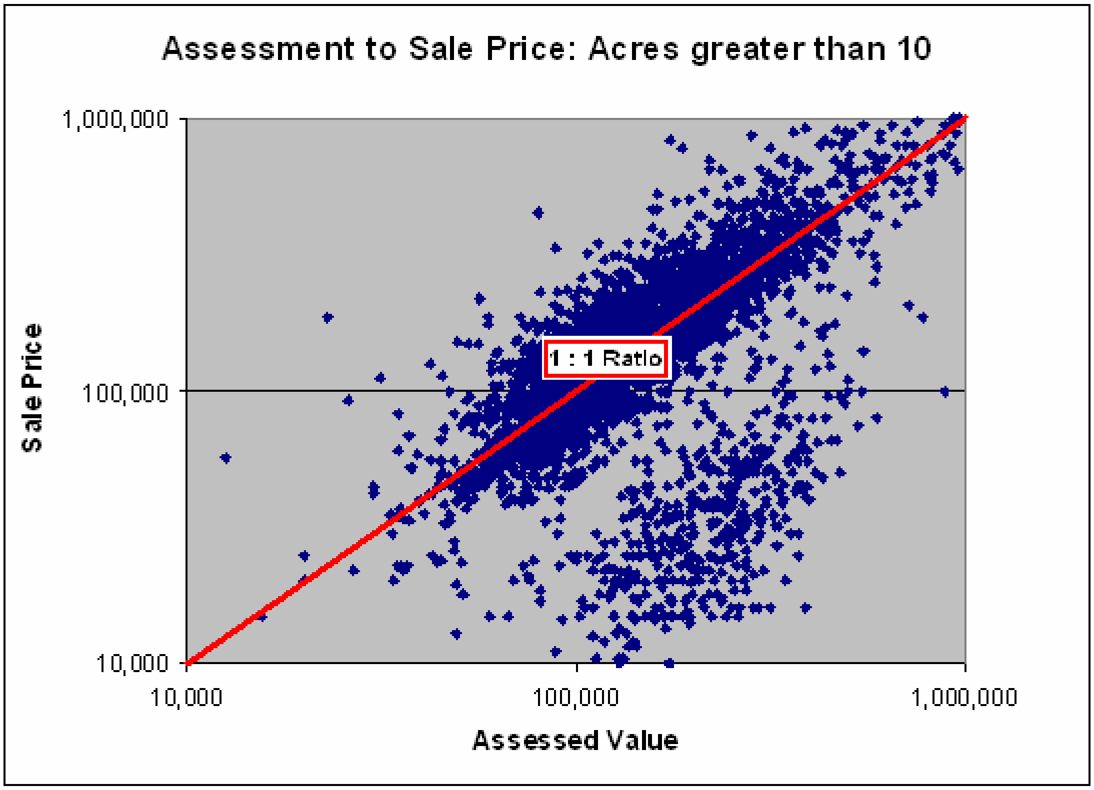
APPENDIX E

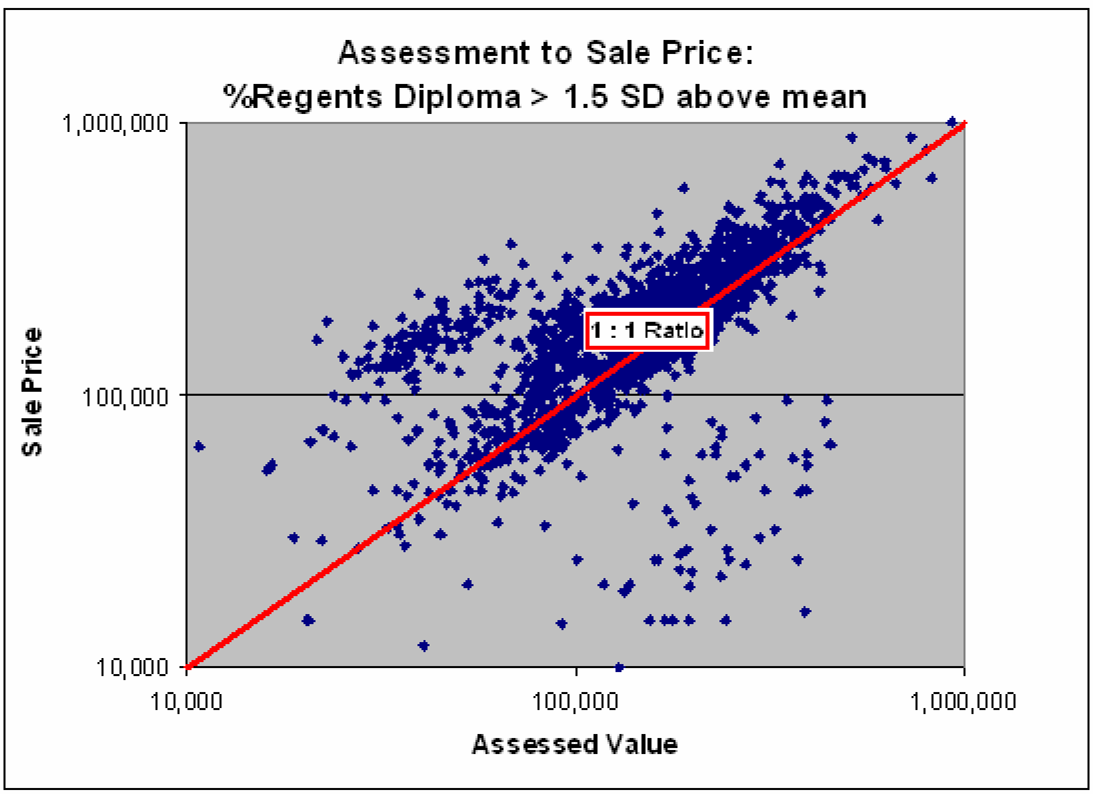


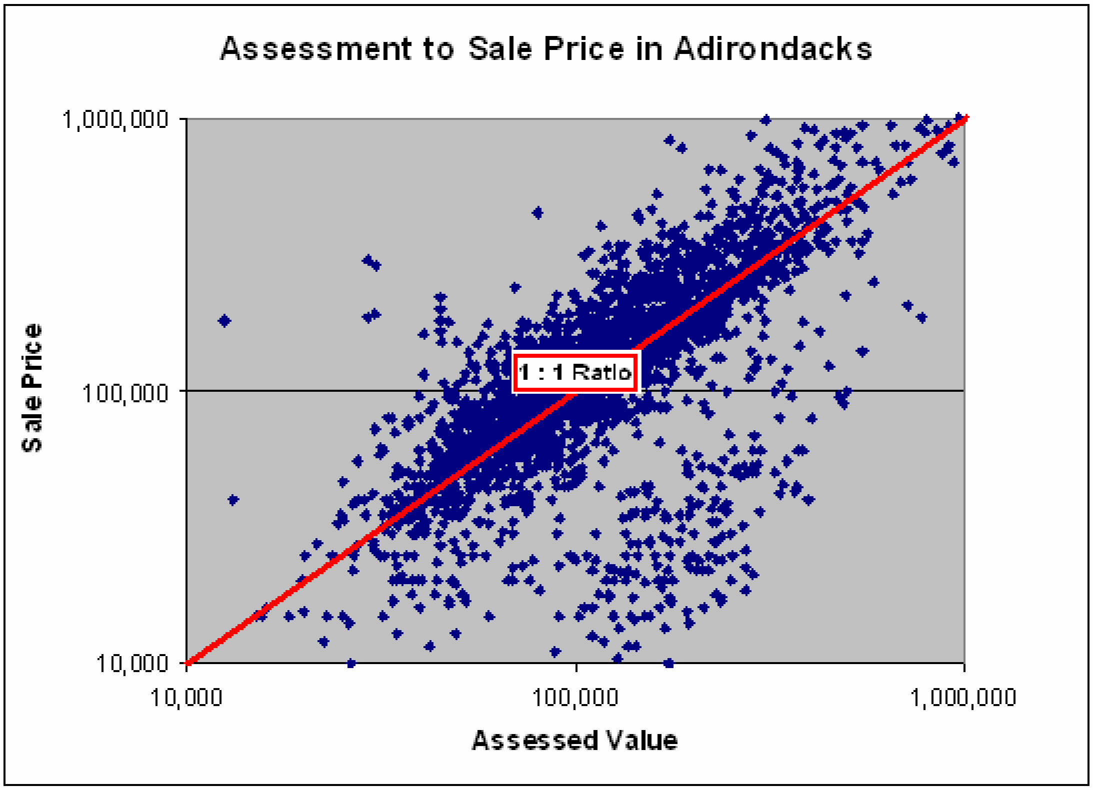
Assessment to Sale Price: Non-Residents
1,000,000
100,000
10,000
Sale Price
1 : 1 Ratio
10,000
100,000
1,000,000
Assessed Value



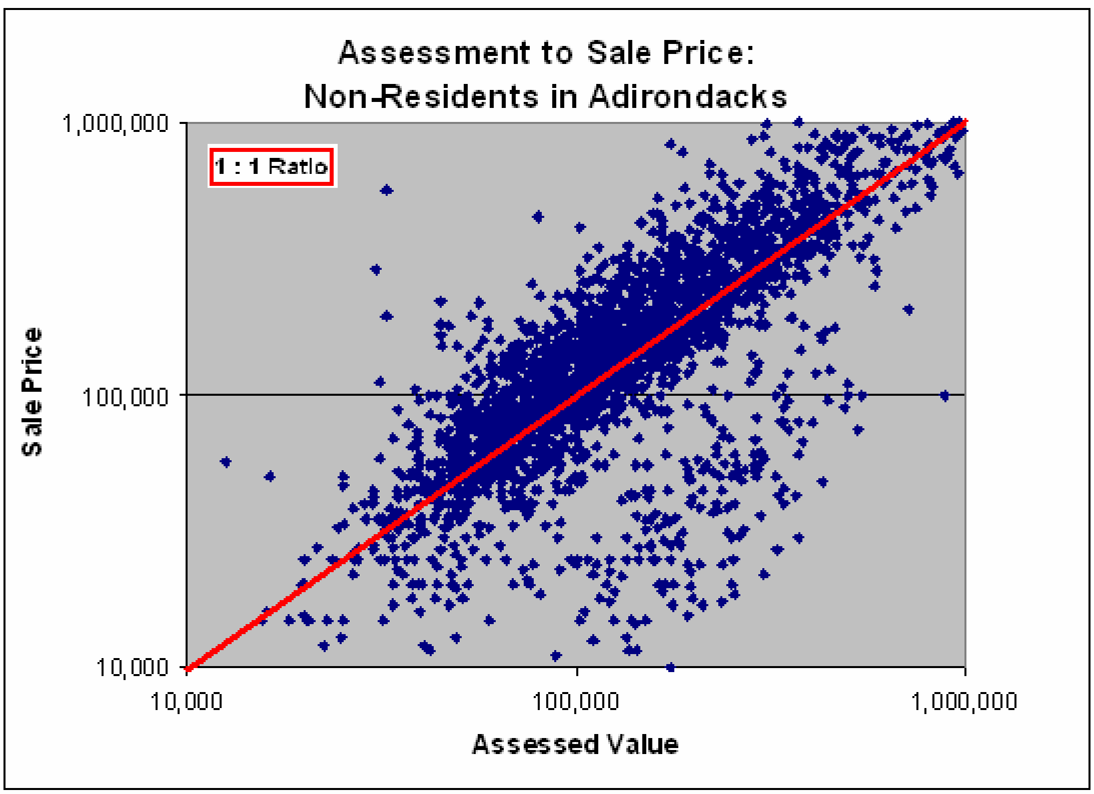
Assessment to Sale Price: Residents
1,000,000
100,000
10,000
Sale Price
1 : 1 Ratio
10,000
100,000
1,000,000
Assessed Value


Assessment to Sale Price: Acres greater than 10
1,000,000
100,000
10,000
Sale Price
1 : 1 Ratio
10,000
100,000
1,000,000
Assessed Value

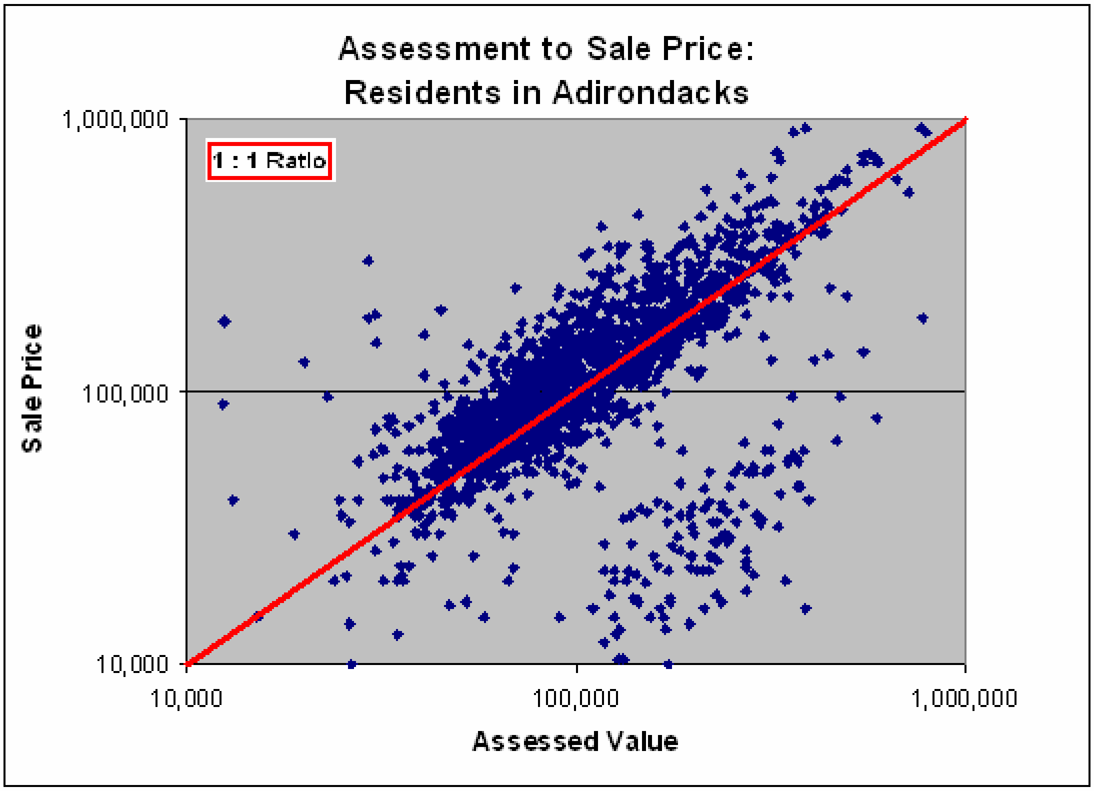

Assessment to Sale Price:
%Regents Diploma > 1.5 SD above mean
1,000,000
100,000
10,000
Sale Price
1 : 1 Ratio
10,000
100,000
1,000,000
Assessed Value



Assessment to Sale Price in Adirondacks
1,000,000
100,000
10,000
Sale Price
1 : 1 Ratio
10,000
100,000
1,000,000
Assessed Value



Assessment to Sale Price:
Non-Residents in Adirondacks
1,000,000
100,000
10,000
Sale Price
1 : 1 Ratio
10,000
100,000
1,000,000
Assessed Value



APPENDIX F

Percent of Public High School Graduates Intending to Enroll in College				
Region	**2000/01**	**2001/02**	**2002/03**	**2003/04**
Essex County	78	80.1	70	78.5
Hamilton County	67.3	81.3	73.3	91.3
Saratoga County	82.8	88.4	87.4	85.6
Warren County	77.4	87.8	81.8	83.4
New York State	**78.6**	**80.8**	**82.1**	**81**
Average for Essex, Hamilton, Saratoga and Warren	**76.82**	**83.68**	**78.92**	**83.96**

Information taking from: NYS Kids' Well-being Indicators Clearinghouse

APPENDIX G

Effect of STAR on Log of Housing Price

COEFFICIENT	(1)
STAR	0.0913***
	(0.010)
Constant	11.95***
	(0.0087)
Observations	18182
R-squared	0.00

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

APPENDIX H

Summary Statistics of Pct_Male with and without Hadi identified outliers removed

	Variable	Obs	Mean	Std. Dev.	Min	Max
Full sample	pct_male	18182	49.25259	2.620842	34.22655	79.46514
Outliers removed	pct_male	17938	49.05559	1.41462	43.07412	53.01028

APPENDIX I

Effects of Housing and Parcel Characteristics on Log of Housing Price: Testing to see if coefficients are statistically different using Chebyshev's Rules

COEFFICIENT	**Residents**	**Non-Residents**	**Coefficients are Statistically Different at least 3.6% of the time**
tot_waterfront	0.424***	0.925***	**Yes**
	(0.023)	(0.024)	
ln_sfla	0.825***	0.781***	No
	(0.013)	(0.023)	
ln_nbr_bedrooms	-0.0534***	-0.0426	No
	(0.016)	(0.027)	
ln_acres_capped	0.0465***	0.0426***	No
	(0.0038)	(0.0071)	
adks	-0.0645*	0.393***	**Yes**
	(0.033)	(0.047)	
ln_age	0.00137	0.0389***	**Yes**
	(0.0011)	(0.0025)	
pctnw	0.00141**	-0.00645***	No
	(0.00070)	(0.0014)	
pct_21_and_under	-0.00137	-0.00676***	No
	(0.00096)	(0.0016)	
acres_capped_dum	-0.112***	-0.229***	No
	(0.019)	(0.027)	
Constant	5.209***	5.742***	No
	(0.37)	(0.41)	
Year Dummies	Yes	Yes	
Town Dummies	Yes	Yes	
Acreage Capped Dummies	Yes	Yes	
Observations	12578	5604	
R-squared	0.62	0.57	

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

APPENDIX J

Table 19: The Effects of Housing and Neighborhood Characteristics with School District Dummies On the Natural Logarithm of Housing Prices

COEFFICIENT	(1)
tot_waterfront	0.793***
	(0.016)
ln_sfla	0.781***
	(0.012)
star	0.0244***
	(0.0081)
ln_nbr_bedrooms	-0.0448***
	(0.014)
ln_acres_capped	0.0480***
	(0.0036)
adks	0.141***
	(0.032)
ln_age	0.0131***
	(0.0011)
pctnw	-0.00135**
	(0.00067)
pct_21_and_under	-0.00351***
	(0.00086)
district_cd__1	0.131
	(0.34)
district_cd__2	-0.970***
	(0.31)
district_cd__3	-0.954***
	(0.30)
district_cd__4	0
	(0)
district_cd__5	-1.786***
	(0.49)
district_cd__6	0
	(0)
district_cd__7	0
	(0)
district_cd__8	0.0366
	(0.31)
district_cd__9	-1.001***
	(0.35)
district_cd__10	-0.513
	(0.53)
district_cd__11	0
	(0)
district_cd__12	0.368
	(0.30)
district_cd__13	-0.647**
	(0.31)
district_cd__14	-0.535

	(0.35)
district_cd__15	-0.139
	(0.43)
district_cd__16	0
	(0)
district_cd__17	0
	(0)
district_cd__18	0
	(0)
district_cd__19	0
	(0)
district_cd__20	0.103
	(0.19)
district_cd__21	0
	(0)
district_cd__22	-1.213**
	(0.49)
district_cd__23	0
	(0)
district_cd__24	0.0795
	(0.46)
district_cd__25	0.122
	(0.46)
district_cd__26	0.210
	(0.48)
district_cd__27	0
	(0)
district_cd__28	-0.119
	(0.45)
district_cd__29	0.0804
	(0.46)
district_cd__30	0.0690
	(0.46)
district_cd__31	0.0346
	(0.46)
district_cd__32	0.0722
	(0.46)
district_cd__33	0.203
	(0.46)
district_cd__34	0.103
	(0.46)
district_cd__35	-0.271
	(0.46)
district_cd__36	0.144
	(0.46)
district_cd__37	-1.533***
	(0.47)
district_cd__38	-1.671***
	(0.46)
district_cd__39	-1.872***
	(0.47)
district_cd__40	-1.688***

	(0.47)
district_cd__41	-1.671***
	(0.47)
district_cd__42	0.0872
	(0.50)
district_cd__43	-1.794***
	(0.47)
district_cd__44	-2.057***
	(0.47)
district_cd__45	-1.869***
	(0.46)
Constant	6.277***
	(0.32)
Year Dummies	Yes
Town Dummies	Yes
Acreage Capped Dummies	Yes
Observations	18182
R-squared	0.59

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

APPENDIX K

Effects of Housing, Education and Neighborhood Characteristics on the Log of Housing Price in the Adirondack Park, with a Residency and Primary School Interaction Variable

COEFFICIENT	
tot_waterfront	0.781***
	(0.017)
ln_sfla	0.785***
	(0.013)
STAR	-0.0216
	(0.016)
ln_nbr_bedrooms	-0.0213
	(0.015)
ln_acres_capped	0.0502***
	(0.0038)
ADKS	0.183***
	(0.029)
ln_age	0.0154***
	(0.0012)
pctnw	-0.00157**
	(0.00073)
pct_21_and_under	-0.00311***
	(0.00090)
ln_new_sch_tax	0.616***
	(0.061)
ln_stu_teach_ratio	0.282***
	(0.065)
ln___regdipl	0.0567***
	(0.015)
ln_avg_per_l4	-0.000493
	(0.0034)
STAR x ln_avg_per_l4	0.0125***
	(0.0047)
Constant	4.626***
	(0.35)
Year, Acreage Capped and Town Dummies	Yes
Observations	15962
R-squared	0.58

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1