The Impact of Education Reforms on Property Values:
A Review of the Literature

Thomas Downes

Lincoln Institute of Land Policy
Working Paper

Lincoln Institute Product Code: WP09TD1

Abstract

The last two decades have been marked by an unparalleled growth in the involvement of federal and state governments in the provision of elementary and secondary education, with such important policy changes as federal mandates for accountability as exemplified by No Child Left Behind (NCLB) Act and state-level legislation that has broadened public school choice (e.g., charter schools) and reformed the systems for financing the schools. To provide context for the review of the research on the impact of policy changes, this article begins with a a brief review of this recent literature on the hedonics of schooling, focusing on recent studies that have taken advantage of methodological and data improvements to address lingering concerns about the results of the preceding research. The newer research has consistently shown that home buyers value higher standardized test scores and other readily observable attributes of schools that are perceived to be correlated with school quality. The latter portion of this paper indicates how these recent studies have influenced research examining the impact on property values of major changes in federal or state policy, such as the introduction of school choice or accountability or as the reworking of a state's system of school finance. The results of this research are summarized, and suggestions are made for work that can close gaps in our knowledge about the effects of these policy changes.

About the Author

Thomas A. Downes is an Associate Professor of Economics at Tufts University. Professor Downes's research focuses primarily on the evaluation and construction of state and local policies to improve the delivery of publicly provided goods and reduce inequities in these services, with particular attention paid to public education. He has also pursued research on the roles of the public and private sectors in the provision of education. Professor Downes served as a member of the Panel on Formula Allocations of the Committee on National Statistics of the National Academies and was a participant in the symposia sponsored by the New York State Board of Regents that resulted in Educational Finance to Support High Learning Standards and Educational Finance and Organizational Structure in New York State Schools. He received his B.A. in Economics and Mathematics from Bowdoin College and his Ph.D. in Economics from Stanford University.

Thomas Downes
Associate Professor of Economics
Tufts University
Department of Economics
306 Braker Hall
8 Upper Campus Road
Medford, MA 02155
tel: 617/627-2687
fax: 617/627-3917
thomas.downes@tufts.edu

Acknowledgements

Thanks to the Lincoln Institute of Land Policy for providing the financial support that made this research possible. The findings and conclusions of this paper do not necessarily reflect the official views and policies of the Lincoln Institute of Land Policy.

Table of Contents

The Impact of Education Reforms on Property Values: A Review of the Literature

Introduction

The last two decades have been marked by an unparalleled growth in the involvement of federal and state governments in the provision of elementary and secondary education. Nevertheless, ultimate control of elementary and secondary education continues to be local. One reason for concerted opposition to federal and state policies, like the No Child Left Behind (NCLB) Act and reform of state systems for financing the schools, that appear to reduce local control may be the perception that school quality in a locality is an important determinant of property values (Shelly, 2007). While this link between school quality and property values has long been a concern of the hedonics literature, a recent set of papers has both confirmed the strength of the link and provided a more nuanced picture of the nature of that link.

This article provides a brief review of this recent literature on the hedonics of schooling. The focus of this review will be on recent studies that have taken advantage of methodological and data improvements to address lingering concerns about the results of the preceding research. The newer research has consistently shown that home buyers value higher standardized test scores and other readily observable attributes of schools that are perceived to be correlated with school quality. These recent studies have also been the jumping off point for studies that have examined the impact on property values of major changes in federal or state policy, such as the introduction of school choice or accountability or as the reworking of a state's system of school finance. The latter portion of this paper will review the growing body of evidence on the effects of these policy changes.

What this paper will not provide is a discussion of the problems that must be surmounted by a researcher interested in estimating the demand for school quality. For an overview of this and other technical concerns that have been addressed in the literature, the interested reader is referred to Taylor (2008) and Yinger (2009). Also, no attempt will be made to provide an exhaustive review of the hedonics literature; Sheppard (1999) and Ross and Yinger (1999) are excellent sources for such reviews. And Clapp, Nanda, and Ross (2008) provides a more exhaustive summary of the literature on the relationship between school attributes and property values than the current paper will provide. Here, the review of the general hedonics literature is offered to provide context for the review of the research on the impact of policy changes.

This selective review of the hedonics literature is included in the next section of this paper, as is a brief overview of recent findings on the extent of heterogeneity across space and across individuals in the value placed on school attributes. The third section of the paper reviews the literature on the impact on property values of the introduction of

school choice or accountability systems. The fourth section offers a discussion of the literature that has examined the potential effects of school finance reforms that, like choice and accountability programs, could alter for home buyers the relative attractiveness of school districts in a state. The paper finishes with concluding remarks.

School characteristics and house prices: A brief review of the literature

The use of hedonic regressions of house prices on school characteristics dates from Oates' (1969) seminal paper. Using data on per pupil expenditures and average house values in 53 northern New Jersey municipalities, Oates documents a positive relationship between school expenditures and house values. He interprets this result as evidence in support of Tiebout's (1956) assertion that individuals make their residential location decisions in response to inter- or intra-jurisdictional differences in taxes and public services provision, an interpretation which has since been widely criticized.[1] Nevertheless, in the aftermath of Oates' work, a number of researchers have estimated similar relationships, typically using a better methodology or improved data. What follows in this section is a brief review of recent papers that have advanced the methodology for quantifying the relationship between house prices and school characteristics. The section closes by touching on several papers that have established the need to account for heterogeneity when estimating hedonic regressions that account for school characteristics.

While the focus of this section is on papers that have used new methodologies to quantify the relationship between house prices and school characteristics, a number of recent papers have added to the literature while applying variants of traditional, more structural methodologies. Among these are Hayes and Taylor (1996), Haurin and Brasington (1996), Weimer and Wolkoff (2001), Clapp and Ross (2004), Cheshire and Sheppard (2004), Brasington and Haurin (2006), Clapp, Nanda, and Ross (2008), and Yinger (2009). Since the goal of this section is to provide context for the later discussion of the impact of accountability, school choice, and school finance reforms on house prices, the selective review presented here will concentrate on papers that have used new methodologies to overcome some of the concerns typically raised in the hedonics literature.[2] A couple of lessons from the recent body of work are, however, worth highlighting. First, use of data on individual properties enables researchers to generate a more nuanced picture of how school characteristics and property values are related.

---

1 In fact, a number of authors have noted that if the assumptions of the Tiebout model hold, in equilibrium there will be no relationship between public service levels and land prices. See Lang and Jian (2000) for further discussion of this issue. For discussion of other criticisms of Oates' approach, see Mieszkowski and Zodrow (1989).

2 Papers that use a more traditional approach have universally recognized the problem created by correlation between unobserved neighborhood attributes and school characteristics and have taken a number of different approaches to address this problem. For example, Gibbons and Machin (2003) estimate a model with deviations from spatially-weighted means of the determinants of house prices as the controls. The drawback of all of these approaches is that they depend critically on the correctness of the assumed structure.

Second, in specifying hedonic relationships what should be included is the information on local schools that purchasers use when making their location decisions. The information used will depend on the information available to the purchasers and on the purchasers' perceptions of what factors determine school quality. Thus, for example, while Hayes and Taylor (1996) argue that the education production literature implies that school quality should be measured by a school's value added, Downes and Zabel (2002), Kane, Staiger, and Samms (2003), Brasington and Haurin (2006), and Yinger (2009) all show that home buyers do not appear to look at value added when assessing a school's quality. This lesson will prove important when evaluating the plausibility of the results in the literature on accountability and school choice.

As was hinted at in the discussion above, efforts to use improved methodologies have been motivated primarily by the possibility that estimates of the relationship between school characteristics and house prices could be biased because of correlation between unobserved neighborhood characteristics and attributes of the local schools. A number of studies, beginning with Bogart and Cromwell (1997), have used a regression discontinuity design to control for unobserved neighborhood characteristics. The logic behind this approach is that houses that are geographically close together but are on different sides of a school (or school district) attendance boundary are in the same neighborhood. Researchers who use the regression discontinuity approach can estimate a model which controls for unobserved attributes common to neighborhoods by including neighborhood-specific constants, otherwise known as "boundary fixed effects." This approach thus allows researchers to control not only for school district-level factors like taxes and local public goods but also for neighborhood characteristics that are common to houses within the boundary areas.

In their study, Bogart and Cromwell (1997) considered the sales prices of houses in regions in the Cleveland area that extended across school district boundaries but otherwise had uniform taxes and public services. By comparing the sales prices of houses on either side of the school district boundary, they developed estimates of the value of better schools. Their data did not, however, allow the authors to determine which specific attributes of schools consumers valued. Further, while the areas they consider were contiguous, Bogart and Cromwell could not rule out the possibility that some of the sales price variation was attributable to differences in neighborhood quality rather than to differences in school quality. In separate regressions, they showed that up to 7.5 percent of the sales price variation could be attributable to neighborhood quality variation.[3]

3 In a second paper Bogart and Cromwell (2000) used the variation created by a school district realignment in Shaker Heights, Ohio to generate estimates of the value of attending a neighborhood school. While their results tended to confirm the importance of controlling for within school-district variation, the absence of substantial cross-school variation in quality made it difficult for Bogart and Cromwell to estimate direct measures of the value of school quality.

While Black's (1999) analysis is similar in spirit to that of Bogart and Cromwell, her data allowed her to estimate the value that parents place on elementary school quality as measured by test scores while still controlling for neighborhood quality. Specifically, she used data on 22,679 house sales from 1993 to 1995 for three counties in Massachusetts. Because she had the exact location of each home, she was able to estimate a "boundary fixed effects" model. Like Bogart and Cromwell, Black argued that the extent of bias in a traditional hedonic could be large. In her preferred specification, Black found an elasticity of house prices with respect to test scores of 0.45, compared to the estimated elasticity of 0.9 produced using a standard house price hedonic.

The increasing availability of data on sales of individual houses and on student performance and demographics at the school level and improvements in geographic information systems (GIS) have made implementation of the regression discontinuity approach feasible in a wide variety of contexts. Kane, Riegg, and Staiger (2006) use the approach to quantify the extent to which property values in the Charlotte, NC area are related to school characteristics; Gibbons and Machin (2003) do the same for London, Leech and Campos (2003) for Coventry, and Fack and Grenet (2008) for Paris. Those studies that compare results from traditional hedonics and those from the regression discontinuity approach confirm Black's finding that the traditional approach overstates the value of improved student performance, though these studies also consistently find that home buyers value schools with higher test scores.

One drawback of the regression discontinuity approach, or of any approach that uses fixed effects to control for unobservables, is that these fixed effects also account for any determinants of house prices that are spatially or temporally stable. This reality can make it difficult to compare estimates of the relationship between house prices and school characteristics generated using a more traditional approach and a fixed-effects approach. For example, one of these neighborhood characteristics for which Black implicitly controls with her boundary fixed effect is quality of the public high school serving the community, since this is common to boundary areas. Thus, in her preferred specification, the coefficient on test scores is measuring the value that home owners place on elementary school quality. She claims that the difference in estimated elasticities arises from the omitted variable bias that plagues the standard hedonic model. But, since her standard hedonic does not control for quality of the high school, the test score coefficient in the standard hedonic is a measure of district-level (including high school) school quality. Thus the difference in the estimates can also be explained by the fact that they are measuring school quality at different levels.

In addition, the validity of the regression discontinuity approach depends critically on the assumption that houses located on either side of the boundary are, in fact, in the same neighborhood. Including only houses that are very close to the boundary increases the likelihood this assumption is valid, but limiting the sample in this way reduces the likelihood that any results are generalizable. And, no matter how close to the boundary

the included houses are required to be, there is a risk that houses on either side of a relatively long boundary will be in different neighborhoods. Further, if school attendance zone boundaries are relatively stable over time, neighborhood boundaries might adjust to match attendance zone boundaries. The boundary fixed effects would then fail to account fully for omitted neighborhood attributes. Kane, Staiger, and Samms (2003) provide evidence consistent with this latter possibility.

An alternative to the boundary fixed effect approach is a more traditional fixed effect approach, which is feasible if repeated observations on the same house are available. If, over time, school quality changes more rapidly than neighborhood quality, then this approach will generate valid estimates of the relationship between school characteristics and house prices. One variant of this second approach is typified by Bradbury, Mayer, and Case (2001), who used a repeat sales analysis to look at the relationship between changes in school quality and changes in house prices in 208 cities and towns in Massachusetts. Since the period they considered post-dates Proposition 2½, the levy limit established by this initiative constrained spending levels to be below that which would be determined by the public choice process in many of the cities and towns. Bradbury, Mayer, and Case hypothesized that, when such constraints were present, not all changes in public sector spending were capitalized.[4] They argued that only those changes that moved a constrained community closer to its desired level of spending would be reflected in house prices. To test this hypothesis, they regressed the percent changes in house prices between 1990 and 1994 for these 208 cities and towns on the change in per-pupil operating spending in, the combined test score in 1990, the change in per capita non-school spending, and demographic and location variables. Since school and non-school spending were endogenous, Bradbury, Mayer, and Case instrumented for these variables. For those communities most constrained by Proposition 2½, both school quality measures were significant, and the results were consistent with the hypothesis that changes in spending were most likely to increase house prices in those communities in which Proposition 2½ had proved an impediment to having school spending at its desired level.

While repeat-sales indices are widely used in the housing literature,[5] there are several potential drawbacks to using repeat-sales indices to generate estimates of the relationship between property values and school characteristics. First, as Kiel and Zabel (1997) show, house price indices calculated using the repeat sales methodology can be systematically biased because they are based on a non-random sample of houses. Second, while Bradbury, Mayer, and Case are able to control for inter-jurisdictional variation in changes in school quality, they cannot account for intra-jurisdictional variation in changes in quality because the repeat-sales indices are not disaggregated below the town level.

---

4 In general, only unanticipated changes in public spending will be capitalized since, as Bogart, Bradford, and Williams (1992) note, any anticipated changes will already be reflected in the pre-change house price levels.

5 See, for example, Glaeser, Gyourko, and Saiz (2008).

Since a number of recent studies (e.g., Black (1999), Weimer and Wolkoff (2001), Downes and Zabel (2002), Gibbons and Machin (2003), Leech and Campos (2003)) indicate that intra-jurisdictional variation in the attributes of local schools affect the distribution of house prices within communities, failing to control for this variation could result in incorrect estimates of the extent of capitalization.

An alternative to using repeat-sales indices is to create a data set that matches over time information on individual houses and their values. An example of this alternative is offered by Downes and Zabel (2002), who estimated the impact of school characteristics on house values in Chicago for 1987 and 1991 using a data set in which individual houses were observed in each year. They were therefore able to control for house-specific effects, which account for any temporally stable characteristics of the houses and their neighborhoods that are unobserved to the researcher. Using this traditional fixed-effects approach, they found that, holding all else equal, individuals were willing to pay more for a house proximate to a school with higher standardized test scores. Specifically, the elasticity of home values with respect to test scores was approximately equal to one. Other measures of school quality such as changes in test scores (i.e., the value-added of the schools) and per pupil expenditures did not appear to be significant determinants of house values. But the racial/ethnic composition of the local schools did seem to matter to home buyers, with house prices being lower near schools with larger fractions African-American and Hispanic. In the hedonic, the coefficient on the fraction of students in the school who were African-American was statistically significant and implied that a one percentage point increase in the share of students who were African-American would result in a 0.562 percent reduction in house prices. Interestingly, once the mean test performance and the racial/ethnic composition of a school were taken into account, house values were unrelated to the fraction low income and the fraction limited English proficient in the nearest elementary school.

Estimates of the relationship between school characteristics and property values that use either a boundary fixed effects approach or a more traditional fixed approach have strengthened our understanding of the nature of the relationship between schooling provision and property values and have confirmed that relationship is strong. At the same time, a number of studies, both some that have taken advantage of these methodological advances and some that have not, have produced a more nuanced view of the spatial variation in the nature of capitalization of schooling provision. Some of these studies have also shown that capitalization analyses must account the likely identity of the buyer of a property.

As Lang and Jian (2000) note, researchers have long recognized that, in a Tiebout-style setting, capitalization of school characteristics into house prices can only occur if the market is not in equilibrium or if perfect Tiebout sorting cannot occur because the assumptions laid out by Tiebout (1956) do not hold. Hilber and Mayer (2004) build on this logic to argue that the extent to which school characteristics will be capitalized into

property values will depend on the amount of developable land in a community, with little or no capitalization occurring in communities with readily available land for new development. They find evidence to support this argument using both data from Massachusetts and national data. Similarly, Brasington (2002) finds that, for metropolitan areas in Ohio, the extent of capitalization of school characteristics into property values declines the further from the urban center a property is located.

The relationship between school characteristics and property values depends not only on the location of the property but also on the likely identity of the buyer. For example, Hilber and Mayer (2004) show that the extent to which education spending is related to the fraction in the community who are elderly depends on the amount of developable land in the community. Elderly support for education spending is larger in those communities with less developed land, possibly because the elderly recognize that in the near future they may well be selling their house to a family with children. This is less likely to be true when new development is possible.

For similar reasons, capitalization of school characteristics into property values will be less the more likely it is that the prospective purchaser is acquiring the property as a vacation home. Johnson and Walsh (2009) find evidence consistent with buyers of vacation homes being very sensitive to local property tax rates. Whether owners of vacation homes account for other measures of public provision is an open question.

Does the Introduction of Accountability or School Choice Change the Equilibrium Distribution of House Prices?

During the last decade, two types of policy change have dramatically altered the nature of the set of choices available to consumers of elementary and secondary education: the universal introduction of school accountability as a result of the No Child Left Behind (NCLB) Act of 2001 and the growing importance of public school choice resulting from the growth of charter schools[6] and other public sector choice programs. While most of the research on these policy changes have focused on their impact on student achievement (see Figlio and Ladd, 2008; Gill and Booker, 2008; and Bifulco and Bulkley, 2008 for reviews of this research), several recent papers have examined the impact of these policy changes on house prices. Such impacts would be expected, since these policies have the potential of changing the relative attractiveness of communities by providing more information about the quality of public services or by breaking the link between where a child lives and where that child attends school.

6 Charter schools are independent public schools started by parents, teachers, or entrepreneurs and paid for by tax dollars. Anyone who can arrange transportation to the charter schools' home district is eligible to enroll in the school, and, if the school is oversubscribed, no information on past performance or other attributes of the prospective students can be used to select enrollees. The schools are freed from many state and local regulations that govern other public schools, thereby allowing the charter school administrators and teachers more autonomy.

Prior to NCLB, most states had in place some form of standardized testing and reporting of the results of those tests. What NCLB did in most states was increase the number of grades tested and encourage the modification of the reporting system so that the information provided on a school or a district was a grade or a percent proficient, rather than a mean test score. Thus, research on the impact of accountability on property values has focused not on whether test scores are related to property values but on the effect of new and/or different information on property values.

The general lesson from the work on the impact of accountability is that, while the initial release of standardized test scores alters the distribution across communities of property values, release of additional information beyond these initial test scores has very little impact on the distribution of property values. Figlio and Lucas (2004) were the first to establish this result. Using data on the two most recent sales of each developed parcel in 37 of Florida's 67 counties, Figlio and Lucas examined the impact of Florida's A+ system, which starting in 1999 assigned letter grades to each school in the state based on the standardized test performance of the school's students and on such other factors as the school's attendance rate. Because Figlio and Lucas had multiple observations on each parcel, they were able to control for parcel-specific fixed effects, in a manner similar to Downes and Zabel (2002). Thus, any changes in the distribution of property values was plausibly attributable to the introduction of the grading system.

And Figlio and Lucas (2004) found that, initially, the grading system did have large effects on the distribution of values, with properties served by schools with a grade of A in 1999 being, on average, worth 19.5 percent more than like properties served by schools with a grade of B. But, as significant year-to-year fluctuations in schools' grades made it apparent to observers that the grades provided little true information about schools that was not already revealed by test scores, these premiums for higher grades dissipated. Thus, in the long run the new accountability system had little, if any, impact on the distribution of house prices.

Using different methodologies in different contexts, Kane, Staiger, and Samms (2003) and Dills (2004) generated findings that closely parallel those of Figlio and Lucas (2004). Kane, Staiger, and Samms (2003) applied a regression discontinuity approach in their analysis of the relationship between property values and school characteristics in the Charlotte-Mecklenburg, NC area. They found that, while property values were higher in those areas served by schools with higher long-term mean student performance, year-to-year fluctuations in test scores did not result in changes in property values. Further, the introduction of a system of grading the schools had no impact on the distribution of property values, once long-term mean student performance was taken into account. Home buyers appeared to have decided that the year-to-year changes in test performance provided no new information about the effectiveness of a community's school. Instead, probably correctly given the existing evidence on the amount of noise in year-to-year test

score changes (Kane and Staiger, 2002), buyers focused on the history of a school's test performance.

Dills (2004), who used school district-level data on test performance and total house values in Texas, examined the impact of the introduction of a new testing system on property values in the state. She found that, while property values were related to a district's initial mean test scores under the new testing system, changes in test scores were not related to property values, once the initial test score was taken into account. Again, buyers acted as if there was little information provided by year-to-year fluctuations in performance, instead focusing on the test score information they felt signaled a school's or district's effectiveness in the long term.

This research on accountability systems seems to indicate that introduction of these systems affects the distribution across communities of property values only if buyers feel that the accountability systems are providing new information about the effectiveness of schools. The introduction of wide-scale school choice differs from an accountability system because the former changes the options available to consumers, while for the most part the latter only changes the information consumers have about those options (Figlio and Ladd, 2008). As a result, school choice programs are far more likely to affect the distribution of property values, if for no other reason than because choice can break the link between where a family lives and where that family's children attend school.

Brunner, Sonstelie, and Thayer (2001) looked at voting behavior in California on a school voucher initiative to see if there was evidence that home owners recognized that the implementation of school choice could alter the distribution of property values. They argued that home owners in precincts with good schools were most likely to experience declines in property values if choice was made available, since the premium associated with living near a good school would be dissipated by the fact that attendance at the school would no longer be linked to proximity to the school. Voting behavior for the initiative was consistent with this argument, but Brunner, Sonstelie, and Thayer were not able to show conclusively that voters in these precincts rejected the initiative because of the threat to their property values.

Evidence provided by Reback (2005) indicates that the voters in California would have been correct if they had perceived that choice was a threat to their property values. Beginning in the 1987-88 school year, Minnesota made it possible for students to enroll in any public school district in the state. Reback argued that, in the aftermath of such an open enrollment plan, property values would decline in those districts to which students transferred and would increase in those districts from which students transferred. Again, the logic behind this argument was that, once the link between residence and school attendance was broken, the premium attached to being located near a good school would

decline.[7] Looking at data on the percent change in total residential property values in school districts in Minnesota, Reback found that values did decline in districts that attracted enrollees and did increase in districts that lost students. And, while for reasons noted below, an analysis based on aggregate property values cannot provide as refined a picture of capitalization effects as an analysis that uses information on individual properties, Reback's results offer compelling evidence that wide-scale choice programs could have important distributional consequences.

Housing Prices and Finance Reforms

Dating back to the 1970s, the constitutionality of the systems states use to finance their public schools has been challenged in almost every state in the nation. These challenges have, in almost every state, resulted in fundamental changes in the system of financing the public schools. And, while much of the focus of the empirical work on school finance reforms has been on the impact of these reforms on education spending and on student performance, a significant body of research has developed that documents the variety of responses of states, localities, and private citizens to school finance reforms and that show that these responses vary in type and magnitude. The capitalization of the spending changes associated with court-mandated finance reforms into housing prices and rents is one potential outcome of such responses. That finance reforms could have important capitalization effects was first noted by Wyckoff (1996), who laid out a simple theoretical model in which changes in equalizing intergovernmental aid are capitalized into property values. Wyckoff went on to argue that these capitalization effects can have dramatic effects on the impact of the changes in the aid program on consumer well-being. Empirical evidence in line with Wyckoff's prediction was provided by Barrow and Rouse (2004), who established a positive relationship between state aid for K-12 education and property values.

Because the school finance landscape has changed so dramatically in the last 30 years and because the data to evaluate the capitalization effects of these changes has become available, in the last decade a literature on the capitalization effects of finance reforms has developed. The earliest work on the impact of finance reforms on housing costs was that of Dee (2000), who found that housing prices and rents increased more rapidly in states with court-mandated finance reforms, relative to states not facing such mandates. Further, the changes in property values were largest in those districts with the lowest pre-reform spending, as one would expect if the spending changes associated with court-mandated finance reforms were capitalized into housing prices and rents.

Dee's (2000) finding that the effects of court-mandated finance reforms were capitalized into property values was executed using national-level data on property values drawn

7 Kane, Staiger, and Samms (2003) point out that, since families prefer to be near the school their children attend, there will still be some premium attached to homes located near good schools.

from the Decennial Census. Numerous authors (e.g., Hoxby, 2001; Downes, 2004) have argued that the diversity of state responses to court mandates means that any national-level analysis necessarily groups together states in which the expected impact of reform is very different. Nevertheless, state-level analyses examining other potential effects of finance reforms have tended to confirm the results of national-level studies while providing a richer picture of the impact of the reforms. This seems to be true in this context, with state-level analyses both confirming elements of Dee's findings, while also providing a more nuanced picture of the impact of reforms on housing costs. For example, though Hoxby and Kuziemko (2004) found that in Texas property values in low-wealth communities increased after that state's finance reforms, they also argued that the "Robin Hood" school finance formula in that state destroyed $81 billion in property wealth in high-wealth communities. Similarly, Roy (2004) found that the finance reforms that followed Proposal A in Michigan served to close the gap between high and low spending districts in their trends in property values. This gap closing occurred primarily by slowing growth in districts that had been high spending prior to the reform, with these high spending districts also experiencing immediate declines in their per pupil housing stock after the finance reforms. Thus, both Hoxby and Kuziemko (2004) and Roy (2004) found that, while there were increases in property values in those districts that benefited most from the finance reforms, the capitalization effects were larger in the districts that benefited least from the reforms.

The findings of Sherlock (2008), who looked at the effects of finance reforms in Vermont on changes in aggregate residential property values after these reforms, are in sharp contrast to those of Hoxby and Kuziemko (2004) and Roy (2004). Sherlock found a positive relationship between the growth in property values and changes in student performance. But she also found a negative relationship between changes in education spending and property values, a result that she noted was both unexpected and in contrast with findings in the literature.

Sherlock's surprising result on the relationship between spending and property values may highlight a drawback to using Vermont data to execute a traditional capitalization study. As the discussion above of the general hedonics literature suggests, the availability of developable land and the importance of vacation homes in the Vermont market may help explain why results generated using Vermont data look different. In addition, most of the recent work on capitalization has utilized within metropolitan area variation to quantify the extent to which education provision is capitalized into property values. Within a metropolitan area labor market opportunities are the same, so residential choice will be determined primarily by variation in local taxes and public goods provision (Tiebout, 1956). Vermont is not a single labor market, so in that context estimating the extent to which schooling provision is capitalized into property values is particularly challenging. Only sharp changes in spending, like those that resulted from the state's school finance reforms, would be likely to produce the type of variation that would make it possible to isolate the relationship between schooling provision and property values.

The timing of Sherlock's data was such that she only had available information after 1999. By then, most of the finance reform-induced changes in the distribution of spending were already in place (Downes and Steinman, 2008). In the Vermont context, estimating the extent of capitalization requires data from before and after the state's school finance reform.

Sherlock also used administrative data on aggregate property values to construct her dependent variables. As a result, Sherlock used data on assessed, not market, values of property. Further, as Sherlock notes, her measure included changes in aggregate value attributable both to increases in the value of existing properties and to new construction. Quantifying the extent to which a state-level policy change, like a finance reform changes the relationship between schooling provision and property values necessitates holding constant the attributes of the housing stock. Otherwise, if, after a policy change, new construction in a community differed from the stock of housing that existed prior to that change, then some of the post-reform change in value would incorrectly be labeled as a change in the value of schooling provision. Since, with the exception of Dee (2000), all of the above-mentioned research on the impact of school finance reforms on property values has used data on aggregate values, this criticism applies to much of the existing research.

As may be apparent from the foregoing discussion, the methodological advances in the literature relating schooling provision and property values have not been as evident in this work examining the capitalization effects of finance reforms. The paper that comes closest to utilizing a methodology that incorporates the lessons of the recent literature is Brunner, Murdoch, and Thayer's (2002) analysis of the impact on Los Angeles area properties of the changes in the late 1970s in California's system of K-12 finance. Using data on tax-adjusted sales prices for properties in Los Angeles County for the years 1975, 1980, 1985, and 1990, Brunner, Thayer, and Murdoch estimated the extent to which changes in education spending and test scores were capitalized into property values. Because their data spanned the finance reform in California in the late 1970s, Brunner, Murdoch, and Thayer could quantify the impact of this reform on property values. They found that the reform resulted in convergence between high- and low-spending districts of the premium for schooling provision, an analogous result to those of Roy (2004) and Hoxby and Kuziemko (2004). Further, Brunner, Murdoch, and Thayer argued that this convergence appeared to be the result of leveling-down of the perceived quality of schooling provision.

Of the research quantifying the impact of finance reforms on property values, Brunner, Murdoch, and Thayer's comes closest to accounting for the innovations in methodology and data that have characterized the recent hedonics literature. Their use of data on individual sales and of district-specific fixed effects are particularly noteworthy. Their data do not, however, enable them to account for unobservable neighborhood characteristics using either a regression discontinuity design or a more traditional fixed effects approach. Also, as Dee (2000) notes, the unusual nature of the housing market in

California and of finance reform in that state may limit the generalizability of results based on California data. Further, the contemporaneous occurrence in California of finance reform and Proposition 13, that state's draconian property tax limit, means that any estimates using California data necessarily confound the effects of these two policy changes. For all of these reasons, the extent to which the cross-district changes in spending and schooling provision that follow finance reforms are capitalized into house values remains an open question.

Concluding Remarks

In the realm of elementary and secondary education, the last two decades have been marked by large scale policy changes at the state and federal level that had the potential to dramatically alter home buyers perceptions of the relative attractiveness of communities. At the same time, methodological innovations in the hedonics literature have improved researchers' ability to quantify the impact on property values of changes in perceived school quality. The result is a growing body of research, which is reviewed in this paper, that attempts to document the effect of these policy changes on property values while also accounting for the insights that have motivated the methodological innovations in the hedonics literature.

The most publicized of the recent large scale policy changes, the introduction of standards and accountability as typified by the systems put in place by many states after NCLB, appears to have had little impact on the distribution across communities of property values. This lack of an impact of accountability seems to be a result of the fact that home buyers feel that little new information about the relative quality of schools is provided by the accountability systems most states have put in place.

Broadened public school choice and reforms of states' systems of school financing do appear to change the equilibrium distribution of property values, possibly because home buyers feel that these policy changes substantively alter the quality of school options in many communities. The evidence on the impact of these policy changes is, however, less definitive than the evidence on the impact of accountability, mainly because research on the impact of these policy changes has not been able to take advantage of the methodological advances in the hedonics literature as effectively as has the research on the impact of accountability. An important task for future research is identifying data sets and contexts in which the impact of broadened choice or of finance reforms can be explored using data on individual properties and in which the effects of changes in perceived school quality can be isolated from the effects of changes in the attributes of the neighborhood in which a house is located.

References

Barrow, Lisa and Rouse, Cecilia E. [2004] "Using Market Valuation to Assess Public School Spending." *Journal of Public Economics* 88: 1747-1769.

Bifulco, Robert and Bulkey, Katrina. [2008]. "Charter Schools." In Helen F. Ladd and Edward B. Fiske, editors, *Handbook of Research in Education Finance and Policy* (New York: Routledge): 166-182.

Black, Sandra. [1999] "Do Better Schools Matter? Parental Valuation of Elementary Education." *Quarterly Journal of Economics* 114: 577–599.

Bogart, William T., Bradford, David F. and Williams, Michael G. [1992] "Incidence Effects of a State Fiscal Policy Shift: The Florio Initiatives in New Jersey," *National Tax Journal* 45: 371-87

Bogart, William T. and Cromwell, Brian A. [1997]. "How Much More Is a Good School District Worth?," *National Tax Journal* 50: 215-232.

_____. [2000]. "How Much Is a Neighborhood School Worth?," *Journal of Urban Economics* 47**:** 280-305.

Bradbury, Katherine L., Mayer, Christopher J., and Case, Karl E. [2001] "Property Tax Limits, Local Fiscal Behavior, and Property Values: Evidence from Massachusetts under Proposition 2½." *Journal of Public Economics* 80: 287-311.

Brasington, David M. [2002] "Edge versus Center: Finding Common Ground in the Capitalization Debate." *Journal of Urban Economics* 52: 524-541.

_____ and Haurin, Donald R. [2006] "Educational Outcomes and House Values: A Test of the Value-Added Approach." *Journal of Regional Science* 46 (May): 245-268.

Brunner, Eric J., Murdoch, James, and Thayer, Mark. [2002] "School Finance Reform and Housing Values: Evidence from the Los Angeles Metropolitan Area." *Public Finance Management* 2 (4): 535-565.

Brunner, Eric J., Sonstelie, Jon, and Thayer, Mark. [2001] "Capitalization and the Voucher: An Analysis of Precinct Returns from California's Proposition 174." *Journal of Urban Economics* 50: 517-536.

Cheshire, Paul and Sheppard, S. [2004] "Capitalising the Value of Free Schools: The Impact of Supply Characteristics and Uncertainty." *Economic Journal* 114:

F397-F424.

Clapp, John M., Nanda, Anupam, and Ross, Stephen L. [2008] "Which School Attributes Matter? The Influence of School District Performance and Demographic Composition on Property Values." *Journal of Urban Economics* 63: 451-466.

Clapp, John M. and Ross, Stephen L. [2004] "Schools and Housing Markets: An Examination of School Segregation and Performance in Connecticut." *Economic Journal* 114: F425-F440.

Dee, Thomas S. [2000] "The Capitalization of Education Finance Reforms." *Journal of Law and Economics* 43 (April): 185-214.

Dills, Angela A. [2004] "Do Parents Value Changes in Test Scores? High Stakes Testing in Texas." *Contributions to Economic Analysis and Policy* 3(1): Article 10.

Downes, Thomas A. [2004] "School Finance Reform and School Quality: Lessons from Vermont," in John Yinger, editor, *Helping Children Left Behind* (Cambridge, MA: MIT Press).

Downes, Thomas A. and Steinman, Jason. [2008] "Alternative Revenue Generation in Vermont Public Schools: Raising Funds Outside the Tax Base to Support Public Education." Medford, MA, Tufts University, Mimeo.

Downes, Thomas A. and Zabel, Jeffrey. [2002] "The Impact of School Quality on House Prices: Chicago 1987-1991." *Journal of Urban Economics* 52 (July): 1-25.

Fack, Gabrielle and Grenet, Julien. [2008] "When do Better Schools Raise Housing Prices? Evidence from Paris Public and Private Schools." Paris, Paris School of Economics, Mimeo.

Figlio, David N. and Ladd, Helen F. [2008] "School Accountability and Student Achievement." In Helen F. Ladd and Edward B. Fiske, editors, *Handbook of Research in Education Finance and Policy* (New York: Routledge): 166-182.

Figlio, David N. and Lucas, Maurice E. [2004] "What's in a Grade? School Report Cards and the Housing Market." American Economic Review 94 (June): 591-604.

Fischel, William A. [1998] "School Finance Litigation and Property Tax Revolts: How Undermining Local Control Turns Voters Away from Public Education." Lincoln Institute of Land Policy Working Paper, Cambridge, MA, Lincoln Institute of Land Policy.

_____. [2001] *The Homevoter Hypothesis* (Cambridge, MA: Harvard University Press).

Gibbons, Steve, and Machin, Stephen. [2003] "Valuing English Primary Schools." *Journal of Urban Economics* 53 (March): 197-219.

Gill, Brian and Booker, Kevin. [2008]. "School Competition and Student Outcomes." In Helen F. Ladd and Edward B. Fiske, editors, *Handbook of Research in Education Finance and Policy* (New York: Routledge): 166-182.

Glaeser, Edward L. [1996] "The Incentive Effects of Property Taxes on Local Governments." *Public Choice* 89 (October): 93-111.

_____, Gyourko, Joseph, and Saiz, Albert. [2008] "Housing Supply and Housing Bubbles." Cambridge, MA, Harvard University, Mimeo.

Haurin, Donald R. and Brasington, David. [1996] "The Impact of School Quality on Real House Prices: Interjurisdictional Effects," *Journal of Housing Economics* 5: 351-368.

Hayes, Kathy J. and Taylor, Lori L. [1996] "Neighborhood School Characteristics: What Signals Quality to Homebuyers?," *Economic Review - Federal Reserve Bank of Dallas* Fourth Quarter: 2-9.

Hilber, Christian A. L. and Mayer, Christopher J. [2004] "Why Do Households Without Children Support Local Public Schools?" National Bureau of Economic Research Working Paper Series No. 10804, Cambridge, MA, National Bureau of Economic Research.

Hoxby, Caroline M. [2001] "All School Finance Equalizations Are Not Created Equal: Marginal Tax Rates Matter." *The Quarterly Journal of Economics* 116 (November): 1189-1231.

Hoxby, Caroline M., and Ilyana Kuziemko. [2004] "Robin Hood and His Not-So-Merry Plan: Capitalization and the Self-Destruction of Texas's School Finance Equalization Plan." National Bureau of Economic Research Working Paper Series No. 10722, Cambridge, MA, National Bureau of Economic Research.

Johnson, Erik B. and Walsh, Randall. [2009] "The Effect of Property Taxes on Location Decisions:Evidence From the Market for Vacation Homes." National Bureau of Economic Research Working Paper Series No. 14793, Cambridge, MA, National Bureau of Economic Research.

Kane, Thomas J., Riegg, Stephanie K., and Staiger, Douglas O. [2006] "School Quality, Neighborhoods, and Housing Prices." *American Law and Economics Review* 8 (Summer): 183-212.

Kane, Thomas J. and Staiger, Douglas O. [2002] "The Promise and Pitfalls of Using Imprecise School Accountability Measures." *Journal of Economic Perspectives* 16 (Fall): 91-114.

Kane, Thomas J., Staiger, Douglas O., and Samms, Gavin. [2003] "School Accountability Ratings and House Values." *Brookings-Wharton Papers on Urban Affairs* 4: 83-127.

Kenyon, Daphne. [2007] The Property Tax - School Funding Dilemma (Cambridge, MA: The Lincoln Institute of Land Policy).

Kiel, Katherine A. and Zabel, Jeffrey E. [1997]. Evaluating the Usefulness of the American Housing Survey for Creating House Price Indices, *Journal of Real Estate Finance and Economics* 14: 189-202.

Lang, Kevin and Jian, Tianlun. [2000] "Property Taxes and Property Values: Evidence from Proposition 2½." Boston, Boston University, Mimeo.

Leech, Dennis and Campos, Erick. [2003] "Is Comprehensive Education Really Free? A Case Study of the Effects of Secondary School Admissions Policies on House Prices in One Local Area." *Journal of the Royal Statistical Society Series A (Statistics in Society)* 166 (Part 1): 135-154.

Mieszkowski, Peter and Zodrow, George R. [1989] "Taxation and the Tiebout Model: The Differential Effects of Head Taxes, Taxes on Land Rents, and Property Taxes," *Journal of Economic Literature* 27: 1098-1146.

Oates, Wallace E. [1969] "The Effects of Property Taxes and Local Public Spending on Property Values: An Empirical Study of Tax Capitalization and the Tiebout Hypothesis." *Journal of Political Economy* 77: 957–971.

Reback, Randall. "House Prices and the Provision of Local Public Services: Capitalization Under School Choice Programs." *Journal of Urban Economics* 57: 275-301.

Roy, Joydeep. [2004] "Effect of a School Finance Reform on Housing Stock and Residential Segregation: Evidence from Proposal A in Michigan." Washington, DC, Economic Policy Institute, Mimeo.

Shelly, Bryan. [2007] "Local Control, Democracy, and Separation in the Public Opinion of School Finance Reform." *Journal of Educational Research & Policy Studies* 7(1): 15-35.

Sherlock, Molly. [2008] "Capitalization and Vermont's Act 60." New York, City University of New York, Mimeo.

Ross, Stephen, and Yinger, John. [1999] "Sorting and Voting: A Review of the Literature on Urban Public Finance." In *Handbook of Urban and Regional Economics, Volume 3, Applied Urban Economics*, edited by P. Cheshire and E. S. Mills (North-Holland): 2001-2060.

Sheppard, S. [1999] "Hedonic Analysis of Housing Markets." In *Handbook of Urban and Regional Economics, Volume 3, Applied Urban Economics*, edited by P. Cheshire and E. S. Mills (North-Holland): .

Taylor, Laura O. [2008] "Theoretical Foundations and Empirical Developments in Hedonic Modeling." In *Hedonic Methods in Housing Markets: Pricing Environmental Amenities and Segregation*, edited by Andrea Baranzini, José Ramirez, Caroline Schaerer, and Philippe Thalmann (New York: Springer: 2008): 15-54.

Tiebout, Charles M. [1956] "A Pure Theory of Local Public Expenditures." *Journal of Political Economy* 64: 416-424.

Weimer, David L. and Wolkoff, Michael J. [2001] "School Performance and Housing Values: Using Non-Contiguous District and Incorporation Boundaries to Identify School Effects," *National Tax Journal* 54: 231-253.

Wyckoff, Paul G. [1996] "Capitalization, Equalization, and Intergovernmental Aid." *Public Finance Quarterly* 23 (October): 484-504.

Yinger, John, editor. [2004] *Helping Children Left Behind* (Cambridge, MA: MIT Press).

Yinger, John. [2009] "Hedonic Markets and Explicit Demands: Bid-Function Envelopes for Public Services, Neighborhood Amenities, and Commuting Costs." Syracuse, NY, Center for Policy Research, Maxwell School, Syracuse University, Mimeo.

Yinger, John, Bloom, Howard S., Börsch-Supan, Axel, and Ladd, Helen F. [1988] *Property Taxes and House Values: The Theory and Estimation of Intrajurisdictional Property Tax Capitalization* (San Diego, CA: Academic Press).