School Quality and Massachusetts Enrollment Shifts in the Context of Tax Limitations

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Like most states, Massachusetts underwent a large shift in public school enrollments between the 1980s and 1990s, requiring a number of sizable fiscal and educational adjustments by individual school districts. Between school years 1980 and 1989, the number of students in kindergarten through grade 12 fell 21 percent, from 1.04 million to 825,000. As children of baby boomers reached school age, the picture changed and enrollments grew more than 90,000 over the next seven years. These aggregate trends gloss over even more marked shifts at the local level.

Consider the communities of Brookline and Arlington, whose public school enrollments in school year 1980 were 6,246 and 6,245, respectively. Both are suburban communities located close to downtown Boston with little buildable land. The quality of Arlington's schools is considered slightly above average for the state, while Brookline's schools are perennially ranked among the top districts in the Commonwealth. By the mid 1990s the enrollment patterns for the two districts could not have looked more different. Arlington was closing schools. Despite the pickup in aggregate statewide enrollments, its 1996 enrollment was 4,059, a drop of more than one-third from 1980. Meanwhile Brookline experienced a much smaller decline in its number of students in the 1980s and faced an influx of students in the 1990s. By 1996, its enrollment was 6,039, barely 3 percent below its level in 1980.

This disparate pattern of enrollment shifts was not unique to these two communities. During the same 16-year period, almost one-quarter of Massachusetts communities lost more than 20 percent of students from their 1980 levels; at the other extreme, one-quarter gained more than 12 percent. These shifts in enrollment posed a significant fiscal challenge for communities struggling to provide facilities and teachers for the widely varying numbers of students. After all, educational expenditures represent almost one-half of the local budget for a typical community in Massachusetts.

The fact that households move is not surprising. Economists since Tiebout (1956) have recognized that households sort themselves based on their ability to pay and their preferences regarding both local public services and local housing characteristics, and these preferences can change over time as families begin having children or households decide to retire. Location models would predict a "flight to quality," for example, as households with children who reach school age choose to move to communities with higher-quality schools.

Shifts in school enrollment can pose a significant fiscal challenge: Educational expenditures represent almost one-half of the local budget for a typical community in Massachusetts.

As documented below, this pattern of sorting greatly increased between the 1980s and the 1990s in Massachusetts, with a much higher percentage of households with children moving in recent years. Demographics may explain part of this pattern. In the 1980s aggregate school enrollments were declining as the tail end of the baby boom was exiting the public schools and many older baby boomers had delayed childbearing. In the 1990s school enrollments were again rising. In addition, baby-boomers who were having children in the 1990s had additional income to spend on housing based on gains made in the housing market from the 1980s.

As households change their desires based on life-cycle considerations, economic models also predict that communities would adjust the amount of public services (such as police, fire, and schools) in response to the changing desires of households. Thus, one might have expected cities and towns to respond to the demographically driven increase in demand for good schools in the 1990s by raising educational expenditures. However, a statewide property tax limitation measure, Proposition 2½, raised strong barriers to providing desired services in some communities.

This article investigates the degree to which the constraints of Proposition 2½, and other factors such as demographic and economic shifts and differences in school quality, affected the adjustments that both local governments and households in the Commonwealth made to a demographically driven turnaround in enrollment growth. The research accomplishes this task by comparing changes in enrollments in the first half of the 1980s to those in the first half of the 1990s. It relies on two sources of data to measure and analyze the mobility of students over time: Census estimates of the number of children living in each town in Massachusetts in 1980 and 1990, and annual public school enrollments from 1980 to 1995.

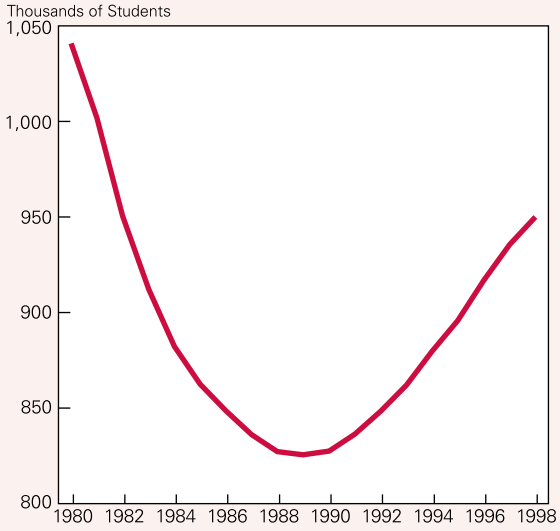
The study reports three major findings. (1) Net public school enrollment changes are positively related to differences across communities in school quality. (2) Shifts in enrollments were much more pronounced in the 1990s, when aggregate enrollments were rising and the economy was improving. (3) Proposition 2½ appears to have significantly altered the pattern of enrollment changes, with families with students moving to districts less constrained by this property tax limit.

The article is organized as follows. Section I documents the large cross-sectional differences in public school enrollment changes across Massachusetts communities in the 1980s and 1990s and relates them to differences in test scores. The next section discusses the manner in which households make residential location choices, sorting themselves among localities, and describes the economic, demographic, and political changes that affected these outcomes in the Commonwealth over the sample period. Section III presents regression results that examine the relationship between various community characteristics related to this broad context and the difference between actual

Economic models predict that communities will adjust the amount of public services in response to the changing desires of households. However, in Massachusetts Proposition 2½ raised strong barriers to providing desired services in some communities.

Figure 1

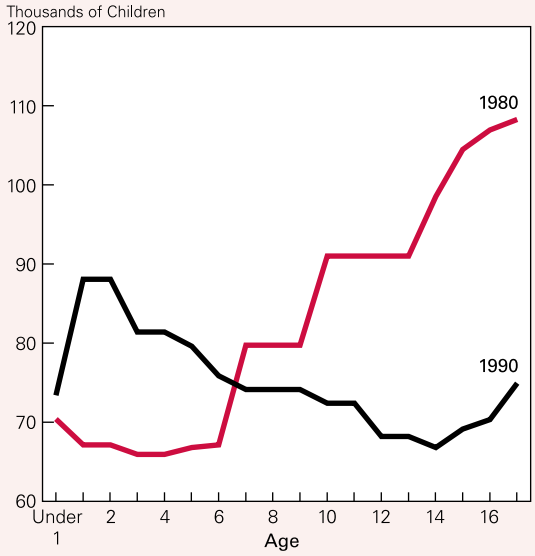
Elementary and Secondary Public School Enrollment in Massachusetts



Note: Enrollment as of October 1 of previous year.
Source: Massachusetts Department of Education, Individual School Report.

Figure 2

Age Distribution of Children in Massachusetts
1980 Census and 1990 Census



Note: Age distribution is interpolated for Census age groups that include more than one year (1–2, 3–4, 7–9, 10–11, 12–13).
Source: U.S. Bureau of the Census, Census of Population and Housing.

and demographically predicted changes in enrollments from 1980 to 1985 and 1990 to 1995. The conclusion explores the implications of the results.

I. Patterns of Enrollment Change in Massachusetts in the 1980s and 1990s

Public school enrollments declined statewide in Massachusetts in the 1980s and expanded in the 1990s (Figure 1). The 1980s decline was driven by demographics in that birth cohorts in the state had been shrinking over time. The situation reversed around 1990 when statewide enrollments began to expand. This change, too, was demographically driven, as birth cohorts grew larger beginning in the mid 1980s, leading to larger cohorts of first-graders replacing smaller cohorts of graduating high school seniors starting around 1990. This general pattern is consistent with the experience of other states over the same period. Figure 2 depicts the age distribution of preschool and school-age children in Massachusetts in 1980 and 1990. In 1980, the small preschool cohorts relative to large high school cohorts presage the ensuing enrollment losses. Similarly, in 1990 the bulge in preschool-age children compared to school-age children foretells the early 1990s enrollment gains.

Table 1 reports statewide enrollment in grades 1 through 8 from school year 1979–80 to school year 1994–95 (henceforth referred to, like fiscal years, as 1980 and 1995), with the number of public school students dropping in the early 1980s, stabilizing in the second half of the 1980s, and rising in the early 1990s.[1]

Since every student who would be in grade 1 and above in 1985 had been born by 1980 (and similarly for 1995 by 1990), Figure 2's data on the distribution of

[1] Grades 1 to 8 are used for this exercise rather than the full range of kindergarten through twelfth grade because there is more "noise" in the data for the highest and lowest grades. Kindergarten attendance is not required by Massachusetts law; hence some of the variation among communities in kindergarten enrollment simply reflects parental decisions about children's "readiness" for school and choices between day care and school enrollment. Similarly, dropouts become a factor in high school, introducing another difference among communities in public school enrollment that is unrelated to parental decisions about residential location or private school. In addition, regional vocational school enrollments are more difficult to allocate to individual cities and towns than other regional school enrollments; vocational schools operate only in grades 9 and up.

Table 1
Public School Enrollment in Massachusetts, 1980 to 1995
Grades 1 through 8, Statewide

	1980	1985	1990	1995
Enrollment (000)	608.2	491.6	502.6	560.4
5-Year % Change		−19.2		11.5
Population (000)				
Age 6 to 13	670.4	n.a.	579.7	n.a.
Age 1 to 8	559.7	n.a.	642.9	n.a.
Predicted 5-Year % Change in Enrollment[a]		−16.5		10.9
Actual minus Predicted (percentage points)		−2.7		.6

n.a. = not available

[a]Predicted change in enrollment is the beginning-of-period ratio of (population age 1 to 8) to (population age 6 to 13) minus 1, expressed as percent.

Source: Massachusetts Department of Education, U.S. Bureau of the Census.

preschool and school-age population of Massachusetts residents from the decennial Census provide a quantitative demographic "prediction" of enrollment changes in the first half of each decade.[2] These predictions indicate how enrollment would change if no families moved into or out of the state and private school enrollment rates were unchanged.[3]

For the state as a whole, public school enrollment in grades 1 to 8 shrank 19.2 percent from 1980 to 1985; the 1980 age mix implied a 16.5 percent decline in the ensuing five years. Presumably some families with school-age children moved out of the state or out of the public schools in the early 1980s, making the actual loss somewhat greater than the predicted loss. Net migration was slightly positive for Massachusetts during the 1980–85 period, but net migration results from large gross flows in each direction. Families with school-age children may have moved away, on net, and been (more than) replaced by other family types moving in; private school enrollment rates did rise in the 1980s (no data are available for the mid-decade year 1985).

Between 1990 and 1995, enrollments rose 11.5 percent. The 1990 Census showed a cohort aged 1 to 8 that was 10.9 percent bigger than the overlapping cohort aged 6 to 13, predicting a gain only slightly smaller than what actually occurred. Again, some combination of net in-migration of families with school-age children and declining private school enrollment rates could explain the small gap between the predicted and actual changes. Overall, Massachusetts experienced substantial out-migration of population, on net, in the 1990–95 period. But it may be that the out-migration response to the severe downturn of the early 1990s was concentrated among households without children, and that families with children were moving in and were somewhat more likely to attend public schools. In addition, the recession may have caused some resident families to forgo private schools for their children.

While demographic swings reduced and then augmented public school enrollments statewide, enrollments in individual communities were not moving in lockstep. Individual districts experienced these statewide shifts to a greater or lesser degree, depending not only on their beginning-of-period age mix but also on net movements of families with children into or out of the district and into or out of private schools in each period. Table 2 reports average actual and predicted 1980–85 changes in enrollment for communities grouped by local public school quality as measured by standardized test scores. (See the Box for a description of this measure of school quality and Appendix Table A1 for a list of cities and towns in each group.) In the early 1980s when enrollments were dropping statewide, enrollments in higher-quality school districts fell faster than enrollments in lower-quality districts, on average (column 1). The top 5 percent of communities lost an average of 22 percent of their students from 1980 to 1985 while the lowest 5 percent lost 14 percent.[4]

These differences among communities in rates of enrollment growth are consistent with what would be predicted by demographics, but movements among communities offset some of the effects of differences in 1980 age mix. According to the 1980 Census, the

[2] Because Census data are collected only every 10 years, this calculation can be done only for the first half of each decade.

[3] Private school enrollment rates are implicit in the Census-year ratio of public school enrollment to population. The predictions also implicitly assume that death rates are the same for preschool and school-age children. Since death rates are, in fact, higher among younger children, predicted enrollment growth is overestimated.

[4] The "all communities" differences between actual and predicted enrollment changes in Tables 2 and 3 do not exactly match the aggregate differences shown in Table 1 for two reasons: (i) Tables 2 and 3 report averages for only 321 communities (30 communities with 1980 enrollments under 150 excluded) while Table 1 includes all 351 cities and towns in the state; (ii) data observations for each community are weighted by beginning-of-period enrollment in calculating average changes by group in Tables 2 and 3 whereas Table 1's statewide totals implicitly weight each change by its own denominator.

Table 2
1980–85 Enrollment Changes by School Quality
Average percent change in grades 1–8 enrollment for 321 Massachusetts communities grouped by school quality

School Quality Rank	Actual Enrollment Change	Predicted Enrollment Change	Difference (percentage points)	Number of Communities
Lowest 5 percent	−13.5	−9.0	−4.5	16
Next 20 percent	−20.5	−14.1	−6.4	65
Below-median quartile	−20.8	−18.4	−2.4	79
Above-median quartile	−20.2	−19.5	−.7	80
Next 20 percent	−22.9	−24.7	1.7	66
Highest 5 percent	−22.4	−27.9	5.5	15
All	−19.2	−16.8	−2.5	321

Note: See Table 1 for explanation of predicted enrollment change.
Community data weighted by 1980 enrollment in grades 1 through 8.
School quality measure is average eighth-grade math and reading test scores, 1988-94.
See Appendix Table A2 for variable definitions and sources.

Table 3
1990–95 Enrollment Changes by School Quality
Average percent change in grades 1–8 enrollment for 321 Massachusetts communities grouped by school quality

School Quality Rank	Actual Enrollment Change	Predicted Enrollment Change	Difference (percentage points)	Number of Communities
Lowest 5 percent	5.3	17.8	−12.6	16
Next 20 percent	11.7	12.3	−.6	65
Below-median quartile	11.4	6.9	4.4	79
Above-median quartile	12.4	7.5	4.9	80
Next 20 percent	19.0	5.3	13.7	66
Highest 5 percent	22.5	3.7	18.8	15
All	11.5	10.7	.8	321

Community data weighted by 1990 enrollment in grades 1 through 8.
Note: See Table 2.

high-test-score communities had relatively fewer young children than communities with lower school quality, leading to a prediction of greater enrollment declines (in percentage terms) in high-score communities (column 2). The third column shows the difference between actual and predicted enrollment changes, which is a measure of intercommunity migration and shifts in private school attendance over the five years. These data indicate that migration and changes in private school attendance rates augmented public school enrollments in communities with higher-quality schools, compared with predictions, between 1980 and 1985. Many families with young children in 1980 apparently moved out of low-score communities as their children grew older, adding to public school enrollments in towns with higher test scores.

Table 3 reports similar data for the 1990 to 1995 period. The difference between actual and predicted enrollments across communities is much larger in this time period than the previous one. As enrollments rose statewide, high-score districts enjoyed greater student growth than low-score districts, with first through eighth grade headcounts rising 23 percent in the 15 towns with the highest test scores and only 5 percent in the 16 communities with the lowest scores. The age mix in 1990 predicts the opposite pattern of enrollment changes; as in 1980, the high-test-score communities had fewer preschool and primary-grade children relative to those of school age than the lower-score communities. Interjurisdictional movements and changes in private school enrollment patterns more than offset the initial demographics. These movements reduced the relative growth in student counts in the communities with the lowest test scores by over 12 percentage points, on average, and added 19 percentage points to the gains of the highest test-score communities.

Thus, net intercommunity movements of families with children and changes in private school attendance rates were positively associated with school quality during both periods, 1980–85 and 1990–95. The attraction of high-quality schools was much more pronounced in the 1990s, when enrollments were generally rising, than in the 1980s, when decreasing numbers of youngsters arrived at the schoolhouse door each year.[5]

[5] The school quality index is actually measured in the years surrounding 1990, as noted in the Box. It may be that the weaker relationship between school quality and net enrollment change in the 1980s as compared with the 1990s is partly due to a weaker relationship between the school quality index and actual school quality in the early 1980s (as observed or perceived by parents).

Measure of School Quality

Local school quality is measured by the average score on eighth grade reading and math assessment tests between 1988 and 1994. Community rankings differ very little on reading versus math, so the two are summed in this measure. The Massachusetts Educational Assessment Program (MEAP) tests were given to all Massachusetts public school eighth-graders in even-numbered years, but they have been discontinued in favor of a new set of tests beginning in 1998. While these tests are useful in generating a relative ranking of school quality across districts, they are not designed for comparison between years. In fact, the mean and variance of the scores are standardized in each year and the Massachusetts Department of Education explicitly warns against using the tests for comparisons over time. Consequently, the average score for each public school district, averaged over the years 1988 through 1994, is used only as a measure of cross-sectional differences in quality.

Test scores reflect a specific aspect of school quality—how well the average student performs on standardized tests. Test scores vary across districts both because the quality and quantity of "school inputs" such as teachers, books, and science labs vary across districts and because the quality of "student inputs" varies—some students enter school with more barriers to learning than others. For example, physical and mental disabilities and poor nutrition may handicap individual students; so may a lack of books or role models for academic achievement at home. Test scores can also be influenced by "peer effects," a term that encompasses the role of a student's neighborhood and in-school classmates in shaping expectations and performance. Because many of these influences on test scores cannot be determined by educational or budget decisions of schools or districts, test scores are a poor measure of "school quality" in the sense of how well a school is able to advance the learning of the students who attend it. But from the point of view of parents who want "the best education" for their children, peer effects can be just as important as school-determined factors such as teacher quality and curriculum. Thus, test scores can be a useful shorthand measure of the broader aspects of school quality that matter to parents choosing public schools for their children.

II. The Demographic, Economic, and Fiscal Context in Massachusetts

Differences in the degree of sorting between the 1980s and 1990s may be explained by a number of factors. Households' residential location choices will be influenced by the availability of public services and other amenities in individual cities and towns if they value these community characteristics to different degrees and if they are relatively mobile across communities. Any household's demand for housing in a particular community will reflect the degree to which its own preferences match the town's characteristics, as well as its ability to pay relative to the cost of locating there.[6]

At any point in time, households would be expected to have sorted themselves among communities according to their valuation of the specific attributes available in each place. For example, if a particular characteristic such as school quality is more important to one group of households, such as those with children, then one would expect to see more households with children in communities with high-quality schools, unless other types of households are able to outbid them for some reason. This sorting process is ongoing, as new households continuously enter the market. Furthermore, existing households might alter their location choices as their own preferences change, as community attributes change, or as the sorting and hence demand for housing of other households is disturbed by other shifts.

Thus, the redistribution of students across towns results from the interaction of demographics, economic conditions, and the housing market with local public sector attributes such as school quality. These factors form the context in which residential mobility occurs, and should help explain why actual public school enrollments in both 1985 and 1995 were greater

[6] Ross and Yinger, forthcoming, summarize a broad literature related to the allocation of households among communities, focusing on the role and endogeneity of the local public sector.

Table 4
Homeownership by Age of Head of Household

Age of Head	U.S. Homeownership Rate (Percent) 1980	1990
All	65.6	64.1
<25	21.3	15.3
25–29	43.3	35.9
30–34	61.1	51.5
35–39	70.8	63.1
40–44	74.2	70.4
45–54	77.7	76.1
55–64	79.3	80.4
65–74	75.2	78.7
>74	67.8	71.0

Source: Joint Center for Housing Studies, Harvard University, "The State of the Nation's Housing," 1991.

Table 5
Presence of Children by Age of Head of Household

Age of Head	U.S. Households with Children as Percent of all Households 1980	1990
All	39.1	33.9
<25	33.8	31.1
25–34	60.0	54.6
35–44	74.8	64.1
45–64	28.9	32.6
>64	2.8	3.1

Source: Joint Center for Housing Studies, Harvard University, "The State of the Nation's Housing," 1991 and 1996.

in communities with better schools than what would have been predicted assuming no households with children had moved into or out of any town. Furthermore, changes in this context may explain why the flight to quality was especially pronounced in the 1990s.

Demographic Bulge, Household Incomes, and the Housing Market

Aggregate enrollments were declining in the 1980s and rising during the 1990s, a sea change that one would expect to be associated with a shift in the strength of overall demand for and interest in schools and school quality in different locations. "Baby boomers," born during the period of high birth rates between 1946 and 1964, produced a bulge in the population distribution that has had a substantial effect on many areas of the economy.[7] The size and shape of the baby-boom bulge was similar in Massachusetts and the nation, although the post-boom cohort—the "baby bust"—was somewhat smaller in Massachusetts; that is, the post-boom drop-off was somewhat steeper in Massachusetts.

In 1980, the boomers were between the ages of 16 and 34. The bulk of them were in their twenties and, as shown in Table 4, home ownership rates have always been low for this age group. In 1980, only 21 percent of U.S. households with the head under age 25 and 43 percent of households headed by individuals between 25 and 29 years old owned homes, while over three-fifths of older householders were homeowners. Similarly, households with younger heads are less likely to contain children. Table 5 reports the fraction of households with children by age of head. In 1980, only one-third of households with head under age 25 included children, as compared with three-fifths of those with heads ages 25 to 34 and three-quarters of those in which the head was between 35 and 44 years old.

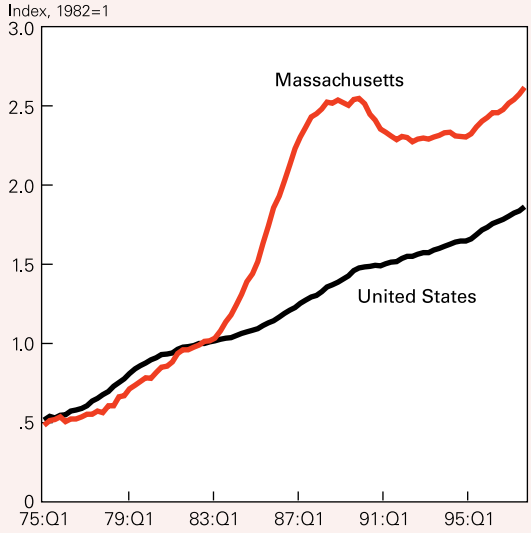
As the baby boom cohort aged from 1980 to 1985 (when they ranged in age from 21 to 39), an increasing number of its members had children and many young baby boomers entered the housing market as first-time buyers. Not only were these households moving up their "age-earnings" profiles, but per capita income was rising faster in Massachusetts than in the United States as a whole (see Case 1986). Housing prices began to rise sharply in late 1984, but did not explode upwards until 1985. (See Figure 3 and Case and Mayer 1996).

The period between 1985 and 1990 was one of dramatic change. Home prices in the average Massachusetts community nearly tripled. A home purchased for $100,000 in 1982 sold for $275,000 in 1989 at the peak of the market, with most of the appreciation

[7] In a provocative and often cited paper, Mankiw and Weil (1989) argue that the aging of the "baby boom" would lead to a substantial decline in housing prices as that cohort aged and moved out of the housing market. While its drastic conclusions have been challenged by a number of authors, it highlights clearly the potential importance of demographics. In a related study, Case and Mayer (1996) show that differences in demographics due to the baby boom can affect the relative price of housing across different communities.

Figure 3

Home Prices
Repeat Sales Price Index for Homes with Conventional Mortgages



Source: Fannie Mae and Freddie Mac.

occurring between 1985 and 1988 (Case and Mayer 1995). The largest price increases were recorded in the lower-income towns where many first-time buyers resided. Then in 1989, the Massachusetts "miracle" began to dissolve. The region's real estate boom turned to bust and the New England region headed into the 1990–91 recession well before the rest of the nation.

By 1990, the boomer cohort was between 26 and 44—mostly in its thirties. While the younger boomers were still first-time home buyers, the older group had children in school and were ready to trade up. Aggregate school enrollments were rising. The recession of 1990–91 was followed by recovery beginning in 1992, and conditions were ripe for older boomers with children to purchase homes in better school districts. Housing prices had come down between 10 and 15 percent and mortgage interest rates fell to record lows in 1992 and 1993. While incomes stagnated in 1990 and 1991, they resumed their upward trend in 1992 and, in addition, the boomers were moving into their peak earning years.

Equally important, households wanting to trade up came to the table with equity. Table 6 shows the equity buildup by mid 1990 for a household that had bought a $100,000 home between 1982 and 1987. The average household buying a home before 1986, as many baby-boomers did, had gained between $70,000 and $170,000 in equity by 1990. The 1989–92 fall in housing prices resulted in only a small decline in equity relative to the sizable gains of the mid 1980s.

Table 6
Equity in 1990 in a $100,000 Home by Year of Purchase

Year Purchased	Equity in 1990
1982	$170,000
1983	146,000
1984	106,000
1985	69,000
1986	40,000
1987	24,000

Note: Includes appreciation based on Massachusetts repeat sales conventional mortgage home price index and amortization of an 80 percent loan at 8 percent.
Source: Authors' calculations based on data from Fannie Mae and Freddie Mac.

The combination of cash buildup, low interest rates, and higher and rising incomes meant that trade-up buyers could now afford to buy into the school systems that they and their predecessors could not afford a decade earlier. And the aging of the baby boomers meant that more of them had children, implying that a greater fraction of households were interested in schools. As a result, the distribution of enrollments dramatically shifted towards the better school districts between 1990 and 1995.

Change in Local Fiscal "Rules"

Added to these demographic and economic changes in Massachusetts was the property tax limitation measure, Proposition 2½. Passed by voters in November 1980, it required communities in Massachusetts to reduce their property tax levies by 15 percent per year until they attained a maximum rate of 2.5 percent of the market value of property. Once those cuts had occurred, the property tax levy could not exceed the town's levy limit, which rose by only 2.5 percent per year, plus an allowance for new development, unless local voters passed an override to increase taxes more.

About two-fifths of the state's 351 cities and towns were required to make budget cuts in fiscal year 1982; all had reached the 2.5 percent rate limit by fiscal year 1984. After the initial cuts, Proposition 2½ had only minor effects on local budgets from 1985 to 1990 because of three favorable factors: The Commonwealth provided sizable increases in local aid, the real estate boom led to considerable new development that increased the tax base, and school enrollment declines reduced pressures on local budgets. However, these favorable trends reversed at the end of the decade; the local economy went into a nose-dive, the state cut back on aid, and the baby boom echo caused enrollments to pick up. As a result, an increasing number of communities bumped up against their levy limits.[8]

Thus, in the early 1990s, as baby-boomer families began to purchase trade-up homes, they may have looked not only at the school quality of each community in which they could locate but also at the degree to which each community was constrained by the growth-limit provisions of Proposition 2½. Communities required by Proposition 2½ to reduce their taxes might have been more attractive to families with children who preferred direct voter oversight of tax increases and who believed municipal officials were likely to overspend in the absence of such budget constraints. Alternatively, more constrained cities and towns might be less attractive because they were less able to respond to resident preferences regarding local public services, both school and nonschool.[9] Tables 7 and 8 suggest that the latter factors dominated, that is, families with children found constrained communities less attractive, on average. Communities facing greater Prop 2½ property tax reductions in the early 1980s saw bigger declines in enrollment between 1980 and 1985, net of initial demographics, than communities facing no cuts. And between 1990 and 1995, communities bumping against their levy limits before the period began (fiscal year 1989) similarly saw smaller enrollment increases than less constrained communities.

However, just as for school quality, the observed pattern of enrollment changes may result from other characteristics of these communities. That is, Proposition 2½ may have disproportionately affected communities that might otherwise have failed to attract public school children. To look at how the variety of eco-

Table 7
1980–85 Enrollment Changes by Degree of Constraint
Average percent change in grades 1–8 enrollment for 321 communities grouped by number of years of initial property tax reductions

Proposition 2½ Constraint in 1980s	Actual Enrollment Change	Predicted Enrollment Change	Difference (percentage points)	Number of Communities
Zero years of cuts	−18.0	−19.7	1.7	166
One year of cuts	−21.6	−18.8	−2.8	122
Two or three years of cuts	−17.4	−11.6	−5.9	33
All	−19.2	−16.8	−2.5	321

Note: See Table 1 for explanation of predicted enrollment change.
Community data weighted by 1980 enrollment in grades 1 through 8.
See Appendix Table A2 for variable definitions and sources.

Table 8
1990–95 Enrollment Changes by Degree of Constraint
Average percent change in grades 1–8 enrollment for 321 communities grouped by leeway between levy and levy limit in fiscal year 1989

Proposition 2½ Constraint in 1990s	Actual Enrollment Change	Predicted Enrollment Change	Difference (percentage points)	Number of Communities
Not at levy limit	15.0	8.0	7.0	193
At levy limit	8.9	12.7	−3.8	128
All	11.5	10.7	.8	321

"At levy limit" defined as levy greater than or equal to 99.9 percent of levy limit.
Note: See Table 1 for explanation of predicted enrollment change.
Community data weighted by 1990 enrollment in grades 1 through 8.
See Appendix Table A2 for variable definitions and sources.

[8] The number of cities and towns whose property tax levies were within 0.1 percent of their levy limits jumped from 82 in FY1988 to 224 in FY1990.

[9] In an earlier paper, Bradbury, Mayer, and Case (1997) found that Proposition 2½ significantly reduced school and nonschool spending in constrained communities between 1990 and 1994, and thereby reduced house prices in constrained communities, other things equal.

nomic, demographic, and fiscal forces described above influenced families with school-age children as they sorted themselves out among communities and made choices about public versus private schooling, one needs more than the single-variable cross-tabulations reported in Tables 2, 3, 7, and 8. The regressions explored in the next section of the paper explain community enrollment changes, controlling for beginning-of-period demographics, and allow quantification of the magnitude of some of these influences.

III. Economic, Demographic, and Fiscal Influences on Enrollment Changes, 1980–85 and 1990–95

As the discussion in the preceding section makes clear, many factors would be expected to influence families' residential location choices, and the importance of various factors might differ for families with children compared with childless households. To examine the attractiveness of specific community characteristics to families with children, regressions are estimated to explain net enrollment changes in grades 1 through 8 between 1980 and 1985 and from 1990 to 1995. Net enrollment change, the dependent variable, is defined as the difference between the actual percentage change in enrollment in grades 1 through 8 and the predicted enrollment change, where the predictions are calculated as the percentage difference between the number of resident children ages 1 to 8 and the number ages 6 to 13 at the beginning of the period (1980 or 1990).[10] Net changes over each five-year period reflect movements of families with school-age children among communities and shifts in private school enrollment patterns.[11] The equations are estimated across 321 cities and towns in Massachusetts; 30 of the state's 351 communities with total 1980 enrollments under 150 have been excluded.[12] Appendix Table A2 reports variable means and sources.

Basic Influences: Local Public Sector Attributes and Developable Space

Families with school-age children are likely to care more about school quality than families with no children. Whether enrollments are generally declining or rising, net enrollment changes are likely to be greater (more positive) in higher-quality districts, other things equal, as mobile families attempt to move their children into the better public schools.

Whether the constraints imposed by Proposition 2½ would have differential effects on households with children as compared with childless households is less clear. Nonetheless, like any other factor that alters the attractiveness of individual communities, Prop 2½ constraints will affect public school enrollments indirectly as families make their locational choices on a variety of grounds, and then send their children to local public schools. As discussed in the previous section, cities and towns forced into a cutting mode early on and those that faced tighter restrictions going into the 1990s might be more attractive if Proposition 2½ provided a needed restraint and direct voter control of tax increases that were positively valued by residents, or they might be less attractive to potential residents than communities that were able to make spending decisions independent of the levy limits imposed by Proposition 2½.[13]

Aside from these public sector attributes, the potential for growth in the local housing stock can be expected to influence gross enrollment changes. Communities with more developable land could accommodate more additional households (with or without children) in any five-year period, via new construction, than communities that were already more densely developed.

Columns 1 through 3 of Table 9 report estimates from a sparse regression that includes the public sector attributes and availability of developable land. The school quality results are roughly consistent with the patterns shown in Tables 2 and 3, indicating a positive association between school quality and net enrollment increases in both time periods. As in the simple cross-tabs, the relationship is much stronger in the 1990s. According to the 1990–95 coefficient estimate, a community with test scores 140 points (one standard deviation) above the mean would see about 6 percentage points faster growth in enrollments between 1990 and 1995 than a community with average

[10] This is the "difference" variable shown in column 3 of Tables 2, 3, 7, and 8.

[11] The measure is labeled "net" change because it nets out initial differences in age mix and private school enrollment rates.

[12] For this cutoff, total enrollment is defined to include all grades—pre-kindergarten through grades 12, 13, 14, and ungraded.

[13] The degree of constraint imposed by Prop 2½ may be seen by potential residents as an indication of future changes in school quality. David Figlio (1998) finds that the property tax limitation Measure 5 significantly increased student-teacher ratios in Oregon's school districts, and the effect was more pronounced in districts more constrained by the measure (those that relied more heavily on local property tax revenues before Measure 5). Also see footnote 9 above.

Table 9
Regression Results
Net Changes in Grades 1 to 8 Enrollment, 1980–85 and 1990–95
Dependent Variable: Percentage Point Difference between Actual and Predicted Enrollment Change
(Robust standard errors in parentheses below estimated coefficients)

Independent Variables:	1980–85 (1)	1990–95 (2)	1990–95 (3)	1980–85 (4)	1990–95 (5)	1980–85 (6)	1990–95 (7)
School quality index	7.36*	41.4***	44.6***	.0654	31.6***	.425	29.7***
	(4.10)	(5.7)	(4.7)	(6.78)	(7.2)	(6.69)	(7.2)
Prop 2-1/2 initial revenue cuts for one year	−1.03	−1.11		−.406		−.664	
	(1.19)	(1.67)		(1.21)		(1.17)	
Prop 2-1/2 initial revenue cuts for two or three years	−5.63***	−4.02		−3.71*		−3.86**	
	(1.88)	(2.76)		(1.93)		(1.86)	
At levy limit in FY1989		−3.17**	−3.60**		−3.16**		−2.89**
		(1.52)	(1.42)		(1.30)		(1.33)
Developable land per housing unit (1984)	2.05*	1.09	1.42*	1.73	.833	1.97**	1.05*
	(1.18)	(.824)	(.78)	(1.14)	(.627)	(.98)	(.61)
Median family income ($000) in 1980 or 1990				.400**	.453***	.599***	.526***
				(.189)	(.107)	(.219)	(.117)
% of resident adults college-educated in 1980 or 1990				.0437	−.109	.196*	−.0124
				(.0836)	(.101)	(.104)	(.122)
Dummy variable: Located inside Boston metropolitan area				−5.17***	−8.30***	−4.36***	−7.12***
				(1.26)	(1.91)	(1.26)	(1.99)
Median house value ($000) in 1980 or 1990						−.222***	−.0210
						(.080)	(.0309)
Median unit rent ($) in 1980 or 1990						.0162	−.0124*
						(.0130)	(.0065)
Constant	−20.7*	−104***	−14***	−8.25	−91.5***	−9.55	−82.0***
	(11.2)	(15.8)	(13)	(16.2)	(17.2)	(16.3)	(17.5)
R-squared	.107	.251	.246	.151	.322	.178	.331
Number of observations	321	321	321	321	321	321	321

***significantly different from zero with 99% confidence or better.
**significantly different from zero with 95 to 99% confidence.
*significantly different from zero with 90 to 95% confidence.
See Appendix Table A2 for variable definitions.

scores, other things equal. By the same token, two communities with scores differing by 625 points—the difference between the average community in the top 5 percent of scores and the average in the bottom 5 percent—would show almost 28 percentage points difference in net enrollment change, equal to the bulk of the unconditional difference shown in Table 3.[14]

Several explanations are possible for the stronger effect of school quality in the 1990s. As discussed earlier, the differential effects in the two periods may be related to aggregate enrollment trends. When statewide counts of school-age children are rising, a greater fraction of families will include children and hence care about school quality, and families with increased numbers of children will care more strongly about school quality. The combination of this demographic swing and shifts in family income and house prices is likely to have altered the observed net mobility responses to local school quality. An additional factor relates to national trends that altered the payoff to education. During the 1980s, the distribution of earn-

[14] The figures shown in Table 3 are "unconditional" in the sense that they control for no other variables; the regression coefficient in column 3 controls for associated variations in the other included variables.

ings became more unequal as less educated workers saw their real earnings fall markedly while the labor market returns to higher education rose. As parents became increasingly aware of the importance of education to their children's future prospects, they may have placed a heavier weight on the quality of local public schools in making their family's residential location choices.

During the 1980s less educated workers saw their real earnings fall markedly, and parents became increasingly aware of the importance of education to their children's future prospects.

Proposition 2½ appears to have affected enrollments as well. Variables measuring the number of years of initial budget cuts that the tax limitation required are negatively associated with net enrollment growth from 1980 to 1985. Specifically, communities required to cut their budgets for two or three years saw almost 6 percentage points greater enrollment losses over the five years than communities with no initial cuts mandated, other things equal, although communities with one year of cuts were indistinguishable (in terms of 1980–85 net enrollment changes) from those with no cuts.[15]

These measures of initial cuts are unrelated to net enrollment changes a decade later (column 2). But Proposition 2½'s limits on revenue growth affected increasing numbers of communities toward the end of the 1980s, and a variable measuring the stringency of the growth limit does help to explain enrollment changes from 1990 to 1995.[16] Specifically, communities at their levy limits in 1989 experienced smaller enrollment increases between 1990 and 1995, 3 to 4 percentage points less, than did communities less constrained by Proposition 2½.[17] Whether by cutting the quality of schools in ways not captured by the test score measure, reducing the quality of nonschool public services, or inhibiting community flexibility more generally, Proposition 2½ made constrained communities relatively less attractive to families with children, both in the early 1980s and the early 1990s.[18]

Land use data for Massachusetts communities are available only for 1984. A 1984 measure of open and residential land relative to the 1980 housing stock ("developable" land) was associated with net enrollment growth in both periods.[19] Several explanations are possible for the finding of a larger estimated effect of developable land in the 1980s. First, space to accommodate added families was probably more at issue in the early 1980s than in the early 1990s. Two pieces of evidence suggest that the number of households was expanding more in the earlier period despite the fact that enrollments were shrinking: (1) The state experienced net in-migration between 1980 and 1985 while population moved out, on net, in the early 1990s. (2) Based on permits, more housing was constructed in Massachusetts in the 1980–85 period than in the 1990–95 period. A second explanation has to do with measurement: The measure of developable land

Proposition 2½ made constrained communities relatively less attractive to families with children, both in the early 1980s and the early 1990s.

[15] The unconditional difference in net enrollment growth between communities with zero years of cuts and those with two or three years of cuts (shown in Table 7) is 7.6 percentage points.

[16] Because column 2 indicates the initial FY1982–84 property tax cuts had no discernible effects on enrollment growth by the early 1990s once the current (FY1989) constraint imposed by Proposition 2½'s growth limits is controlled for, column 3 reports a reestimate of the 1990–95 equation dropping the two variables measuring years of initial cuts. The other coefficient estimates are changed very little. This pared-down version is carried forward into columns 5 and 7 as additional variables are included.

[17] The unconditional difference shown in Table 8 is 10.8 percentage points. Thus, differences between constrained and unconstrained communities in the other included variables (school quality, developable land) account for more than half of the observed difference in net enrollment change from 1990 to 1995.

[18] Among communities at their levy limits in FY1989, one might expect those that had passed at least one override to be less constrained than communities that had never passed an override. Override passage prior to FY1990, however, is not associated with 1990–95 enrollment changes in a statistically significant manner when "at levy limit" is controlled for.

[19] Ideally, the quantity of developable land would be adjusted for local zoning restrictions, but such data are not available.

may relate more strongly to growth in the 1980s because the year land use was tallied, 1984, obviously precedes the 1990–95 period by six-plus years. To the degree that the mid-decade 1980s housing boom elicited residential development on open land, this 1984 measure may not reliably represent differences among communities in the availability of land as the 1990–95 period opened.[20]

Other Local Amenities

Because of peer effects in local schools as well as more general neighborhood effects, families with children might be attracted to communities whose residents have higher incomes or are more highly educated. Location is another key local characteristic; proximity to jobs, retail services, and other economic activity would be viewed as a plus by most households, although some household types may be willing to pay more for increased access than others.

In both periods, communities with higher-income residents at the beginning of the period realized greater net enrollment gains. Communities near Boston experienced larger net enrollment declines in the 1980s and smaller increases in the 1990s than communities outside the Boston area.

The regressions reported in columns 4 and 5 of Table 9 add measures of these other local amenities to the analysis. In both periods, communities with higher-income residents at the beginning of the period realized greater net enrollment gains. By contrast, the percentage of residents with a college or higher education is unrelated to enrollment changes.[21] An indicator of geographic location is also included in the equations. Coefficient estimates on a dummy variable for the Boston metropolitan area imply that communities near Boston experienced larger net enrollment declines in the 1980s and smaller increases in the 1990s than communities outside the Boston area.[22] The effect of location was somewhat stronger in the 1990s than in the 1980s.

Inclusion of this location variable reduces the importance of developable land in both periods, especially 1990–95. This effect is understandable, as the two variables are correlated (developable land is more abundant outside the metro area of the state's largest city) and likely to be picking up the same effect —more room for additions to the housing stock (and hence enrollment growth) at greater distances. Since one would expect metro Boston location to be an attraction, not a disamenity, the "room to grow" effect must be dominating the accessibility effect. Put another way, households without public school children must be willing to pay more for access to Boston's concentration of economic activity, outbidding households with public school children for these locations, other things equal.

Inclusion of the nonpublic sector amenity variables also reduces the size or statistical significance of other variables. Most notable is the 1980–85 coefficient on school quality, which becomes insignificantly different from zero once these other variables are included. These results suggest that the pattern in Table 2 and the coefficient estimate in column 1 of Table 9 may reflect some other factor such as median family income, percent of residents college-educated, or location that is associated with both school quality and net enrollment change. Alternatively, these variables might also be correlated with school quality as measured by student test scores. Students from more highly educated families are likely to have higher test scores independent of the schools that they attend. If such parents also choose to live in higher-quality school districts, it may be difficult to pick up an independent effect of school quality in this regression.

[20] The fact that 1984 is near the end of the 1980–85 period should bias the 1980–85 coefficient estimate downward, if anything, since development occurring between 1980 and 1983 would presumably be positively associated with added families but would reduce open land in 1984, other things equal.

[21] One might also expect families with children to be more sensitive to the (negative) amenity of crime than households without children. However, alternative versions of the regressions shown in columns 4 and 5 that also include a beginning-of-period crime rate obtain coefficient estimates on the crime rate that are not significantly different from zero.

[22] The Boston PMSA, as defined by the Census Bureau based on 1980 commuting patterns, includes 106 cities and towns in eastern Massachusetts.

Trade-off: Cost Differentials

As households consider the relative attractiveness of the "packages" of characteristics available in individual cities and towns, they must weigh their own preferences against the price they must pay to buy each package. The market-wide valuation of each community's traits is reflected in existing house prices and rents. Other things (all the attributes in the package) equal, communities with higher house prices or rents would be less attractive from a cost or affordability perspective.

The market-wide valuation of each community's traits is reflected in existing house prices and rents. Households must weigh their own preferences against the price they must pay.

Columns 6 and 7 report coefficient estimates from equations that include the house price and rent variables—each community's median house value and median rent at the beginning of the period. As would be expected for cost measures, higher-priced communities generally saw smaller net enrollment gains or greater net losses, other things equal, in both periods. The effect of median house value is significantly different from zero only in the 1980s[23] and the effect of median rent only in the 1990s.

Inclusion of the housing cost variables alters several other coefficient estimates. Median family income and percent college-educated both have more positive effects on enrollment growth once house prices are controlled for. Because these characteristics are positive attractions, their historical effects on housing demand are capitalized in higher beginning-of-period house prices. Thus, the coefficients on the amenity variables in columns 4 and 5 reflect the net effect of the attraction of these attributes offset somewhat by the associated higher house prices. In columns 6 and 7, these cost effects are estimated separately, allowing the amenity coefficients to be just that. Most notable among these effects, the fraction of adult population with a college degree or more obtains a coefficient that is significantly different from zero in the 1980–85 period. The average community contained about 20 percent college-educated adults in 1980, with a range across the 321 communities from 5 to 60 percent. A community with 10 percentage points (a little less than one standard deviation) more college-educated residents in 1980 would have seen about 2 percentage points more enrollment growth over the 1980–85 period than a community with average educational attainment, other things equal.

Overall, the regression results indicate that differences in school quality and the stringency of Proposition 2½ altered rates of enrollment growth in Massachusetts communities during the early 1980s and early 1990s. Aside from these effects of the local public sector, a boom-bust-recovery economic cycle and the demographic phenomenon of the baby boom played out to influence enrollment changes differentially in the two periods. Enrollments generally declined in the early 1980s as the youngest baby boomers graduated from high school and left smaller cohorts behind. During this period, although school quality had no apparent effect, families with children were more likely to move into high-income communities outside the Boston metro area, with more developable land, more college-educated residents, and lower housing costs. In the early 1990s, by contrast, enrollments generally expanded as increasing numbers of children of baby boom parents entered their school-attending years. As family incomes and housing equity recovered from the bust, older baby boom families were able to trade up while younger baby boom families

Overall, differences in school quality and the stringency of Proposition 2½ altered rates of enrollment growth in Massachusetts communities during the early 1980s and early 1990s.

[23] One explanation for the smaller effect of house prices in the 1990s is that more families were "trading up" rather than buying for the first time in the 1990s; the oldest baby boomers were only 34 in 1980 but 44 by 1990. For existing homeowners contemplating a move, higher house prices represent an increment to their buying power as well as the cost of what they intend to buy.

entered the market for the first time, facing housing costs that had come down from their speculative highs. The draw of higher-income neighbors continued from the 1980s, while the attraction of higher school quality became dominant. The increased numbers of households with the wherewithal to choose may have combined with growing recognition of the importance of education, raising enrollments in communities with higher test scores, on net.

IV. Conclusion and Outlook

The findings described here suggest that economic and demographic factors, along with the passage of Proposition 2½, have had a significant impact on reallocating public school enrollments across districts in Massachusetts. The study reports two major findings: First, the regression estimates support the hypothesis that school quality was a key determinant of family location decisions, and hence enrollment growth, in the early 1990s, when aggregate enrollments were rising and the economy was improving, but the effect of school quality was negligible in the 1980s once other factors were controlled for. Second, Proposition 2½ appears to have significantly shifted the pattern of enrollment changes, with students moving, on net, to districts that are less constrained by this tax limit. Compared with otherwise similar communities, cities and towns with two or three years of property tax cuts in the early 1980s saw greater enrollment declines from 1980 to 1985 and communities at their levy limits in 1989 saw smaller enrollment gains from 1990 to 1995.[24]

The Proposition 2½ results of this study are troubling because they suggest that the tax limitation may be interfering with the efficient sorting of families among communities.

A range of theoretical and empirical research suggests that some efficiency gains result from community specialization in the provision of local public services and the resulting sorting of residents among local jurisdictions according to their preferences and ability to pay. The school quality results are supportive of these hypotheses, as they imply that families made location choices that increased the number of children in high-quality schools. By contrast, the Proposition 2½ results are troubling because they suggest that the tax limitation may be interfering with that "efficient" sorting. Families with children appear to be "voting with their feet," moving out of communities that have run up against their tax limits and chasing communities that have excess capacity to support schools because they are below their mandated tax limit.

The attraction of school quality to families with children is unlikely to diminish, as educational attainment remains a key determinant of individual economic success.

These findings are consistent with previous work that examined the relationship between house prices and the constraints of Proposition 2½ (Bradbury, Mayer, and Case 1997). That research found house prices declining more or rising less between 1990 and 1994 in communities more constrained by Proposition 2½. The current paper addresses the "quantity" rather than "price" side of the housing market, focusing on families with children, and finds the (quantity) demand for housing lower in communities more constrained by Proposition 2½.

Looking forward, the importance of Proposition 2½ may diminish somewhat in the next few years, but the key role of school quality is likely to persist. The constraints of Proposition 2½ appear less binding as the economy improves and communities pass more overrides; the fraction of cities and towns "at" their levy limits has declined gradually since peaking in 1991. By contrast, the attraction of school quality to families with children is unlikely to diminish in the

[24] Because the binding provisions of Proposition 2½ shifted from the early 1980s (initial cuts) to the 1990s (growth limits), the measure of constraint, but not Prop 2½'s negative effect on enrollments, changed between the 1980s and the 1990s.

remainder of this decade or early in the next. For one thing, educational attainment remains a key determinant of individual economic success as income inequality remains high, and recent research has stressed the role of elementary and secondary education along with college.[25] In addition, the scarcity element of school quality associated with demographic pressures will continue to increase into the next decade, as enrollments continue rising.[26] Furthermore, new "high stakes" student testing and reporting mandated by Massachusetts' education reform law will focus additional attention on school quality and how it varies among communities.

Indeed, test results are expected to provide parents with information to hold local school districts "accountable" for school performance through city and town governmental channels as well as by voting with their feet as they have always done. A by-product of the reforms may thus be a broadening of the impetus to improve local education in below-average districts beyond the negative pressures that declining enrollments have historically exerted. To the degree that communities respond to this internal parental pressure, the need for interdistrict movements documented in this article should decline. In this context, however, Proposition 2½'s constraints may loom larger, as they impair some communities' access to the resources needed to upgrade local schools.

[25] For example, see McMurrer and Sawhill 1998, chapter 8.

[26] Based on the pattern of annual births in Massachusetts through 1996, the number of children in grades 1 through 8 will rise each year through 2001 and only then begin to ease slightly, while the number of children in first through twelfth grade will continue to rise.

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Appendix Table A1

Massachusetts Communities Ranked by Average Test Score 1988–94[a]

(Alphabetical within rank groups)

BOTTOM HALF

Lowest 5 percent
(scores 2220–2515)
Boston
Brockton
Cambridge
Chelsea
Everett
Fall River
Fitchburg
Holyoke
Lawrence
Lowell
Lynn
New Bedford
Somerville
Springfield
Webster
Worcester

Next 20 percent
(scores 2520–2630)
Acushnet
Amesbury
Ashfield
Athol
Attleboro
Ayer
Belchertown
Bellingham
Blackstone
Buckland
Carver
Charlemont
Charlton
Chicopee
Colrain
Conway
Deerfield
Dracut
Dudley
Fairhaven
Freetown
Gill
Gloucester
Granby
Granville
Halifax
Haverhill
Holbrook
Hudson
Kingston
Lakeville
Leominster
Malden
Mashpee
Maynard
Medford
Methuen
Middleborough
Milford
Millville
Montague
North Adams
Northbridge
Orange
Oxford
Pembroke
Petersham
Plymouth
Plympton
Quincy
Randolph
Revere
Royalston
Salem
Shelburne
Sunderland
Taunton
Tewksbury
Waltham
Ware
Wareham
Westport
Whately
Winchendon
Woburn

Below median quartile
(scores 2631–2695)
Adams
Agawam
Avon
Barre
Bernardston
Blandford
Bourne
Bridgewater
Brimfield
Brookfield
Cheshire
Chester
Clinton
Danvers
Dartmouth
Dedham
Douglas
Easthampton
Egremont
Falmouth
Franklin
Gardner
Groveland
Hanson
Hardwick
Holland
Hubbardston
Hull
Huntington
Littleton
Ludlow
Mansfield
Marion
Marlborough
Mattapoisett
Merrimac
Monson
Montgomery
Nantucket
Newbury
New Marlborough
Northampton
North Attleborough
North Brookfield
Northfield
Norton
Oakham
Palmer
Peabody
Pittsfield
Raynham
Rochester
Rockland
Rowley
Russell
Salisbury
Saugus
Seekonk
Sheffield
Somerset
Southbridge
Southwick
Stoneham
Stoughton
Sturbridge
Sutton
Swansea
Uxbridge
Wakefield
Wales
Warren
Watertown
West Brookfield
West Newbury
Weymouth
Whitman
Wilmington
Winthrop
Worthington

TOP HALF

Above-median quartile
(scores 2696–2790)
Abington
Arlington
Ashburnham
Ashby
Ashland
Auburn
Barnstable
Becket
Berkley
Berlin
Beverly
Billerica
Boylston
Braintree
Burlington
Canton
Chesterfield
Dalton
Dennis
Dighton
East Bridgewater
East Brookfield
East Longmeadow
Easton
Edgartown
Essex
Foxborough
Framingham
Georgetown
Goshen
Grafton
Great Barrington
Greenfield
Hampden
Harwich
Hinsdale
Hopedale
Ipswich
Lancaster
Lanesborough
Lee
Leicester
Marshfield
Melrose
Millbury
Millis
Milton
Nahant
Newburyport
Norfolk
North Andover
Norwood
Oak Bluffs
Pepperell
Phillipston
Plainville
Provincetown
Rehoboth
Rockport
Shirley
Southampton
South Hadley
Spencer
Stockbridge
Templeton
Tisbury
Townsend
Truro
Tyngsborough
West Bridgewater
Westfield
Westhampton
Westminster
West Springfield
West Stockbridge
West Tisbury
Williamsburg
Williamstown
Wrentham
Yarmouth

Next 20 percent
(scores 2791–2955)
Amherst
Bedford
Belmont
Boxford
Brewster
Chatham
Chelmsford
Clarksburg
Cohasset
Dunstable
Duxbury
Eastham
Erving
Groton
Hadley
Hamilton
Hanover
Harvard
Hingham
Holden
Holliston
Hopkinton
Lenox
Leverett
Lincoln
Longmeadow
Lunenburg
Lynnfield
Manchester
Marblehead
Medway
Mendon
Middleton
Natick
Needham
Newton
Northborough
North Reading
Norwell
Orleans
Paxton
Pelham
Princeton
Reading
Richmond
Rutland
Sandwich
Scituate
Sharon
Shrewsbury
Shutesbury
Southborough
Sterling
Swampscott
Topsfield
Upton
Walpole
Wayland
Wellfleet
Wenham
Westborough
West Boylston
Westford
Westwood
Wilbraham
Winchester

Highest 5 percent
(scores 2960–3075)
Acton
Andover
Bolton
Boxborough
Brookline
Carlisle
Concord
Dover
Lexington
Medfield
Sherborn
Stow
Sudbury
Wellesley
Weston

[a]Average test score is sum of eighth-grade math and reading scores on the MEAP tests, averaged over the even-numbered years from 1988 through 1994 (missing years omitted, average adjusted for statewide trend). N = 321; 30 communities with total school enrollment less than 150 in 1980 are not included. Members of regional school districts (for eighth grade) are assigned their regional district's average eighth-grade score.

Appendix Table A2

Variables Used in the Analysis

(Number of observations = 321 Massachusetts cities and towns)

Variables:	Mean	Standard Deviation	Minimum	Maximum
Percent change in enrollment, grades 1–8				
1980–85	−17.1	10.5	−50.8	21.6
1990-95	14.2	12.3	−40.0	62.3
Predicted percent change in enrollment, grades 1–8[a]				
1980–85	−17.3	10.9	−42.9	15.0
1990–95	6.9	10.4	−19.8	41.4
Net change in enrollment, grades 1–8 (percentage points)[b]				
1980–85	.2	10.3	−32.2	45.7
1990–95	7.2	14.1	−77.8	68.0
School quality index[c]	2.71	.14	2.22	3.07
Dummy Variables: Prop 2-1/2 revenue cuts[d]				
for one year	.38	.49	0	1.00
for two or three years	.10	.30	0	1.00
Dummy variable: At levy limit in fiscal year 1989[e]	.40	.49	0	1.00
Developable land per housing unit[f]	.96	.93	.04	9.31
Median family income ($000)				
1980	20.0	5.3	10.1	47.6
1990	42.3	12.0	20.5	95.1
Percent of resident adults college educated				
1980	19.9	11.0	4.9	59.6
1990	26.7	12.7	6.9	65.5
Dummy Variable: Located inside				
Boston metropolitan area	.33	.47	0	1.00
Median house value ($000)				
1980	51.8	17.1	29.0	143.6
1990	169.7	57.4	88.9	497.9
Median unit rent ($)				
1980	272	55	116	501
1990	597	122	248	1001

Notes:

a. Predicted change in enrollment is the ratio of (number of MA residents who were age 1 to 8 at beginning of period) to (number who were age 6 to 13 at beginning of period) minus 1, expressed as percent.

b. Net change is actual percent change in enrollment minus predicted change, in percentage points.

c. School quality index is average student's combined math and reading test score averaged over the years 1988 through 1994, expressed in thousands.

d. Initial property tax cuts were made in fiscal years 1982 (one year), 1983, and 1984.

e. Communities are "at levy limit" if levy is greater than or equal to 99.9 percent of levy limit.

f. Developable land is acres of residential and nonpublic open land in 1984 divided by number of single family housing units in 1980.

Source: Massachusetts Department of Revenue; U.S. Bureau of the Census; Massachusetts Department of Education.