CHAPTER 3

THE DATA AND SAMPLE USED

The objective of this dissertation is to test the following propositions:

1. Educational opportunity became more equal as a consequence of MERA.
2. The degree to which socio-economic status is a determinant of educational outcomes in Massachusetts has decreased as a consequence of MERA.
3. Education standards have been raised and educational outcomes have improved as a consequence of MERA.

Educational opportunity is measured by expenditure per pupil. Socio-Economic Status is assessed using Education, Median Income, Poverty and a composite index known as the TSEI2. Education standards are measured by the results of two sets of standardized tests: scores from MEAP and scores from MCAS. The largest possible sample of school districts and towns was selected to address Factor 3 in DEA efficiency evaluation – refer to Section 8 of Chapter 4.

3.1 The Sample School Districts and Towns

In Massachusetts, in theory, each of the 351 Cities and Towns is a school district. In practice, there are School Districts that are too small to actually be operative, and there are Regional School Districts in which Towns pool their students either at all levels or for particular grades such as High School, or High School and Middle School. Adding to the complexity are Regional Vocational and Agricultural School Districts, School Choice, Private Schools and the emergence since the mid 1990's of a growing number of Charter Schools.

In the period from 1987 to 2000 approximately 10 percent of the K-12 population in Massachusetts were in Private Schools. About 75 percent were in local schools, around 10 percent were in Academic Regional School districts and about 2 percent were in Vocational Regional Schools – see Table 3.01.

Table 3.01 – K-12 Enrollment in Massachusetts 1988 to 2001.

Year	Total	Local		Academic Regional		Vocational Regional		Private	
1987	944,644	711,006	75.3%	76,792	8.1%	23,330	2.5%	119,825	12.7%
1988	938,016	713,509	76.1%	72,538	7.7%	21,598	2.3%	115,461	12.3%
1989	935,561	712,926	76.2%	74,151	7.9%	21,914	2.3%	113,794	12.2%
1990	941,234	721,941	76.7%	73,676	7.8%	21,359	2.3%	111,570	11.9%
1991	944,926	723,714	76.6%	78,197	8.3%	20,819	2.2%	109,518	11.6%
1992	952,040	726,282	76.3%	81,586	8.6%	20,405	2.1%	109,237	11.5%
1993	966,854	742,052	76.7%	80,365	8.3%	20,154	2.1%	109,078	11.3%
1994	980,767	742,612	75.7%	95,947	9.8%	20,925	2.1%	105,922	10.8%
1995	1,003,501	761,428	75.9%	94,251	9.4%	22,102	2.2%	108,543	10.8%
1996	1,017,891	771,064	75.8%	97,970	9.6%	23,007	2.3%	107,474	10.6%
1997	1,034,073	781,479	75.6%	101,796	9.8%	21,859	2.1%	108,249	10.5%
1998	1,039,701	796,248	76.6%	94,009	9.0%	22,460	2.2%	102,972	9.9%
1999	1,038,030	787,252	75.8%	92,533	8.9%	22,793	2.2%	108,336	10.4%
2000	1,061,008	799,133	75.3%	104,624	9.9%	22,119	2.1%	104,751	9.9%

Source: The Massachusetts Department of Education.

Some Towns form Academic Regional Districts for high school students only and some for junior and middle. Vocational Regional districts take high school students and tend to cover many more towns than do the Academic Regions. Given that about 95 percent of students attending public schools are covered by Academic Regions and Local Districts: it made sense to combine towns into their Academic Regions and to aggregate data to achieve this.

For example, Up-Island is a K - 8 region bringing together students from Aquinnah, Chilmark and West Tisbury. Together with Edgartown, Oak Bluffs and Tisbury, these three towns form Marthas Vineyard Regional. For the purposes of the

analysis it made sense to treat these six towns as a single region[18]. So for 8th Grade MCAS scores, for example, the Up-Island average MCAS score multiplied by the number of 8th Grade students at Up-Island would be added to Aquinnah's average MCAS score multiplied by the number of 8th Grade students in Aquinnah. Add in the multiple for Chilmark and for West Tisbury and divide by the total number of 8th Grade students at Up-Island, Aquinnah, Chilmark and West Tisbury and the result is an average 8th Grade MCAS score for Marthas Vineyard.

Adjustments were made for vocational regions – see Appendix K. Models were run using data including and excluding vocational regions and the results were similar as to trend so Vocational Regions are not be considered further.

Approximately 3 percent of K-12 students either attend collaborative schools (0.4%) or exercise school choice (2.6% in 2000) – see Table 3.02. At its simplest, school choice involves students from one town opting to go to another. Data for school choice is sparse, so no attempt was made to adjust for it.

From 1995 onwards the data for school choice include Charter Schools, which took 1.3 percent of enrollment in 2000. Charter Schools are concentrated heavily in Boston, Worcester and Springfield. Boston was excluded from the sample partly for this reason. The other adjustments made to test scores to account for Charter Schools are detailed in Appendix D.

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[18] Because data for the number of students in these towns and for MCAS 4th Grade English Language Arts tests are missing for the years 1999 and 2000 these towns were, in fact, dropped from the analysis.

Table 3.02 – Massachusetts K-12 Enrollment Other Public Number and Percent of Total.							
				School Choice			
Year	Total	Colaboratives		Total		Charter	
1995	1,003,501	3,123	0.3%	14,054	1.4%	2,396	0.2%
1996	1,017,891	3,171	0.3%	15,205	1.5%	5,195	0.5%
1997	1,034,073	3,207	0.3%	17,483	1.7%	6,572	0.6%
1998	1,039,701	3,516	0.3%	20,496	2.0%	9,797	0.9%
1999	1,038,030	3,788	0.4%	23,328	2.2%	12,518	1.2%
2000	1,061,008	3,992	0.4%	27,373	2.6%	13,799	1.3%
Source: The Massachusetts Department of Education.							

The sample is listed in Appendix C. It is indistinguishable from the State when compared on a number of factors – see Appendix M.

3.2 MEAP and MCAS – Reporting and Scores 1988 to 2002

In the late 1980's and early 1990's the Massachusetts Department of Education ("DOE") published "District Data Books" giving MEAP scores at school district level for the State. MCAS scores are published on the DOE Web Pages.

MEAP and MCAS scores are reported on hybrid norm-referenced and criterion-referenced scales: refer to Section 6 of Chapter 1. In each case proficiency levels were set with criteria against which the difficulty of the assessments could be measured and the raw scores would then be scaled onto a curve that followed a normal distribution. MEAP scores were scaled to a State mean of 1300 and a standard deviation of 100.

> After a scale has been established at a given grade level, it is maintained across subsequent MEAP administrations to permit comparisons of school and district performance over time. That is, scaled scores below 1300 indicate a decline in performance from the initial year of testing, and scaled scores above 1300 indicate an improvement in performance. Real educational changes are detected when scaled scores rise or fall at least 50 points. – Massachusetts Department of Education (1996 October).

Scores were not produced for schools with fewer than 20 students tested in a subject and score for schools with fewer than 60 students should be viewed with caution.

MEAP Proficiency Levels were more criterion-referenced in nature and described students' performance in five different bands on a scale that was related to, but not identical to the scaled scores. Criterion-referenced scores are not available at the level of granularity that would make them usable in the analysis undertaken in this research.

For the 2001 MCAS results, the reporting scale was adjusted – refer to Table 3.03. Average scaled scores in 2001 are not directly comparable to scores from previous test administrations.

From the raw to scaled score conversions, given in Table 3.03, it seems that, in 2001, all the tests were deemed to be have a much tougher baseline than in previous years, and thus the bottom end raw scores translated onto higher scaled scores than in the previous three years. Perhaps the large number of raw scores translating onto 200 in the first three years was the problem? If, on the other hand, the scaling changed without a change in the nature of the assessments, then the effect is to increase the average scaled scores, without an underlying improvement in the children assessed.

Table 3.03 – Scaled and Raw MCAS Scores – Grade 10 – English Language Arts – 2001.

Scaled Score	1998	1999	2000	2002	2001
280	84.	72.	72.	72, 71, 70.	71, 70, 69, 68, 67.
278	82, 81.	71, 70.	71, 70, 69.	69.	None.
276	None.	None.	None.	None.	66.
274	79.	69.	68.	68.	65.
272	None.	None.	None.	None.	64.
270	75.	67.	67.	67.	None.
268	74.	66.	66.	66.	63.
266	72.	65.	65.	65.	62.
264	71.	64.	64.	64.	61.
262	69.	63.	63.	63.	60.
260	68.	62.	62.	62.	59.
258	66.	61.	61.	61.	58.
256	65, 64.	60, 59.	60, 59.	60.	57.
254	None.	None.	None.	None.	None.
252	61.	57.	58.	59.	56.
250	60.	56.	57.	58.	55.
248	59.	55.	56.	57.	54.
246	57.	54.	55.	56.	53.
244	56, 55.	53, 52.	54, 53.	55.	52.
242	None.	None.	None.	54, 53.	51.
240	52.	50.	52.	52.	50.
238	51.	49.	51.	None.	49.
236	50, 49.	48, 47.	50, 49.	51.	48.
234	None.	None.	None.	50.	47.
232	None.	None.	None.	49.	None.
230	47, 46.	46, 45.	48, 47.	48.	46.
228	43.	43.	46.	47.	45.
226	42.	42.	45.	46.	44.
224	41, 40.	41, 40.	44, 43.	45.	43.
222	39.	39.	42.	44.	42.
220	37.	38.	41.	43, 42, 41.	41, 40, 39.
218	36.	37.	40.	40, 39, 38, 37, 36.	38, 37, 36, 35.
216	35.	36.	39.	35, 34, 33, 32, 31.	34, 33, 32, 31, 30.
214	34.	35.	38.	30, 29, 28, 27, 26.	29, 28, 27, 26.
212	32.	34.	37.	25, 24, 23.	25, 24, 23, 22.
210	30.	32.	36.	22, 21, 20, 19.	21, 20, 19.
208	29.	31.	35.	18, 17.	18, 17, 16.
206	28.	30.	34.	16, 15, 14.	15, 14.
204	26.	29.	33.	13, 12, 11, 10.	13, 12, 11, 10.
202	25, 24.	28, 27.	32, 31.	9, 8, 7, 6.	9, 8, 7, 6.
200	23, 21, 20, 19, 18, 16, 15, 14, 13, 12, 11, 10, 9, 8, 7, 6, 5, 3, 2, 1, 0.	26, 25, 24, 23, 22, 21, 20, 19, 18, 17, 16, 15, 14, 13, 12, 11, 10, 9, 8, 7, 5, 4, 3, 2, 0.	30, 29, 28, 27, 26, 25, 24, 23, 22, 21, 20, 19, 18, 17, 16, 15, 14, 13, 12, 11, 10, 9, 8, 7, 6, 5, 4, 3, 2, 1,0	5, 4, 3, 2, 1, 0.	5, 4, 3, 2, 1, 0.

Source: Massachusetts Department of Education.

The average score of those scoring below 220 is estimated to be likely to have been increased by up to 10 points. It looks fortuitous, to say the least, that this change should have occurred in the year that Graduation should become dependent on achieving a scaled score of at least 220.

Raw scores are not published for either MEAP or MCAS. Conversion tables exist for the MCAS as we have seen above, but they are many (raw) to one (scaled score) and thus unsuitable for backwards conversion. Raw scores would anyway be dependent on the difficulty of the assessment. Criterion-referenced scores that were consistently scaled and consistently referenced to solid criteria would be ideal for comparisons across time, but MEAP is not scaled consistently with the MCAS and the criteria were different (some of the assessments were of different subjects). The MCAS itself is not scaled consistently and scaled scores would not appear to have been consistently referenced to the criteria.

One way to consider the data is to think of it as coming from at least three different systems. MEAP, MCAS to 2000 and MCAS 2001 and later.

A number of other issues and problems are associated with using the results of the assessments to measure progress in education over time. Looking first at who is being tested. If we make the assumption that the less good students avoid being tested, if they can, then in general MEAP average scores should be higher since Special Education and Other Needs students were exempted from testing and as a consequence a lower percentage of students took MEAP tests than take the MCAS – see Table 3.04.

Table 3.04 – Percentage of Enrolled Students Tested – 1988-2002.										
	MEAP						MCAS			
Grade	1988	1990	1992	1994	1996	1998	1999	2000	2001	2002
3	-	-	-	-	-				97	97
4	90	90	89	90	90	97	96	95	94	96
6	-	-	-	-	-	-	-	-	98	98
7	-	-	-	-	-	-	-	-	94	95
8	90	89	88	89	89	97	96	93	94	97
10	-	-	-	86	85	96	95	93	92	94
Source: Massachusetts Department of Education.										

Grade retention is a way in which schools can avoid their worst students being tested. A record number of 2000-2001 grade nine students were retained (8.4 percent[19]). If we assume that the reason for this is that students who would not do well on the Grade 10 tests being held back, then the effect of retention should be to increase the average scaled scores for 2001.

3.2.1 Sample School Districts Test Scores

It should come as no surprise that average test scores for school districts are highly correlated at a high level of significance (all p-values were less than 0.000)– see Table 3.05.

[19] According to Statistics from the Massachusetts Department of Education.

Table 3.05 – Pearson Correlations between the Rankings of 2000 Test Scores.

	Grade 4			Grade 8				Grade 10		
Grade 4	ELA	Math	Sci.	ELA	Math	Sci.	Soc.	ELA	Math	Sci.
ELA	1.00									
Math	0.94	1.00								
Science	0.84	0.85	1.00							
Grade 8										
ELA	1.00	0.94	0.84	1.00						
Math	0.82	0.84	0.94	0.82	1.00					
Science	1.00	0.94	0.84	1.00	0.82	1.00				
Social	0.77	0.79	0.89	0.77	0.90	0.77	1.00			
Grade 10										
ELA	0.75	0.75	0.79	0.75	0.81	0.75	0.77	1.00		
Math	0.76	0.78	0.81	0.76	0.85	0.76	0.78	0.92	1.00	
Science	0.71	0.74	0.79	0.71	0.82	0.71	0.78	0.93	0.93	1.00

3.2.2 Normality of Test Scores Distributions

Six sets of test scores for the Sample of 180 School Districts were tested for normality in Minitab. The results are summarized in Table 3.06. Normality plots are given in Appendix E. The results for five of the six sets of scores support the hypothesis that the scores come from Normal distributions at the 0.10, 0.05 and 0.02 significance levels. 1988 12th Grade Mathematics is problematic in that the hypothesis that the data comes from a normal distribution is only supported at a 0.20 significance level.

Table 3.06 – Anderson-Darling Normality Test Results for Six Sets of Sample School Districts' Average Test Scores.		
Test Year, Grade and Subject	A-Squared	P-Value
1988 4th Grade Reading	1.138	0.005
1988 8th Grade Science	0.981	0.013
1988 12th Grade Mathematics	0.513	0.191
2002 4th Grade English Language Arts	1.007	0.012
2002 7th Grade English Language Arts	0.947	0.016
2002 10th Grade Mathematics	0.923	0.019
Note: Anderson-Darling Adjusted Scores From Minitab.		

Notwithstanding the P-Value in the Anderson-Darling Normality test for 1988 8th Grade Mathematics, the Sample School Districts' Average Test scores were accepted as being from normal distributions.

MEAP and MCAS Scale scores were converted to z-scores and then rescaled to a mean of 240 and a standard deviation of 6.8 being approximately the scale of MCAS scores.

3.3 Per Pupil Expenditures

Per pupil expenditures were published by DOE under a number of headings from 1988 until 2000. Consideration of expenditures was therefore limited to that period. Per Pupil Integrated Cost, Per Pupil Special Education Expenditures, Per Pupil Regular Day Expenditures and Per Pupil Expenditures by Grade Level (Elementary, Middle and High School) are the measures used. Each is described in turn in the following sub-sections.

3.3.1 Per Pupil Integrated Cost

> The Integrated Cost Per Pupil counts all of the resident public school-children in a city or town, regardless of where they are enrolled. Tuition and other expenditures associated with those educated outside the district are factored in. If a community belongs to one or more regional school districts, those districts' expenditures are apportioned back to the member town in accordance with its share of enrollment. A city or town's integrated cost, therefore, is a composite of spending and pupils for all publicly-funded school children who reside there.[20]

This measure is available for school districts from 1988 to 2000 when the DOE discontinued the calculation.[21] Statewide statistics and trends in this measure of expenditure are discussed in detail in Section 7 of Chapter 2. Statistics for the 180 Sample School Districts are given in Table 3.07. The Standard Deviation measured as a percentage of the Mean has decreased in each period since 1992, which implies greater equity. The Minimum Expenditure as a percentage of the Mean has increased in each period since 1992, which also implies greater equity.

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[20] http://finance1.doe.mass.edu/statistics/pp01_intcost.html

[21] http://finance1.doe.mass.edu/statistics/pp02_intro.html

Table 3.07 – Trends in Integrated Cost Per Pupil Expenditures (180 Sample School Districts).							
Year	1988	1990	1992	1994	1996	1998	2000
Mean	4,196	4,930	5,007	5,274	5,805	6,398	7,202
Standard Deviation	730	859	928	905	847	893	992
Minimum	2,829	3,304	3,222	3,959	4,285	4,673	5,342
Maximum	6,735	8,013	8,381	8,896	9,550	9,863	11,715
Std. Dev. as Percent Of Mean	17.4	17.4	18.5	17.2	14.6	14.0	13.8
Min as Percent of Mean	67.4	67.0	64.4	75.1	73.8	73.0	74.2
Max as Percent of Mean	160.5	162.5	167.4	168.7	164.5	154.2	162.7
Percentage Growth In Mean		17.5	1.6	5.3	10.1	10.2	12.6
Source: Massachusetts Department of Education and Author's Calculations.							

3.3.2 Per Pupil Expenditures By Grade Level

Data summarizing school district expenditure per pupil by grade level is available for the period from 1988 to 2000. The grade levels summarized are "Elementary", "Middle" and "High". This data serves to show how school districts differ in their emphasis on expenditure as the children progress through grades.

Table 3.08 – Trends in Per Pupil Elementary School Expenditure (180 Sample School Districts).							
Year	1988	1990	1992	1994	1996	1998	2000
Mean	3,243	3,727	3,778	4,039	4,375	4,840	5,528
Standard Deviation	622	718	788	741	682	703	861
Minimum	2,174	2,622	1,927	2,845	3,101	3,626	3,979
Maximum	5,662	5,729	5,974	6,528	7,064	7,834	9,830
Std. Dev. as Percent Of Mean	19.2	19.3	20.9	18.3	15.6	14.5	15.6
Min as Percent of Mean	67.0	70.3	51.0	70.4	70.9	74.9	72.0
Max as Percent of Mean	174.6	153.7	158.1	161.6	161.4	161.9	177.8
Percentage Growth In Mean		14.9	1.3	6.9	8.3	10.6	14.2
Source: Massachusetts Department of Education and Author’s Calculations.							

Average per pupil expenditure at the Elementary School level, up by 46.3 percent between 1992 and 2000, has grown more strongly than per pupil expenditure at the Middle School level (up 32.3 percent) and at the High School level (up 32.0 percent). The minimum expenditure level in 1992 looks to be an anomaly – refer to Table 3.08: but taking the Standard Deviation as a Percent of Mean as a better indicator of the change in equity points to greater equity being seen over time.

Table 3.09 – Trends in Per Pupil Middle School Expenditure (180 Sample School Districts).							
Year	1988	1990	1992	1994	1996	1998	2000
Mean	4,076	4,678	4,667	4,829	5,171	5,510	6,177
Standard Deviation	890	1,151	1,193	1,102	1,038	1,072	1,491
Minimum	2,493	2,486	2,441	3,235	3,171	3,296	3,822
Maximum	8,493	10,142	9,506	11,164	8,714	9,663	16,366
Std. Dev. as Percent Of Mean	21.8	24.6	25.6	22.8	20.1	19.5	24.1
Min as Percent of Mean	61.2	53.1	52.3	67.0	61.3	59.8	61.9
Max as Percent of Mean	208.4	216.8	203.7	231.2	168.5	175.4	265.0
Percentage Growth In Mean		14.8	-0.2	3.5	7.1	6.5	12.1
Source: Massachusetts Department of Education and Author’s Calculations.							

On average more money is spent per Middle School Pupil than per Elementary School Pupil, with most money being spent per High School Pupil. Measured by the Standard Deviation as a Percent of the Mean, it would appear that equity at the Middle School level was monotonically greater in each year after 1992, except for 2000 when the trend appears to have reversed itself – refer to Table 3.09.

Table 3.10 – Trends in Per Pupil High School Expenditure (180 Sample School Districts).							
Year	1988	1990	1992	1994	1996	1998	2000
Mean	4,305	5,222	5,245	5,565	5,876	6,247	6,922
Standard Deviation	761	1,063	1,154	1,151	1,088	1,106	1,324
Minimum	2,684	2,570	2,700	3,326	3,286	3,826	4,675
Maximum	6,887	9,671	9,321	10,187	10,183	10,035	16,366
Std. Dev. as Percent Of Mean	17.7	20.3	22.0	20.7	18.5	17.7	19.1
Min as Percent of Mean	62.3	49.2	51.5	59.8	55.9	61.2	67.5
Max as Percent of Mean	160.0	185.2	177.7	183.1	173.3	160.6	236.4
Percentage Growth In Mean		21.3	0.4	6.1	5.6	6.3	10.8
Source: Massachusetts Department of Education and Author's Calculations.							

The trends in expenditure per High School pupil – see Table 3.10 – are similar to those seen for Middle School pupils.

3.3.3 Per Pupil Expenditures By Program

Data summarizing school district expenditure by program consist of per pupil expenditures for Special Education, Bilingual Education, Occupational Education and Regular Day. Only Special Education and Regular Day per pupil expenditures are available, consistently, for the period from 1988-2000.

Table 3.11 – Trends in Regular Day Per Pupil Expenditure 180 Sample School Districts).							
Year	1988	1990	1992	1994	1996	1998	2000
Mean	3,592	4,149	4,134	4,408	4,722	5,176	5,820
Standard Deviation	629	766	802	794	746	751	887
Minimum	2,509	2,715	2,615	2,969	3,023	3,986	4,211
Maximum	5,616	6,524	6,745	7,452	7,944	8,533	10,875
Std. Dev. as Percent Of Mean	17.5	18.5	19.4	18.0	15.8	14.5	15.2
Min as Percent of Mean	69.9	65.4	63.3	67.4	64.0	77.0	72.4
Max as Percent of Mean	156.4	157.2	163.2	169.1	168.3	164.8	186.8
Percentage Growth In Mean		15.5	-0.4	6.6	7.1	9.6	12.4
Source: Massachusetts Department of Education and Author’s Calculations.							

The results of analysis of Regular Day Per Pupil Expenditures – see Table 3.11 – are similar to those for Per Pupil Integrated Costs.

Table 3.12 – Trends in Per Pupil Special Education Expenditure (180 Sample School Districts).							
Year	1988	1990	1992	1994	1996	1998	2000
Mean	5,603	6,600	6,957	7,648	8,585	9,555	11,172
Standard Deviation	965	1,265	1,518	1,785	1,628	1,799	2,028
Minimum	3,326	4,013	3,481	5,033	3,832	5,023	7,563
Maximum	8,932	13,615	14,049	19,842	15,741	18,174	18,518
Std. Dev. as Percent Of Mean	17.2	19.2	21.8	23.3	19.0	18.8	18.2
Min as Percent of Mean	59.4	60.8	50.0	65.8	44.6	52.6	67.7
Max as Percent of Mean	159.4	206.3	201.9	259.4	183.4	190.2	165.8
Percentage Growth In Mean		17.8	5.4	9.9	12.3	11.3	16.9
Source: Massachusetts Department of Education and Author's Calculations.							

On average more money is spent per pupil in Special Education than per pupil in any other category – see Table 3.12. Measured by the Standard Deviation as a Percent of the Mean: it would appear that equity in Special Education Expenditure per pupil was greater in each year after 1992.

3.4 Socio-Economic Status

Hauser and Warren (1997) describe Socio-Economic Status as follows:

> Socioeconomic status is typically used as a shorthand expression for variables that characterize the placement of persons, families, households, census tracts, or other aggregates with respect to the capacity to create or consume goods that are valued in our society.

Using various search engines to search for "Socio Economic Status" or "SES" a list of 78 papers was compiled. The survey is both random in the sense that no judgment

was applied in the choice of papers and non-random in the sense that it depended on what was in the search engines and readily available. Survey results are given in Appendix F.

Table 3.13 lists the most popular variables and the percentage of the 79 papers that referenced them. Education of the parents was the most used measure of Socio Economic Status in cases where the child's SES was being estimated. Occupation is the next most used measure with a number of Occupational Status / Prestige Indices being used. The index known as TSEI2, updated to cover 1990 Census Occupation categories was used as a scale for measurement of Occupations. Appendix G contains a short discussion of the various Occupational Status / Prestige Indices identified from the survey.

Table 3.13 – Popular Measures Of Socio-Economic Status.

Measure	Percent Using Measure
Education Father	68
Education Mother	68
Occupation Father	68
Occupation Mother	56
Family Income	51
Number of Parents	5
Number of Siblings	6
Number of Books in Home	4
Housing Tenure	10
Crime Rate	3
Poverty Rate	6
Population Density	1
Housing Density	3
Percent Urban	3

Source: Author's Survey.

The last 6 items in Table 3.13: Housing Tenure, Crime Rate, Poverty Rate, Population Density, Housing Density and Percentage Urban are infrequently used. This reflects the fact that most of the studies are concerned with measuring an individual's Socio Economic Status rather than that of a community. Taking this into consideration it becomes apparent that Housing is a variable frequently used to measure a community's Socio-Economic Status as are Poverty and Crime Rates.

Other indicators or measures of a community's SES that have been used include: Health[22], Drop Out Rates, Ethnicity, Divorce Rates, Car Ownership, Wealth, Unemployment Rates, Length of Service and Commuting Distance.

Education, Median Income, Occupation and Poverty were selected as the proxies for Socio-Economic Status. Each is discussed in turn in the following sub-sections.

3.4.1 Education

The 1980, 1990 and 2000 Censuses record the number of persons achieving the categories of education summarized in Table 3.14.

Taking the number of persons in each category, multiplying by the number of "years" and dividing the sum by the total number of people gives an index of a town's education "years".

For Massachusetts the resulting number of years of education are 12.65 years for 1980, 13.17 years for 1990 and 13.64 years for 2000. The top three towns in 2000 were Carlisle (16.87 years), Weston (16.56 years) and Dover (16.44 years). The bottom four towns were Chelsea (11.57 years), Lawrence (11.51 years), New Bedford (11.50 years) and Fall River (11.46 years).

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[22] Oakes and Rossi (2003) trace a strong relationship between SES and health dating back to ancient Greece.

Table 3.14 – 1980, 1990 and 2000 Decennial Census Education Categories of Education.			
1980 Categories	Years*	1990 and 2000 Categories	Years*
Elementary (0 to 8 years) through High School 1 to 3 years	9	Less than 9th grade	8
		9th to 12th grade, no diploma	10
High School 4 years	12	High school graduate (includes equivalency)	12
		Some college, no degree	13
1 to 3 years College	14	Associate degree	14
4 years College	16	Bachelor's degree	16
5 or more years College	20	Graduate or professional degree	20
Source: 1980, 1990, 2000 Decennial Census and Author’s Calculations. Note * Number of years used in calculations.			

3.4.2 Median Incomes

The 1980, 1990 and 2000 Censuses record the median household income at the town level. The top ten towns in each year are given in Table 3.15.

There has been relatively little movement in the rankings with 7 towns, Weston, Sherborn, Dover, Carlisle, Sudbury, Boxford and Wellesley remaining in the top ten throughout.

Table 3.15 – Top Ten Towns In Massachusetts by Median Income, 1980, 1990 and 2000 Decennial Census.			
Rank	1980	1990	2000
1	Weston	Weston	Weston
2	Sherborn	Sherborn	Dover
3	Dover	Dover	Carlisle
4	Carlisle	Carlisle	Sherborn
5	Sudbury	Wellesley	Sudbury
6	Boxford	Sudbury	Wellesley
7	Wayland	Boxford	Boxford
8	Wellesley	Wayland	Harvard
9	Longmeadow	Concord	Southborough
10	Lexington	Lexington	Bolton
Source: 1980, 1990, 2000 Decennial Census			

The bottom ten towns in each year are given in Table 3.16. There has been relatively little movement at the bottom of the rankings with 5 towns, Holyoke, Lawrence, New Bedford, Fall River and Chelsea in the bottom ten in each Census year.

Table 3.16 – Bottom Ten Towns In Massachusetts by Median Income, 1980, 1990 and 2000 Decennial Census.			
Rank	1980	1990	2000
342	Holyoke	Chelsea	Adams
343	Oak Bluffs	Adams	Holyoke
344	Lawrence	Wellfleet	Springfield
345	New Bedford	Holyoke	Chelsea
346	Wendell	New Bedford	Fall River
347	Sunderland	Fall River	Lawrence
348	Fall River	Lawrence	North Adams
349	Chelsea	North Adams	New Bedford
350	Provincetown	Provincetown	Monroe
351	Aquinnah	Aquinnah	Gosnold
Source: 1980, 1990, 2000 Decennial Census			

There was little movement in the rankings by median income over two decades. The Pearson Correlations between the Median Incomes for 1980 with 1990 and 1990 with 2000 were 0.93 and 0.95 with p-values < 0.000.

The relative levels of education across the three censuses were also stable with Pearson Correlations between the “years” of Education for 1980 with 1990 and 1990 with 2000 being 0.95 and 0.95 with p-values < 0.000.

The relationship between Median Incomes and Education was less strong. Correlations between the factors for 1980, 1990 and 2000 were 0.59, 0.62 and 0.65 respectively with p-values < 0.000.

3.4.3 TSEI2 – An Occupational Index of SES

Occupational and Prestige indexes were identified by the survey of SES literature as proxies for SES. TSEI2 was selected for use in this research and updated to cover the 2000 Census Occupational Classifications – see Appendix H.

Massachusetts as a whole scored 34.29 in 1980, 35.49 in 1990, and 37.29 in 2000 on the TSEI. The standard deviation of the 351 scores was 2.91 for 1980, 2.79 for 1990, and 2.55 for 2000. The Pearson Correlations between the values in 1980 and 1990 and between 1990 and 2000 are 0.91 and 0.87 respectively with P-Value of 0.000 in each case. The Pearson Correlations between the rankings (1 to 351) are similar to those for the values, being 0.89 and 0.87 respectively with a p-value less than 0.000 in each case.

Although the index for 2000 was based on some assignments and averaging of categories and scores; the results are not inconsistent with the indices from 1980 and 1990.

Given that the Occupational Prestige / Status Indices combine income and education data to derive a score, a high level of correlation between the TSEI Indices and the income and education data was to be expected. Pearson Correlations of the TSEI Indices with Median Incomes were 0.90, 0.89 and 0.84 and with Education "Years" they were 0.71, 0.73 and 0.71 for the 1980, 1990 and 2000 data respectively with p-values < 0.000.

3.4.4 Poverty

For Massachusetts at the town level, the 1980, 1990 and 2000 Census present numbers of persons whose earnings are in 5 or can be aggregated to 5 bands of percentages of the Federal Poverty level. The bands are: below 75 percent of poverty

level; between 75 and 124 percent of poverty level; between 125 and 149 percent of poverty level; between 150 and 199 percent of poverty level; and 200 percent of poverty level and above.

Taking the numbers of persons in each band and multiplying them by 0.375; 1.0; 1.375; 1.75 and 2.0 respectively and dividing the sum of the result by the total number of persons in the bands gives an index measure of poverty for 1980, 1990 and 2000 for each town in Massachusetts. The smaller the value of the index measure the more severe the poverty.

For Massachusetts as a whole the Poverty Index was 1.77 in 1980, 1.81 in 1990 and 1.80. Measured by the Poverty Index, Chelsea, Holyoke and Lawrence were the most poverty stricken towns in the Commonwealth in 2000 and Boxford, Norfolk and Topsfield were the three towns least affected.

The Poverty Indices are consistent across the three decades. The Pearson Correlation between the 1980 Poverty Index and the 1990 Poverty Index is 0.83, while that between the 1990 and 2000 Poverty Indices is 0.87. When considering the Town's Poverty Ranking the Correlations are 0.84 and 0.87, respectively. All the P-Values were less than 0.000.

The Poverty Indices are less consistent with the Town TSEI Indices. The Pearson Correlation between the 1980 Poverty Index and the 1980 Town TSEI is 0.55. For 1990 and 2000 the corresponding correlations are 0.55 and 0.54. Again all the p-values were less than 0.000.

There is a high degree of correlation between the Poverty Index and Median Incomes – 0.91, 0.90 and 0.89 for 1980, 1990 and 2000 respectively with p-values less than 0.000.