STATE AID AND THE HIGH COST OF LOCAL PUBLIC SERVICES IN SOME COMMUNITIES: THE NEED FOR MORE EQUALIZATION

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ABSTRACT

Equalizing the fiscal resources available to the state's 351 cities and towns has long been a major goal of state aid to local governments in Massachusetts. The Commonwealth's stringent tax limitation measure, Proposition 2 1/2, dramatically increases the importance of this goal. Under the proposition's restrictions, cities such as Somerville and Lawrence which have small per capita tax bases can raise only one third or one fourth the amount of property taxes per capita raised by wealthy communities such as Dover or Wellesley. Furthermore, the amount of tax revenues a community is permitted to raise takes no account of differences across communities in the cost of providing a given package of public services.

This paper first demonstrates how to measure the extent to which local public expenditures vary across communities in response to variations in community characteristics outside the control of local officials. Our results show that these uncontrollable costs vary greatly across Massachusetts communities. Per capita costs of providing all local public services range from 30 percent below average to 38 percent above average, for example, and per capita costs of providing non-school services range from 12 percent below average to 53 percent above average. In addition, the paper shows how these cost (on equivalently service-need) differences can be incorporated into local aid distribution formulas.

The paper does not present a specific proposal for the distribution of state aid in Massachusetts. Instead it provides a flexible framework for designing state aid programs to offset the cost and revenue disadvantages faced by many cities and towns. The framework can be used to design state aid programs that offset cost disadvantages alone or both cost and revenue disadvantages. It can also be used to design either incremental or comprehensive equalizing aid programs, with varying degrees of equalization.

Introduction

In fiscal year 1984 the state government in Massachusetts will provide over $1.8 billion of direct aid to the state's 351 cities and towns. Over half of these funds will help local communities finance public education, while the rest can be used for a variety of local public services such as public safety, sanitation, and recreation. Although state aid has played an important role in increasing the level of financial resources available to all cities and towns and equalizing the resources among communities, significant disparities continue to exist between communities, with some places finding it increasingly difficult to provide adequate levels of basic public services. In this paper we look at the way local aid is currently distributed, and present a framework for designing new more equalizing distribution formulas.

Local governments in Massachusetts are responsible for providing a long list of public services, but their sources of revenue are severely limited by state law. Proposition 2 1/2 has recently restricted local governments' ability to raise revenue from the only two taxes available to them, the property tax and the motor vehicle excise tax. The proposition restricts property tax rates to 2 1/2 percent and also limits the annual growth of property tax collections. It also limits motor vehicle excise tax rates to less than half their pre-Proposition 2 1/2 level.

Given these limitations, the amount of revenue any local government can raise depends on factors beyond its control. The primary factor, of

course, is the value of taxable property within its boundaries. Some suburban communities such as Weston and Dover are blessed with a large proportion of expensive homes, and other places, such as Burlington, have high-value commercial or industrial facilities within their boundaries. Others, however, including many of the state's older cities and towns have relatively small property tax bases in relation to their population because some of their factories have closed, some of their stores have moved to the suburbs, and much of their housing is relatively inexpensive. Communities such as Lowell, Somerville, and Fall River, for example, can raise only one third to one fourth the amount of property taxes per capita raised by wealthy communities.

Table 1 demonstrates that the ability to raise revenue varies tremendously among the state's cities and towns. In fiscal year 1984, the average community can raise $758 per resident prior to the receipt of state aid. (See notes to Table 1 for definition of own-raised revenue) However, 16 communities (with 11 percent of the state's population) can raise less than 1/2 of that amount, while 102 communities (with two-fifths of the state's population) can raise less than three-quarters of the state average. At the same time, 63 communities (with 11 percent of the state's population) are able to raise over 25 percent more revenue per person than the state average.

State aid has grown in importance in recent years; it has more than doubled since 1975, and increased by over 40 percent since 1980. During the same period, and particularly since the passage of Proposition 2 1/2, state aid has financed an increasing share of local government expenditures. In fiscal year 1982, the latest year for which

Table 1

Per Capita Own-Raised And Total Revenues of Massachusetts Cities and Towns, Fiscal Year 1984

Percentage of Mean Own-Raised Revenues Mean = $758	Number of Cities or Towns	Percentage of State Population	Percentage of Mean Total Revenue Mean = $1054	Numbers of Cities or towns	Percentage of State Population
25-50%	16	11.3%	25-50%	0	0.0%
50-75	86	28.9	50-75	43	16.6
75-85	59	12.0	75-85	74	28.2
85-95	48	19.2	85-95	83	22.1
95-110	54	11.7	95-110	73	12.1
110-125	25	6.0	110-125	38	17.3
125-150	30	7.6	125-150	22	3.0
150-175	14	2.4	150-175	6	0.4
175-200	6	0.3	175-200	3	0.2
200% & over	13	0.6	200% & over	9	0.2

Notes: Own-raised revenue for each community is defined as the sum of 1982 motor vehicle excise tax revenue, 1983 General Revenue Sharing receipts, and 1984 potential property tax levy. The potential levy equals the 1984 estimated full and fair cash value of property times the Propostion 2½ mandated tax rate limit. For 11 communities this limit is in excess of 2½ percent, while for 91 jurisdictions the limit has been set at a level below 2½ percent.

Total revenue for each community is own-raised revenue plus 1984 state aid (including aid to regional school districts).

comprehensive data are available, state aid accounted for 32 percent of local spending.

The data on the righthand side of Table 1 indicate that state aid has played a significant role in equalizing fiscal resources among communities. Total revenue per capita available to local governments (including state aid) shows less variation across communities than locally raised revenue. Nevertheless, significant disparities remain; 43 cities and towns (with 17 percent of the state's population) have available total per capita financial resources that are less than 75 percent of the state average. At the same time 40 communities (with 4 percent of the state's population) have resource levels that are at least 25 percent more than the state average. For example, this year Somerville will be able to spend only $750 per capita, while Burlington can spend about $1400 per person, and Weston approximately $1800. Although diversity among cities and towns in the actual mix of services provided is an important element of our governmental system, diversity in public service provision caused solely by difference in the amount of financial resources available is undesirable.

The principle of distributing more state aid to communities with fewer fiscal resources is well established. In Massachusetts the so-called lottery formula, and the major educational aid formula, Chapter 70, both explicitly provide more aid to cities and towns with smaller per capita property tax bases. Equalizing fiscal resources alone, however, will not guarantee that communities can provide equal levels of public services. As we show below, the costs of providing public services vary substantially among Massachusetts' cities and towns. Thus even though two

communities may have the same level of fiscal resources, one community may have higher costs and, hence, will not be able to buy as many public services as the other. Hence a more comprehensive approach to equalization would offset cost differences as well as resource differences.

We emphasize, however, that state aid should not compensate for all cost differences. It should not offset cost differences due, for example, to mismanagement or inefficiency. Furthermore, some aspects of the cost of public services, such as public employees' wage levels, are determined by local governments; state aid should not undercut local government incentives to keep these costs under control. Instead, state aid should be used to offset only those aspects of the cost of public services that cannot be influenced by local governments.

In the following sections of this paper, we measure the magnitude of the cost differences that are beyond the control of local governments, and show several ways to incorporate them into state aid formulas.

The Magnitude and Measurement of Cost Differences

In this section we first define the concept of cost differences and illustrate that they are too large to ignore. We then explain in detail how we measured them.

Definition of Cost Differences

To measure cost differences, it is important to distinguish between public spending and public service or output levels. Public spending

refers to the dollar total of the municipal budget. Public output refers to the results of public spending, such as fire protection, weekly garbage pick-ups, or public school children learning arithmetic. In general, the level of public spending in each community depends both on the level of public output provided by local voters and on the costs per unit of public output.

The cost of providing any given level of public output depends on some factors under the control of local governments, and other factors largely out of their control. The organization of public production is generally determined by local government officials. For example, local governments have control over the number of people assigned to each police patrol car or garbage truck, and the decision to computerize the tax department. They have little control, however, over the local environment which also can have a large impact on the cost of providing public services. The cost of providing a given level of fire protection, for example, is higher in a community with densely packed frame houses, or with tall buildings, than in a community with brick houses on one-acre lots. In order to achieve the same level of fire protection (measured perhaps as the probability of any resident experiencing a $10,000 fire loss), more money for extra firemen and equipment has to be spent in the denser community. Education offers another example of the role of the environment in influencing costs. More teachers, and often special programs, are necessary to provide education in a community where relatively many children participate in remedial, special, vocational, or bilingual education programs.

From the perspective of state policy, only the uncontrollable cost differences are relevant. Hence, we use the term cost differences throughout this paper to refer to cost differences outside the control of local officials. These environmental cost factors are sometimes said to indicate a community's "needs". A city with a lot of commuters, for example, needs to spend more per capita than other cities to provide the same level of public safety services for its residents. In other words, a statement about "needs" can be interpreted as a statement about local public production costs.

Before providing a detailed explanation of our methodology for estimating the magnitude of these environmental cost factors in each city and town in Massachusetts, we present a brief overview of our results. These results indicate that cost differences among the cities and towns of Massachusetts are too large to be ignored in the design of state aid programs.

Size of Cost Differences across Massachusetts Communities

Table 2 presents two separate cost indexes. The first represents the total uncontrollable costs of providing a given level of all local public services, including elementary and secondary education, in each community relative to that in the average community. The second index represents the relative cost of providing non-school services. As discussed further

Table 2

Cost Indexes for Massachusetts Cities and Towns

Total Cost Index		Non-School Cost Index	
Boston	1.38	Cambridge	1.53
Cambridge	1.36	Boston	1.52
Somerville	1.32	Somerville	1.43
Chelsea	1.31	Chelsea	1.39
Ayer	1.27	Everett	1.28
Lawrence	1.21	Brookline	1.25
Everett	1.20	Malden	1.24
Burlington	1.19	Lawrence	1.23
Hull	1.17	Provincetown	1.23
Brockton	1.17	Watertown	1.22
Malden	1.17	Winthrop	1.20
Wilmington	1.16	Worcester	1.19
Dunstable	1.16	Springfield	1.19
Hanover	1.16	Arlington	1.19
Springfield	1.16	Medford	1.18
Monroe	1.16	Waltham	1.17
Braintree	1.14	Lowell	1.17
Bedford	1.13	Nantucket	1.16
Worcester	1.13	Newton	1.16
Lowell	1.13	Salem	1.15
West Bridgewater	1.13	Revere	1.15
Winthrop	1.13	Quincy	1.15
Lynn	1.12	Lynn	1.15
Watertown	1.12	Belmont	1.14
Provincetown	1.12	Brockton	1.13
Revere	1.11	New Ashford	1.13
Newburyport	1.11	Fall River	1.13
Winchendon	1.11	Braintree	1.12
North Reading	1.11	Wellesley	1.11
Brookline	1.10	Holyoke	1.11
Southborough	1.10	Maynard	1.11
Whitman	1.10	Norwood	1.10
Norwood	1.10	Burlington	1.10
Saugus	1.10	Barnstable	1.10
Medway	1.09	Dedham	1.10
Maynard	1.09	Saugus	1.10
Lynnfield	1.09	Woburn	1.09
Huntington	1.09	Swampscott	1.09
Medford	1.09	Monroe	1.09
Billerica	1.09	Melrose	1.09
Colrain	1.08	Fitchburg	1.09
Waltham	1.08	Pittsfield	1.09
Dedham	1.08	Newburyport	1.08
Arlington	1.08	Danvers	1.08

Table 2 (con't)

Cost Indexes for Massachusetts Cities and Towns

Total Cost Index		Non-School Cost Index	
Hanson	1.08	Hadley	1.08
Fall River	1.07	Gosnold	1.08
Avon	1.07	Wakefield	1.08
Topsfield	1.07	Gloucester	1.08
Westminster	1.07	Hull	1.08
Mansfield	1.07	Great Barrington	1.08
Winchester	1.07	New Bedford	1.08
Sudbury	1.07	Bedford	1.07
Holyoke	1.07	Beverly	1.07
Attleborough	1.07	Clinton	1.07
East Bridgewater	1.06	Marblehead	1.07
Berlin	1.06	Greenfield	1.07
Woburn	1.06	North Reading	1.07
Middleton	1.06	Framingham	1.07
Canton	1.06	Lynnfield	1.06
Middleborough	1.06	Wellfleet	1.06
Pittsfield	1.06	Winchester	1.06
Melrose	1.06	Haverhill	1.06
Millville	1.06	North Adam	1.06
Quincy	1.06	Milton	1.05
Concord	1.06	Natick	1.05
New Bedford	1.06	Needham	1.05
Salem	1.05	Wilmington	1.05
Belmont	1.05	West Springfield	1.05
Foxborough	1.05	Lenox	1.05
Haverhill	1.05	Attleborough	1.04
Georgetown	1.05	Southborough	1.04
Newton	1.05	Stoneham	1.04
Rehoboth	1.05	Concord	1.04
Sturbridge	1.05	Lexington	1.04
Danvers	1.05	Peabody	1.04
Montgomery	1.05	Nahant	1.04
Randolph	1.05	Rowe	1.04
Westwood	1.05	Taunton	1.04
Barnstable	1.05	Oak Bluffs	1.04
Seekonk	1.05	Gardner	1.03
Lexington	1.05	Weymouth	1.03
Northborough	1.05	Rockland	1.03
Petersham	1.05	Erving	1.03
Warren	1.05	Hanover	1.03
Stow	1.05	Tisbury	1.03
Westford	1.05	Warren	1.03
Cohasset	1.04	Canton	1.03
Salisbury	1.04	Orleans	1.03

Table 2 (con't)

Cost Indexes for Massachusetts Cities and Towns

Total Cost Index		Non-School Cost Index	
Bolton	1.04	Chicopee	1.03
Natick	1.04	Stockbridge	1.03
Gloucester	1.04	Edgartown	1.03
Holbrook	1.04	Leominster	1.03
Ashburnham	1.04	Athol	1.02
North Brookfield	1.04	Hingham	1.02
Phillipstown	1.04	Avon	1.02
Rockland	1.04	Shelburne	1.02
Acton	1.04	West Bridgewater	1.02
Wakefield	1.04	Westminster	1.02
Abington	1.04	Cohasset	1.02
Great Barrington	1.04	Hardwick	1.02
Hingham	1.04	North Attleborough	1.02
Wareham	1.04	Eastham	1.02
Marshfield	1.03	Montague	1.02
Tewksbury	1.03	Rockport	1.02
Dighton	1.03	Webster	1.02
Peabody	1.03	Williamstown	1.02
North Adam	1.03	Marion	1.02
Wales	1.03	Westwood	1.02
Chelmsford	1.03	Methuen	1.01
Florida	1.03	Randolph	1.01
Bellingham	1.03	Truro	1.01
Russell	1.03	Adams	1.01
New Salem	1.03	Cummington	1.01
Stoughton	1.03	Northhampton	1.01
Weymouth	1.03	Whitman	1.01
Duxbury	1.03	Yarmouth	1.01
Framingham	1.03	Winchendon	1.01
Needham	1.02	Milford	1.01
Nantucket	1.02	Deerfield	1.01
Merrimac	1.02	Seekonk	1.00
Swampscott	1.02	Fairhaven	1.00
Walpole	1.02	Middleborough	1.00
Beverly	1.02	New Salem	1.00
Hubbardston	1.02	Wareham	1.00
Scituate	1.02	Colrain	1.00
Clarksburg	1.02	Auburn	1.00
Holliston	1.02	Northbridge	1.00
Amesbury	1.02	Falmouth	1.00
North Attleborough	1.02	Palmer	1.00
Norwell	1.02	Plymouth	1.00
Swansea	1.02	Reading	1.00
Raynham	1.02	Sandisfield	1.00

Table 2 (con't)

Cost Indexes for Massachusetts Cities and Towns

Total Cost Index		Non-School Cost Index	
Shelburne	1.02	Sheffield	1.00
Franklin	1.02	Westport	1.00
Wellesley	1.02	Conway	1.00
Boxford	1.02	Manchester	1.00
Athol	1.02	Sturbridge	1.00
Clinton	1.02	Walpole	1.0
Rowe	1.02	Williamsburg	1.00
Newbury	1.01	Amherst	.99
Hudson	1.01	Weston	.99
Blackstone	1.01	Chatham	.99
Marblehead	1.01	Chesterfield	.99
Andover	1.01	Andover	.99
Ashby	1.01	Foxborough	.99
Reading	1.01	Westborough	.99
Plymouth	1.01	Amesbury	.99
Milford	1.01	Essex	.99
Westborough	1.01	Bolton	.99
Pembroke	1.01	Northborough	.99
Sheffield	1.01	Orange	.99
Sutton	1.01	Scituate	.99
Chester	1.00	Middleton	.98
Greenfield	1.00	Abington	.98
Northbridge	1.00	Marlborough	.98
Wellfleet	1.00	East Bridgewater	.98
Goshen	1.00	Lee	.98
Marion	1.00	Mansfield	.98
Plympton	1.00	Millville	.98
Longmeadow	1.00	North Brookfield	.98
New Braintree	1.00	Dighton	.98
Douglas	1.00	Bourne	.98
Hadley	1.00	Lancaster	.98
Lunenburg	1.00	North Andover	.98
Stoneham	1.00	Uxbridge	.98
Taunton	1.00	Mashpee	.98
Falmouth	1.00	Petersham	.98
Groveland	1.00	Ashburnham	.98
Tyngsborough	1.00	Blackstone	.98
Auburn	1.00	Dalton	.98
Methuen	1.00	Dartmouth	.98
Montague	1.00	East Longmeadow	.98
Orange	.99	Merrimac	.98
Sharon	.99	Newbury	.98
West Newbury	.99	Swansea	.98
Hardwick	.99	Holbrook	.98

Table 2 (con't)

Cost Indexes for Massachusets Cities and Towns

Total Cost Index		Non-School Cost Index	
Palmer	.99	Russell	.98
Fitchburg	.99	Stoughton	.98
Spencer	.99	Hudson	.98
Chesterfield	.99	Huntington	.98
Oxford	.99	Ipswich	.98
Ashland	.99	Sunderland	.98
Manchester	.99	Whately	.98
Brookfield	.99	Billerica	.97
Buckland	.99	Easthampto	.97
East Brookfield	.99	Plainfield	.97
Lakeville	.99	Salisbury	.97
Hopkinton	.98	Longmeadow	.97
Rowley	.98	Marshfield	.97
Medfield	.98	Millbury	.97
Somerset	.98	Groton	.97
Townsend	.98	Hopedale	.97
Truro	.98	Hinsdale	.97
Chicopee	.98	Buckland	.97
Freetown	.98	Lakeville	.97
Millbury	.98	Plympton	.97
Upton	.98	Ashland	.97
Williamsburg	.98	Somerset	.97
Barre	.98	Westfield	.97
Eastham	.98	Ashfield	.97
Pepperell	.98	Barre	.97
Plainfield	.98	Charlemont	.97
Wendell	.98	Kingston	.97
Leominster	.98	New Braintree	.96
Berkley	.98	Royalston	.96
Blandford	.98	Hancock	.96
Fairhaven	.98	Ayer	.96
Millis	.98	Hawley	.96
Rochester	.98	Shirley	.96
Lenox	.97	Sudbury	.96
Littleton	.97	Upton	.96
Wayland	.97	Chester	.96
Easton	.97	Harwich	.96
New Ashford	.97	Granville	.96
Charlemont	.97	Brookfield	.96
Lee	.97	Chelmsford	.96
Marlborough	.97	Egremont	.96
West Springfield	.97	Lanesborough	.96
Dracut	.97	Warwick	.96
Groton	.97	Douglas	.96

Table 2 (con't)

Cost Indexes for Massachusetts Cities and Towns

Total Cost Index		Non-School Cost Index	
Hampden	.97	Hopkinton	.96
Holland	.97	Middlefield	.96
Sterling	.97	New Marlborough	.96
Webster	.97	Oakham	.96
Gardner	.97	Spencer	.96
Mendon	.97	Franklin	.96
Stockbridge	.97	Medway	.96
Westport	.97	Berlin	.95
Wilbraham	.97	Shrewsbury	.95
Mattapoisett	.97	Wrentham	.95
Gosnold	.96	Goshen	.95
Kingston	.96	Hamilton	.95
Westhampton	.96	Lincoln	.95
Cummington	.96	Tyringham	.95
East Longmeadow	.96	Westford	.95
Hopedale	.96	Blandford	.95
Bourne	.96	Dennis	.95
Oakham	.96	Townsend	.95
Royalston	.96	Littleton	.95
Princeton	.96	Norwell	.95
Tisbury	.96	Acton	.95
Charlton	.96	Bernardston	.95
Dalton	.96	Mendon	.95
Hancock	.96	Wayland	.95
Norfolk	.96	Heath	.95
Savoy	.96	Rehoboth	.95
Heath	.96	Northfield	.95
Norton	.96	Ware	.95
Southwick	.96	Becket	.95
Granby	.96	Templeton	.95
Templeton	.96	Grafton	.95
Tolland	.96	Monson	.95
Brimfield	.96	Tewksbury	.95
Sherborn	.96	West Boyleton	.95
Oak Bluffs	.95	Mount Washington	.95
Granville	.95	Gill	.95
Dover	.95	Rowley	.95
Weston	.95	Boylston	.94
Deerfield	.95	Dudley	.94
Uxbridge	.95	Sutton	.94
Hawley	.95	Ludlow	.94
Bernardston	.95	Mattapoisett	.94
North Andover	.95	Sharon	.94
Acushnet	.95	Wendell	.94

Table 2 (con't)

Cost Indexes for Massachusetts Cities and Towns

Total Cost Index		Non-School Cost Index	
Carver	.95	Alford	.94
Ipswich	.95	Hanson	.94
Otis	.95	Tyngsborough	.94
Plainville	.95	Medfield	.94
Gill	.95	Raynham	.94
Grafton	.95	Southbridge	.94
Leicester	.95	Duxbury	.94
Carlisle	.94	Gay Head	.94
Hamilton	.94	West Newbury	.94
Lanesborough	.94	Windsor	.94
Hinsdale	.94	Acushnet	.94
West Brookfield	.94	Chilmark	.94
Wrentham	.94	Dracut	.94
Ashfield	.94	Wenham	.94
Edgartown	.94	West Stockbridge	.94
Essex	.93	Topsfield	.94
Monson	.93	Worthington	.94
Erving	.93	East Brookfield	.94
Dartmouth	.93	Easton	.94
Harwich	.93	Hubbardston	.94
Southampton	.93	Pepperell	.94
Halifax	.93	Brewster	.93
Milton	.93	Hatfield	.93
Lancaster	.93	South Hadley	.93
Rockport	.93	West Brookfield	.93
Yarmouth	.93	Westhampton	.93
Sandwich	.93	Norton	.93
Egremont	.93	Pelham	.93
Holden	.93	Southwick	.93
Northampton	.93	Berkley	.93
Nahant	.92	Bridgewater	.93
Adams	.92	Dover	.93
Southbridge	.92	Pembroke	.93
Worthington	.92	Otis	.93
Orleans	.92	Princeton	.93
Cheshire	.92	Wales	.93
Northfield	.92	Georgetown	.93
Sandisfield	.92	Millis	.93
Dudley	.92	Oxford	.93
Mashpee	.91	Sterling	.93
Conway	.91	Agawam	.93
Ludlow	.91	Cheshire	.93
Leyden	.91	Leicester	.93
Boylston	.91	Monterey	.93

Table 2 (con't)

Cost Indexes for Massachusetts Cities and Towns

Total Cost Index		Non-School Cost Index	
Easthampton	.91	Clarksburg	.93
Agawam	.91	Florida	.93
Becket	.91	Sandwich	.93
Westfield	.91	Wilbraham	.93
New Marlborough	.91	Freetown	.93
Boxborough	.90	Groveland	.93
Rutland	.90	Holden	.93
West Stockbridge	.90	Holliston	.93
Shrewsbury	.90	Washington	.93
Williamston	.90	Savoy	.92
Middlefield	.89	Lunenburg	.92
Pelham	.89	Rochester	.92
Ware	.89	Phillipston	.92
West Boyle	.89	Ashby	.92
Whately	.89	Leyden	.92
Brewster	.89	Charlton	.92
Paxton	.88	Granby	.92
Peru	.88	Plainville	.92
Bridgewater	.88	West Tisbury	.92
Washington	.88	Bellingham	.91
Hatfield	.88	Belchertown	.91
Richmond	.88	Dunstable	.91
Shirley	.88	Leverett	.91
Windsor	.88	Halifax	.91
Dennis	.88	Montgomery	.91
Chatham	.87	Rutland	.91
Leverett	.87	Norfolk	.91
Monterey	.87	Stow	.91
South Hadley	.86	Brimfield	.91
Warwick	.86	Sherborn	.91
Belchertown	.85	Hampden	.91
Wenham	.85	Richmond	.91
Alford	.84	Shutesbury	.91
Shutesbury	.84	Southampton	.91
West Tisbury	.83	Paxton	.90
Mount Washington	.83	Harvard	.90
Gay Head	.79	Tolland	.90
Amherst	.79	Holland	.90
Chilmark	.78	Carlisle	.90
Lincoln	.77	Boxford	.89
Sunderland	.76	Boxborough	.89
Tyringham	.76	Carver	.89
Harvard	.68	Peru	.88

below, the first index would be appropriate for inclusion in a comprehensive aid formula or for evaluating the overall pattern of existing state aid to local governments. The second would be appropriate for a new formula designed to offset the differential costs of providing non-school services and would complement the existing school aid formula.

The total-cost index ranges from highs of 1.38 in Boston and 1.36 in Cambridge to a low of 0.68 in the town of Harvard. In other words, Boston or Cambridge would have to spend over 35 percent more per person to provide the same level of public services as a community with average costs and would have to spend over twice as much as towns like Harvard. As shown in the table, communities such as Somerville, Lawrence, Hull and Springfield all have costs that are at least 15 percent above average while communities such as Shrewsbury, Ware, Brewster, and Chatham have costs that are more than ten percent below average.

As emphasized above, these cost differences are not due to wage differences or management inefficiencies across communities. Rather, they measure the extent to which the density, amount of business activity, number of school children and other environmental characteristics of a community affect the community's spending.

Many large cities in the state have high costs according to our index, despite the fact that they have below-average proportions of pupils. Not surprisingly, therefore, once we ignore school costs and focus on non-school expenditures, we find an even greater difference between high-cost cities and the average-cost community. We estimate that Boston and Cambridge, for example, have to spend about 52 percent more than the average community to achieve a similar level of public safety and other

non-school services. Our non-school cost index ranges from a high of 1.53 in Cambridge to a low of 0.88 in Peru. Among the cities and towns that have non-school costs more than 15 percent above average are Somerville, Chelsea, Brookline, Watertown, Worcester, and Lowell.

Measurement of Cost Differences

Our measurement procedure has three steps. In STEP 1 we used a statistical technique called regression analysis. We estimated an equation that explains variations across communities in per capita local public spending. With data on all Massachusetts cities and towns, this technique allows us to determine the average effect of each of a number of environmental cost factors on community expenditures in 1980 and, most importantly, to separate these effects from those of other determinants of expenditures, such as wealth differences, and cost differences due to mismanagement. We chose 1980 so that our cost estimates would not be contaminated by the pressures imposed by Proposition 2 1/2.

Regression equations take the following form:

$$Y = a_o + a_1X_1 + a_2X_2 + a_3X_3 + ... + a_nX_n$$

Y is the dependent variable and, in our case, refers to total expenditures per capita in each community. The X's are explanatory variables that measure the fiscal resources and the cost factors in each city and town. The purpose of a regression analysis is to estimate values for the coefficients a_1 to a_n. They represent the average impact of each X variable (for example, density) on the dependent variable, per capita expenditures. A regression equation can be used to derive a predicted value of the dependent variable for each community by substituting the value of each community's explanatory variables into the regression

equation and multiplying these values by the appropriate estimated coefficients.

Regression equations, however, do not result in perfect predictions; the actual value of the dependent variable will differ from the predicted value by some residual. This residual reflects how the expenditures of each community differ from the average expenditure of communities with the same values of explanatory variables. In our case the residual reflects factors not explicitly accounted for by the explanatory variables, namely, cost factors due to inefficiency and mismanagement, and unmeasured factors influencing preferences for specific public services in individual communities.

The dependent variable in our regression equation is total expenditure per capita which includes all school and non-school public expenditures in each community except for transit assessments. (Transit assessments were excluded because they appear to bear little relationship to service levels actually received, especially in the Boston area. They are however added back into total expenditures in Step 2.)

Two main types of explanatory variables were used in the regression, measures of fiscal resources and cost factors. Resource variables include per capita levels of each community's property tax base, referred to as equalized valuation; local non-property tax revenues, including revenues from the motor vehicle excise tax; and four intergovernmental grant variables, direct federal aid, general revenue sharing, total state aid to cities and towns, and state aid to regional school districts (allocated to the cities and towns in the district).

Many environmental cost variables can be identified, but they are often difficult to interpret because they are correlated with other expenditure determinants, such as the tax base. Our approach is to interpret as environmental cost variables only those variables that solely reflect cost considerations. We included nine different cost factors in the regression equation: the number of "weighted" pupils per capita; population density; three per capita employment variables, in trade and services, in manufacturing, and for the state or federal governments; the crime rate; the percent of population below the poverty line; a variable reflecting the average age of the housing stock; and the miles of local roads per registered vehicle in each community.

The pupil weights are calculated by the Department of Education for use in the Chapter 70 aid program, and reflect the fact that some pupils, such as those with learning disabilities, are more expensive to educate than others. Higher population density increases the costs of several public services, such as fire and police protection. The three employment variables are considered cost variables because more employment generally leads to an increased number of commuters, more congestion, and additional demands for street maintenance, sewer and water service, police and fire protection, and traffic control. Higher crime rates directly increase the costs of providing a given level of police protection. Higher concentrations of poor people generally result in higher education costs, and may also lead to higher public health and recreation costs. In general an older housing stock requires increased fire protection costs and, perhaps more important, is also likely to indicate that the public

infrastructure such as sewers and bridges is older and more costly to maintain. And finally, cities and towns with an extensive network of roads have higher snow removal and road maintenance costs.

Four additional variables are included in the regression equation to improve the quality of the estimates. We refer to these as control variables since they do not directly reflect fiscal resources or costs. The first control variable is the proportion of each community's population over the age of 65. This variable controls for the fact that the elderly generally support lower levels of public spending than the population as a whole. This is particularly true for spending in public schools. Second, per capita income in the community is included because, controlling for the local tax base, higher income residents are likely to demand more local public services--they have more resources to spend on goods and services provided both by the public sector and by private markets. The final two control variables are the rate of change in community population between 1970 and 1980, and the square of population change. These variables reflect the fact that expenditures tend to be higher than would otherwise be expected in cities and towns that are experiencing either rapid increases in population or rapid decreases in population. In both cases, a period of several years may be necessary to adjust public services to the new population level. The reason for including each of the control variables is simple: if we were to leave one out, say population change, and if the left-out variable were correlated with one of the cost variables (that is if communities that were losing population also tended to be densely populated), then the estimated coefficient of the cost variable in the regression equation

might overstate the true impact of the cost variable on public expenditures.

Appendix A provides detailed definitions and sources for all the variables included in the equation. Appendix Table A-1 reports coefficient estimates and standard errors from the regression equation, and Table A-2 lists mean values and standard deviations for all the variables.

In STEP 2 of our procedure we substituted average values of the fiscal resource and control variables and actual values of the cost variables into the estimated regression equation to predict what the amount of spending in each community would have been had the community had average levels of each of the fiscal resource and other control variables. Thus, variations in predicted expenditures reflect variations in cost factors alone. In effect, the regression approach allows us to isolate the effect of each cost factor on spending and to measure the contribution of each so that they can be combined into a single measure of costs.

In STEP 3 we translated the predicted expenditure numbers calculated in the previous step into a cost index by dividing each prediction by the mean predicted per capita expenditure for all 351 communities.

To illustrate how the cost index is constructed, we present the results for the five communities listed in Table 3. The table shows the contribution to costs of the five most important cost factors. Each entry in the first five rows is the product of the contribution to total costs of each cost factor as determined from the regression equation, and the difference between the value of each cost factor for the particular city or town and the average for all communities. Thus, each entry can be expressed as:

Table 3

Contribution of Individual Cost Factors to the Estimated Cost Indexes for Selected Communities
(Dollars per capita)

	Somerville	Brockton	Lawrence	Brookline	Dover
Weighted Pupils	-.86	26.54	-12.22	-116.13	14.08
Population Density	237.25	39.31	100.22	86.91	-11.67
Employment in Trade and Services	-.87	13.60	10.44	19.63	-17.46
Crime Rate	7.07	30.12	13.36	26.23	- 2.04
Age of Housing	47.61	7.28	29.57	18.47	-19.80
Other Cost Factors[a]	5.33	7.71	23.90	.27	- 8.65
Assessments for Transportation[b]	35.95	6.61	.60	45.53	12.38
Predicted Expenditures Per Capita[c]	998.18	883.33	918.02	832.54	719.01
Cost Index[d]	1.32	1.17	1.21	1.10	.95
Non-School Cost Index[e]	1.43	1.13	1.23	1.25	.93

Notes

a. Includes employment per capita in manufacturing, employment per capita in state or federal government jobs, percent of population below the poverty line, and miles of road per registered vehicle.

b. Treated separately because transportation assessments appear to bear little relationship to service levels actually received.

c. These are hypothetical; they show what per capita expenditures would have been had the community had average levels of fiscal resources and of other control variables.

d. Calculated by dividing predicted expenditures from the previous line by average predicted expenditures statewide.

e. Excludes effects of variations in weighted pupils across communities.

$$a_j (X_{j,i} - X_{j,avg})$$

where a_j is the coefficient of the jth cost variable, and represents the average impact on spending of a unit change in the value of variable j. The expression in parentheses is the deviation of variable j in community i from the state-wide average value of variable j. Above-average density, for example, contributes to higher costs and a positive entry in the table; below-average density contributes to lower costs and a negative entry in the table.

The table illustrates that the above-average costs in communities such as Somerville, Brockton, and Lawrence reflect differing combinations of cost factors. The key cost factor in Somerville and Lawrence is each city's density. In Brockton no single cost factor stands out; instead above-average values of all factors contribute to its above-average costs.

The table also shows that not all cost factors work in the same direction in a particular community. The proportion of the population in public schools in Brookline, for example, is way below average which leads to substantial cost savings connected with education. Despite this, Brookline still has above average total costs because of its above average density, commercial activity, and crime rate. Dover, in contrast, has below-average costs, despite its slightly above-average school costs..

Updating Cost Indexes

The cost indexes presented in this paper are based on 1980 data on the characteristics of Massachusetts communities. As time passes, these characteristics change, and the 1980 data may become obsolete. There are two separate issues involved in updating the cost indexes--when to update