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

STEP 1 (the estimation of the regression equation), and when to update STEP 2 (calculation of cost-related expenditure predictions). The underlying relationships between cost factors and spending are unlikely to change significantly over time. In addition, when spending is constrained for any reason (such as by Proposition 2 1/2), it is difficult to obtain accurate estimates of the independent effects of cost factors on spending. For these two reasons we would argue that the regression estimates need not be updated frequently. On the other hand, even though the relationship between a specific cost factor and total spending is likely to be reasonably stable, individual communities' values of specific cost factors do change over time. Thus the cost-index could be updated by substituting current values of the cost variables for each community, along with state average values of the resource and control variables to predict cost-related expenditures for each city and town. These predictions could then be used, as before, in STEP 3 to produce updated cost index values. Ideally, this would be done every few years for all the variables. However, some variables (for example, poverty, and age of the housing stock) are available only from the decennial U.S. census. Others, including weighted pupils, the employment variables and crime rate, are available annually, but with a lag. A compromise procedure is to update the index every few years using whatever is the most current value for each variable. Concern about obsolete information should be tempered by the fact that it is only unmeasured shifts in <u>relative</u> positions of individual communities, not across the board increases or decreases in average values that will distort the index.

Bringing Cost Indexes into State Aid Formulas

Cost indexes can be incorporated into state aid formulas several different ways. Existing state aid formulas could be adjusted, for example, to offset the fact that one dollar of state aid buys less in a community with high costs than in a community with average or low costs. This adjustment to current aid formulas would not eliminate all the disadvantages citizens in high-cost communities face compared to citizens in low-cost jurisdictions, however; they would still have to pay more out of locally raised taxes to receive the same level of public services. New distribution formulas are needed to help offset these more basic cost disadvantages.

In the rest of the paper we explain several methods for bringing cost differences into state aid formulas. First, we show how to translate existing aid formulas into real, that is, cost-adjusted, terms. Second, we demonstrate how a state aid formula could help offset the full disadvantage that some communities face because of their high costs. Finally, we show how to design a state aid formula that helps to offset both cost and revenue disparities.

Making State Aid Equivalent in Real Terms

Under most existing aid programs, funds are distributed among jurisdictions without considering how the cost of providing public services varies from one jurisdiction to the next. For example, the lottery formula provides more aid to cities and towns with relatively low equalized value per capita but ignores the cost of public services. Hence, two towns with the same equalized value per capita will receive the

same lottery aid per capita even if that aid buys more public services in one town than in the other.

The simplest way to account for the cost of public services is to define an adjusted aid amount equal to the old aid amount multiplied by the cost index for that community. For example, a community with a cost index of 1.2 that received $120 per capita under a state aid program would receive ($120)x(1.2) = $144 under a cost-adjusted version of the same program. Similarly, a community with a cost index of 0.8 that received $120 would receive an adjusted amount of $96 per capita.

This simple approach is incomplete, however, because the total cost-adjusted aid for all communities may not add up to the same amount as the original aid. This problem can easily be solved by translating cost-adjusted aid into a share of the total aid budget. Under this formulation, a jurisdiction's share of the state aid budget is proportional to cost-adjusted aid as defined above.

We can express this aid formula in symbols. Let C_i stand for the cost index in community i; let N_i stand for the population of the community; let B stand for the aid budget, that is the total dollar amount to be distributed among communities by some aid program; and let A_i stand for the original, unadjusted aid per capita received by community i. Then the adjusted aid per capita is represented as A_i, and the total cost-adjusted aid to community i, called $A_i N_i$, is determined as

follows:

$$A_i N_i = \frac{A_i C_i N_i}{\sum_j A_j C_j N_j} B$$

Total Cost-Adjusted Aid to Town i	Town i's Share of Total Aid	Total Aid Program Budget

In words, a community's share of the total aid budget is equal to its original aid adjusted for its costs divided by the sum over all communities of cost-adjusted aid. (The j indicates the set of all communities in the state and the $\sum$ indicates a sum.) Note that we can divide both sides of this formula by N_i to obtain per capita cost-adjusted aid to community i, namely A_i. The formula indicates that a community's per capita cost-adjusted aid is proportional to its original per capita aid multiplied by its cost index.

State Aid to Offset Cost Disadvantages

Although adjusting aid amounts to insure that state aid is in units with the same purchasing power for all communities may be desirable, it still does nothing to offset the large cost disadvantages that some local governments face in the absence of state aid--it does not correct for the unequal purchasing power of the revenues they raise themselves. Communities with high costs must pay more than communities with low costs to receive the same level of public services. A second type of formula can help to offset these total cost disadvantages.

The cost disadvantage a community faces if it has above-average costs is the difference between what that community has to pay for a basic package of services and what a community with average costs has to pay for that package. Different communities provide different types of public services, but the basic package of local services in the state can be

defined to be the package provided by the average community. Similarly, the amount a community with average costs spends for this basic package of services can be defined to be average spending for all the communities in the state. So if C_i is the cost index in community i and $\bar{E}$ is average spending per capita in the state, then community i must pay $\bar{E}C_i$ to obtain the basic package of services and its cost disadvantage per capita is equal to $(\bar{E}C_i - \bar{E})$.

In Massachusetts, one current aid program, namely Chapter 70 school aid, already partially compensates communities for the high cost of educating certain categories of pupils; the formula is designed to provide more aid per pupil for communities with relatively more pupils in high-cost programs, such as special, vocational, or bilingual education. If policymakers decide that Chapter 70 deals adequately with school costs, they may want to design an aid program that offsets only non-school cost disadvantages. A community's non-school cost disadvantage can be measured by substituting average non-school spending and a non-school cost index into the above formula; that is, a community's non-school cost disadvantage is the difference between what that community has to pay for the basic package of non-school services and what a community with average non-school costs has to pay for that package.

This measure of cost disadvantage for either total or non-school services can easily be brought into a state aid distribution formula. The following simple formula would offset the same percentage of the cost disadvantage in every community, and would provide no cost-related aid to communities with cost advantages, that is, with cost indexes less than

one. If B is the amount of money to be distributed under this program, the ith community would receive aid in line with the following expression:

$$A_i N_i = \frac{(\bar{E}C_i - \bar{E})\, N_i}{\sum_k (\bar{E}C_k - \bar{E})\, N_k} \quad B$$

Total Aid to Town i to offset its cost disadvantage	Town i's Share of Total Aid	Total Aid Program Budget

where k indicates the set of communities with cost disadvantages. According to this formula, a community's share of the total aid budget is proportional to its total cost disadvantage, that is to its cost disadvantage per capita multiplied by its population. As before, we can derive a community's aid per capita by dividing both sides of this formula by N_i. We find that per capita aid to community i is proportional to its per capita cost disadvantage.

Note that the $\bar{E}$ term conveniently cancels out of this formula. Without $\bar{E}$, our measure of cost disadvantage is transformed from dollar terms to percentage terms and the formula for state aid can be written as:

$$A_i N_i = \frac{(C_i - 1)\, N_i}{\sum_k (C_k - 1)\, N_k} \quad B$$

In words, community i's share of the aid budget is proportional to its population multiplied by the difference between its cost index and the average cost index, namely one. Only those communities with cost indexes greater than one would receive aid under this program.

This focus on communities with above-average costs is arbitrary. If the goal were to concentrate scarce state fiscal resources on communities with the greatest cost disadvantages, aid should not be provided to communities with cost indexes only slightly above average. If the goal were to spread resources across many communities, some aid should be provided to communities with cost indexes slightly below one, which, after all, are still disadvantaged relative to the lowest cost communities.

There is no analytically-based way of determining the total number of communities that deserve assistance. To make the policy decision more explicit, however, we redefine a community's cost disadvantage to be the extra amount that it must spend for the basic package of services relative to a community with "baseline" costs, where the baseline is a policy variable chosen by policymakers. In other words, the cost disadvantage in community i would be $(\bar{E}C_i - \bar{E}C^*)$ where C^* is the chosen baseline.

With this new definition of cost disadvantage, the state aid formula becomes:

$$A_i N_i = \frac{(C_i - C^*) N}{\sum_m (C_m - C^*) N_m} B$$

Total Aid to Town i to Offset Its Cost Disadvantage	Town i's Share of Total Aid	Total Aid Program Budget

where m indicates the set of communities with costs above the baseline. Thus a community's share of total aid is proportional to its population multiplied by the difference between its cost index and the baseline cost index. As before, communities with no cost disadvantage, that is, communities with cost indexes below C^*, receive no equalizing aid.

The role of the policy parameter, C^*, is illustrated in Figure 1, which describes three hypothetical aid programs for Massachusetts. All three programs offset non-school cost disadvantages and have a budget of $150 million. The per capita aid received by a community is given on the vertical axis and the community's cost index is given on the horizontal axis. Each line shows the relationship between a community's cost index and the aid it receives for a different value of C^*. The steepest line, which is the one with the highest value for C^*, concentrates the equalizing aid on the one third of all communities with the greatest cost disadvantages. The flattest line spreads the aid out among the neediest 90 percent of all communities and therefore does less to help the communities with the greatest cost disadvantages. The middle line provides aid to half of the communities in the state.

Table 4 presents average per capita aid received under these three programs by communities in various population size classes. On average, larger communities tend to have higher uncontrollable costs than smaller communities. Hence, for any given aid program, average aid tends to increase as one moves from small towns to large cities. In addition, average aid to large cities increases as the aid program becomes more equalizing.

Figure 1. Aid Programs to Offset Non-School Cost Disadvantages with Varying Different Degrees of Equalization

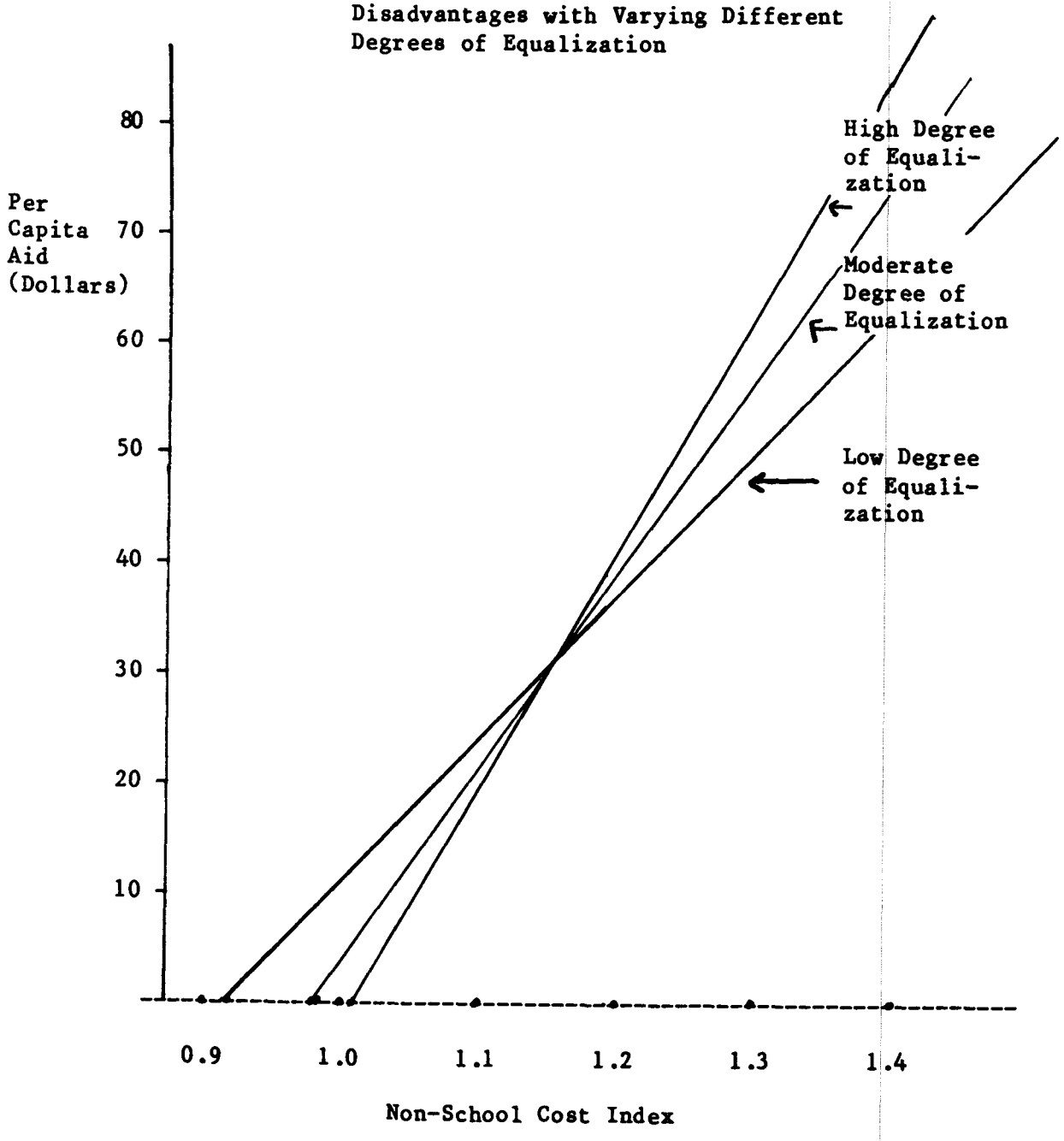

Table 4

Three Illustrative Aid Programs to Offset Non-School Cost Disadvantages in Massachusetts

Population Class	Number of Communities in Class	Degree of Equalization: High — Number of Communities Getting Aid	High — Average Per Capita Aid	Moderate — Number of Communities Getting Aid	Moderate — Average Per Capita Aid	Low — Number of Communities Getting Aid	Low — Average Per Capita Aid
Below 5,000	125	20	$ 9.45	38	$ 8.11	103	$ 7.08
5-10,000	75	15	8.35	26	7.79	65	7.04
10-25,000	90	30	10.27	55	8.93	88	9.95
25-50,000	40	31	19.55	35	19.75	40	19.96
Over 50,000	21	21	39.87	21	39.22	21	36.89
Total	351	117	17.66	175	14.38	317	11.47

Notes: All three programs have a budget of $150 million. The program with a high degree of equalization is one in which the neediest one-third of all communities receive aid. The program with a moderate degree of equalization is one in which half of all communities receive aid. The program with a low degree of equalization is one in which the neediest 90 percent of all communities receive aid.

Increasing the degree of equalization also shifts the distribution of aid toward the highest-cost jurisdictions within a population size class. We should emphasize, therefore, that Table 4, which only reports population class averages, understates the impact of a change in the policy parameter on the aid to a high-cost jurisdiction. To observe the magnitude of this impact, we must return to Figure 1, in which the three values of C^* correspond to the values built into these three programs. According to this figure, changing C^* from a low to a high degree of equalization implies an increase in aid of about $10 per capita for a jurisdiction with a nonschool cost index of 1.3.

This discussion is summarized in Table 5. To design a state aid program to offset cost disadvantages, state policymakers must make three decisions. First, they must decide how much to spend on the aid program. Second, they must decide whether to offset non-school cost disadvantages or all cost disadvantages. In Massachusetts, this decision is equivalent to deciding whether Chapter 70 adequately offsets school cost disadvantages. Third, they must decide on the degree of equalization in the state aid formula. If, for example, policymakers want a high degree of equalization in a program to offset non-school cost disadvantages, they should select a value of the policy parameter, C^*, that is greater than one and use a non-school cost index to measure a community's cost disadvantage.

Table 5

Designing an Aid Program to Offset Cost Disadvantages

Coverage of Aid Program	Desired Degree of Equalization		
	High	Moderate	Low
Non-School Costs	Use non-school cost index Set C^* greater than median cost index	Use non-school cost index Set C^* equal median cost index	Use non-school cost index Set C^* less than median cost index
Total Costs	Use total cost index Set C^* greater than median cost index	Use total cost index Set C^* equal to median cost index	Use total cost index Set C^* less than median cost index

State Aid to Offset Both Cost and Revenue Disadvantages

Communities differ in the revenues resources available to them as well as in their costs of producing public services. Moreover, cost differences and revenue differences sometimes work in the same direction and sometimes in opposite directions. Some high-cost jurisdictions are very short on resources, for example, and so particularly need state aid. Other high-cost jurisdictions have large tax bases and so can cover their high costs with their own resources. In this section, we demonstrate how to design state aid formulas that simultaneously account for both cost and revenue disadvantages.

The key to designing this type of aid program is the need-revenue gap. As we use the term, a need-revenue gap is not a measure of an actual budget deficit; instead it is a measure of the disadvantage a community faces from high costs or low revenues or both in providing a basic package of local services. To be precise, a community's gap is the difference between what it must spend to provide the basic package of services and the revenue available to it. As explained above, the amount a community must spend to provide the basic package of services is equal to EC_i. Let TR_i stand for the total revenue per capita available to the community given the constraints imposed by Proposition 2 1/2. Then the need-revenue gap for community i, G_i, is

$$G_i = \bar{E}C_i - TR_i$$

An aid program of this type could be comprehensive or incremental. An incremental equalizing state aid program would help to offset any need-revenue gap remaining after accounting for all existing state aid programs. In effect, this approach accepts existing aid programs as given, so that no community would receive less aid than it received the previous year, and accomplishes as much equalization as possible with the funds appropriated for the new aid program. With this approach, the total revenue, TR_i, used to calculate the need-revenue gap in each community should include existing state aid, as well as federal aid and local own-source revenue.

An alternative approach is to have a comprehensive equalizing aid program that would help to offset the entire need-revenue gap existing in each community before any general-purpose state aid is allocated. A comprehensive cost-revenue equalizing aid program would be a replacement for all existing general-purpose aid programs. The budget for this comprehensive aid program would presumably equal the amount currently distributed through the lottery, additional assistance and Chapter 70 aid programs plus any additional money state policymakers choose to devote to state aid. Under such a comprehensive program, total revenue, TR_i in the need-revenue gap would include local own-source revenue, federal aid and special purpose (also called categorical) state aid, but not existing general purpose state aid.

In effect, these two approaches define the extremes, and policymakers may want to pick an intermediate position. For example, policymakers may want to design an aid program to offset only non-school cost and revenue disadvantages. This can be done by including school aid in a community's

total revenue, TR_i, and excluding other general purpose aid in calculating the need-revenue gap. The budget of the new equalizing program would include the amounts formerly distributed by non-school general-purpose aid formulas, such as lottery aid and additional assistance. By separating out school aid in this way, this approach assures that all communities get at least some aid -- namely their school aid -- at the same time that the school aid is counted along with their other resources in determining whether general-purpose equalizing aid is needed.

We can follow the same logic here as in the previous section to design a formula that provides aid to a community in proportion to its need-revenue gap. As explained above, we can write this gap as $[EC_i - TR_i]$, so the aid formula is:

$$A_i N_i = \frac{(EC_i - TR_i)\, N_i}{\sum_n (EC_n - TR_n)\, N_n} \quad B$$

Total Aid to Town i to Offset Its Gap.	Town i's Share of Total Aid	Total Aid Program Budget

where n indicates the set of communities with positive need-revenue gaps. Thus, community i's share of the aid budget is proportional to its total need-revenue gap, that is to its per capita need-revenue gap multiplied by its population.

As before, policymakers must also decide the extent to which they want

to concentrate the distribution of state aid from this program on the communities with the largest need-revenue gaps. Let G^* stand for a policy parameter that indicates the baseline level of the need-revenue gap, in dollar terms, above which the state will provide equalizing aid. With the additon of this parameter, the previous distribution formula becomes

$$A_i N_i = \frac{\left[(\bar{E}C_i - TR_i) - G^*\right] N_i}{\sum_h \left[(\bar{E}C_n - TR_n) - G^*\right] N_n} \cdot B$$

where h indicates the set of communities with a need-revenue gap greater than the baseline gap. This formula indicates that community i's share of the total aid budget is proportional to its population multiplied by the dollar difference between its per capita need-revenue gap and the baseline per capita gap defined by policymakers. Similarly, per capita aid for community i is proportional to the difference between its per capita need-revenue gap and the baseline gap. As before, communities with a need-revenue gap less than the baseline receive no aid under this equalizing program, although they would still receive aid under other state aid programs. See Appendix B for numerical examples of how aid is calculated using need-revenue formulas.

We can illustrate the role of the policy parameter, G^*, in a diagram similar to Figure 1. Once the scope of a state aid program has been determined, per capita aid for a community depends only on the need-revenue gap in that community and the value of G^*. As shown in

Figure 2, which portrays three incremental aid programs each with a budget of $150 million, a larger value for G^* concentrates the aid on communities with larger need-revenue gaps. In this case, the highest value of G^* is set so that the neediest one third of communities receive aid. The lowest value is set so that the neediest 90 percent of all communities receive aid. The middle value is set so that 50 percent of all communities will receive aid.

Illustrations of the aid that communities of various sizes would receive from equalizing programs of this type are provided in Tables 6 and 7. Table 6 presents average per capita aid distributions for three incremental aid programs, each with a budget of $150 million, but differing in the amount of equalization they provide. Table 7 presents average per capita aid distributions for three comprehensive programs; the budget for each of these three programs is equal to $150 million plus the amount currently spent for the major general-purpose aid programs, lottery aid, additional assistance, and Chapter 70 school aid. For both incremental and comprehensive programs, the policy parameter is set so that the program with a high degree of equalization concentrates its aid in the neediest one third of the communities and the program with a low degree of equalization spreads its aid over the neediest 90 percent of the communities. Half the communities receive aid under the two programs with moderate equalization.

As summarized in Table 8, the implementation of a state aid program to offset both cost and revenue disadvantages requires two decisions by state policymakers. First, they must decide on the scope of this equalizing aid program. Will it supplement or replace existing general-purpose state aid

Figure 2. Incremental Aid Programs to Offset Need-Revenue Gaps with Different Degrees of Equalization.

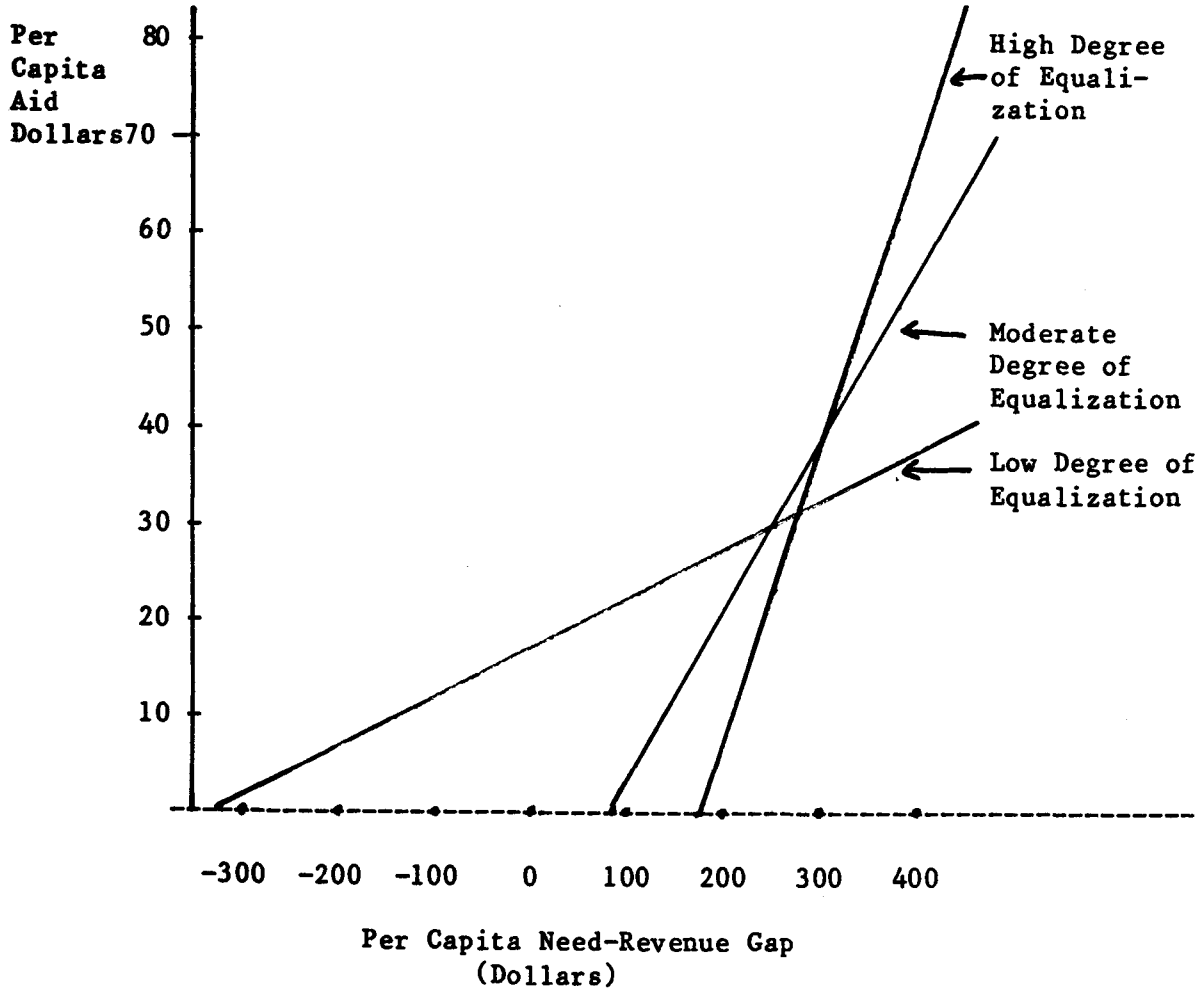

Table 6

Three Illustrative Incremental Aid Programs to Offset Cost and Revenue Disadvantages in Massachusetts

Population Class	Number of Communities in Class	Degree of Equalization					
		High		Moderate		Low	
		Number of Communities Getting Aid	Average Per Capita Aid	Number of Communities Getting Aid	Average Per Capita Aid	Number of Communities Getting Aid	Average Per Capita Aid
Below 5,000	125	17	$13.46	32	$16.17	100	$17.75
5-10,000	75	25	15.99	42	17.62	67	21.58
10-25,000	90	35	21.63	54	21.52	88	21.92
25-50,000	40	22	29.51	29	26.61	40	24.17
Over 50,000	21	18	59.07	19	48.34	21	32.38
Total	351	117	$26.48	176	$23.35	317	$21.51

Notes: All three programs have a budget of $150 million. The program with a high degree of equalization is one in which the neediest one-third of all communities receive aid. The program with a moderate degree of equalization is one in which half of all communities receive aid. The program with a low degree of equalization is one in which the neediest 90 percent of all communities receive aid.

Table 7

Three Illustrative Comprehensive Aid Programs to Offset Cost and Revenue Disadvantages in Massachusetts

Population Class	Number of Communities in Class	Degree of Equalization: High — Number of Communities Getting Aid	High — Average Per Capita Aid	Moderate — Number of Communities Getting Aid	Moderate — Average Per Capita Aid	Low — Number of Communities Getting Aid	Low — Average Per Capita Aid
Below 5,000	125	15	$152.44	34	$130.90	102	$158.82
5-10,000	75	25	185.99	41	176.66	67	203.04
10-25,000	90	38	206.11	54	201.02	87	207.23
25-50,000	40	22	234.74	29	222.82	39	226.68
Over 50,000	21	17	566.12	18	486.11	21	326.08
Total	351	117	$252.62	176	$214.43	316	$204.44

Notes: All three programs have a budget of $1,480 million, which is equal to $150 million plus the budget of current general-purpose state aid programs. The program with a high degree of equalization is one in which only the neediest one third of all communities receive aid. The program with a moderate degree of equalization is one in which half of all communities receive aid. The program with a low degree of equalization is one in which the neediest 90 percent of all communities receive aid.

Table 8

Designing an Aid Program to Offset Cost and Revenue Disadvantages

Scope of Aid Program	Desired Degree of Equalization		
	High	Moderate	Low
Incremental	Include all aid and own-source revenues in calculating a community's gap. Set G^* greater than the gap in the median community	Include all aid and own-source revenues in calculating a community's gap. Set G^* equal to the gap in the median community	Include all aid and own-source revenues in calculating a community's gap. Set G^* less than the gap in the median community
Comprehensive	Exclude current general-purpose state aid in calculating a community's gap. Set G^* greater than the gap in the median community	Exclude current general-purpose state aid in calculating a community's gap. Set G^* equal to the gap in the median community	Exclude current general-purpose state aid in calculating a community's gap. Set G^* less than the gap in the median community

programs? Second, they must decide on the degree of equalization the program will provide: high, moderate, or low. On the basis of these two decisions, per capita aid to each community can be calculated using the formula given above.

Conclusion

The large cost and revenue differences among cities and towns in Massachusetts imply that the state's citizens do not all have equal access to local public services. Through no fault of their own, citizens of high-cost, low-revenue communities receive inadequate schools, police protection, and other local public services while fellow citizens in communities without these cost and revenue disadvantages receive high-quality local services.

The state is the appropriate government unit to mitigate the cost and revenue disadvantages faced by many cities and towns. In the American political system, the states are the constitutional units and local governments derive their powers from the states. In a fundamental sense, therefore, the equity, or lack thereof, of the distribution of local services is a product of state action.

To some degree, Massachusetts has already recognized its responsibility for equalizing access to local public services. As noted earlier, for example, the Chapter 70 school aid formula adjusts for the high costs of certain educational programs and the lottery formula is

weighted toward communities with revenue disadvantages. Extensive cost and revenue disadvantages remain, however, despite existing state aid programs.

To illustrate the magnitude of the cost and revenue disadvantages that exist even with current levels of state aid, Table 9 comparies existing general-purpose state aid for fiscal year 1984 with a hypothetical comprehensive equalizing program, which provides aid to all communities except the 10 percent with the smallest need-revenue gaps. Average levels of aid that would be provided by an incremental cost-revenue equalizing state aid program (also providing aid to 90 percent of communities) are also shown in Table 9.

The hypothetical comprehensive program, as defined earlier, provides aid dollars proportional to the gap between each community's expenditure needs and its locally raised revenues. Thus, if existing state aid programs were substantially reducing need-revenue disadvantages, the actual aid numbers would be similar to the hypothetical aid numbers. The hypothetical numbers indicate that the big cities have the greatest need-revenue gaps, on average. Although existing per capita aid is highest for big cities, the comparison reveals that a large share of existing general-purpose aid goes to small communities with small per capita need-revenue disadvantages or no disadvantage at all.

The incremental aid numbers in the righthand columns of Table 9 provide another indication of the cost and revenue disadvantages communities face even after they receive current levels of state aid. The incremental aid dollars are proportional to the gap remaining between needs and revenues in each community after receiving current aid

Table 9

Comparing Actual General-Purpose State Aid with an Illustrative Comprehensive Aid Program to Offset Cost and Revenue Disadvantages in Massachusetts

		Actual State Aid, FY 1984		Illustrative Comprehensive Aid with a Low Degree of Equalization		Illustrative Incremental Aid with a Low Degree of Equalization	
Population Class	Number of Communities in Class	Number of Communities Getting Aid	Average Per Capita Aid	Number of Communities Getting Aid	Average Per Capita Aid[a]	Number of Communities Getting Aid	Average Per Capita Aid[a]
Below 5,000	125	125	$178	102	$130	100	$14
5-10,000	75	75	196	67	181	67	19
10-25,000	90	90	203	87	200	88	21
25-50,000	40	40	201	39	221	40	24
Over 50,000	21	21	305	21	326	21	32

a. Average based on all communities in size class, not just those getting aid.

distributions. The figures indicate that even when we include existing state aid among the revenues available to each community, per capita disadvantages are over twice as large, on average, in the biggest cities as in the smallest towns.

Thus, a shift toward a set of aid programs that is more equalizing than the existing programs would tend to increase the aid to large and medium-sized cities and towns and decrease the aid to less needy small communities. Furthermore, such a shift would redistribute state aid funds towards the neediest communities within each population size class.

The comparisons in Table 9 make clear the magnitude of the fiscal disadvantages that face many communities today and it shows the direction in which the state should move to provide more equalization. By using one of the incremental approaches described earlier, the state could use new state aid funds to reduce the remaining need-revenue gaps without imposing serious short-run adjustment costs on individual communities.

In summary, this paper provides a flexible framework for designing state aid to offset the cost and revenue disadvantages faced by many cities and towns in Massachusetts. 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.

APPENDIX A. THE REGRESSION EQUATION

Variables in the Equation

CRIME Number of crimes reported per 1,000 inhabitants in 1980. (Note: Population-class average rates were used for 98 small cities and towns for which crime rates are not available). Source: Department of Public Safety, Crime Reporting Unit.

DENSITY Population density determined by dividing 1980 Census population by area in square miles. Source: 1980 Census of Population and various atlases.

EQV80 Total equalized property tax valuation per capita in 1980. Source: Bureau of Local Assessments, Department of Revenue.

ELDERLY Percent of total population over the age of sixty-five in 1980. Source: Census of Population and Housing.

FEDAID General revenue sharing entitlements per capita in fiscal 1980. Source: Eleventh Period Entitlements, Office of Revenue Sharing, Department of the Treasury.

GOVER Number of state and federal government employees per capita in 1980 by place of work. Source: Division of Employment Security, Occupation/Research Department and Annual Survey of Governments.

GRANTS Total direct federal aid per capita other than general revenue sharing in 1980. Source: Annual Survey of Governments.

HOUSAGE Percent of 1980 year-round housing units built before 1940. Source: Census of Population and Housing.

INCOME Personal income per capita in 1979. Source: Census of Population and Housing.

LOCEXP Total amount budgeted as expenditures for local purposes (includes amounts appropriated and amounts otherwise required to be raised such as regional school district assessments) plus assessments and charges for state, county, and metropolitan district purposes per capita in fiscal year 1980. Source: Massachusetts Taxpayers Foundation, Municipal Financial Data and Department of Revenue, Planning and Research Bureau.

LOCREV Estimated local receipts (motor vehicle excise, license fees, fines, special assessments, rentals, sales of services, and other local sources) per capita in fiscal year 1980. Source: Massachusetts Taxpayers Foundation, Municipal Financial Data.

MANUF[1] Number of employees in agriculture, forestry, fisheries, mining, construction, manufacturing, and transportation per capita in 1980 by place of work. Source: Division of Employment Security, Occupation/Industry Research Department.

Variables in the Equation (con't)

POPRAT Rate of population change defined as 1980 population divided by 1970 population. Soruce: Census of Population and Housing.

POPRAT2 Rate of population change squared. Source: Census of Population and Housing.

POVERTY Percent of population with 1979 income below the poverty level. Source: Census of Population and Housing.

REGAID 1980 per capita amount of direct aid to regional school districts allocated to each member municipality. Source: Bureau of Data Collection, Department of Education.

STAID Total amount paid by the state as aid or reimbursement (not including aid to regional school districts) per capita in fiscal year 1980. Source: Massachusetts Taxpayers Foundation, Municipal Financial Data.

TRADE[1] Number of employees in trade, finance, insurance, real estate, and services per capita in 1980 by place of work. Source: Division of Employment Security, Occupation/Industry Research Department.

VEHICLE Local road mileage per registered vehicle in 1980. Source: Department of Public Works.

WFTE Weighted full-time equivalent pupils per capita in 1980. Source: Bureau of Data Collection, Department of Education.

[1]Number of employees in industry divisions for municipalities with disclosure problems was determined by taking a percentage of total employment in the city or town equal to the average percentage for municipalities in the same population-class for that industry division. Applies to MANUF and TRADE only and affects 127 cities and towns.

Table A-1

RESULTS OF REGRESSION EQUATION
(Dependent Variable is 1980 Expenditures Per Capita)

VARIABLE	ESTIMATED COEFFICIENT	STANDARD ERROR
CRIME	0.616	0.295
DENSITY	0.0121	0.00295
EQV80	0.00808	0.000556
ELDERLY	-439	182
FEDAID	2.75	0.684
GOVER	12.4	138
GRANTS	0.0407	0.0722
HOUSAGE	123	50.5
INCOME	0.0218	0.00450
LOCREV	1.20	0.108
MANUF	46.9	50.4
POPRAT	-193	116
POPRAT2	49.8	32.9
POVERTY	151	206
REGAID	-0.664	0.0985
STAID	0.336	0.120
TRADE	207	76.6
VEHICLE	49.6	404
WFTE	1176	186
CONSTANT	51.9	126

Summary Statistics of the Equation

R^2	.780
R^2 Adjusted for Degrees of Freedom	.766
Mean of the Dependent Variable	752
Standard Error of the Regression	10
Number of Observations	336

Table A-2

MEANS AND STANDARD DEVIATIONS OF REGRESSION VARIABLES

VARIABLE	MEAN	STANDARD DEVIATION
CRIME	41.12	23.63
DENSITY	1279.05	2508.46
EQV80	20213.23	13780.90
ELDERLY	0.12	0.04
FEDAID	19.96	8.97
GOVER	0.05	0.04
GRANTS	35.61	81.96
HOUSAGE	0.39	0.16
INCOME	7604.88	1754.70
LOCEXP	752.16	210.94
LOCREV	82.17	59.50
MANUF	0.11	0.13
POPRAT	1.16	0.29
POPRAT2	1.43	0.93
POVERTY	0.07	0.04
REGAID	66.66	81.70
STAID	154.88	67.34
TRADE	0.13	0.10
VEHICLE	0.01	0.02
WFTE	0.24	0.04

APPENDIX B. ILLUSTRATITIVE STATE AID CALCULATIONS

Revenue Variables

CATEGORICAL AID	Special-purpose state aid to local governments (including municipality's share of direct aid to regional school districts) per capita in fiscal year 1983. Source: 1983 Cherry Sheets, Division of Local Services, Department of Revenue.
FULL AND FAIR CASH VALATION	Estimated total full and fair cash valuation in fiscal year 1984. Source: "Proposition 2 1/2: A Review of State and Local Fiscal Data," Michael Meyers of the House Committee on Ways and Means in cooperation with the Massachusetts Development Research Institute, University of Massachusetts/Amherst. (Note: Estimates for Boston, Fitchburg, Hull, Peru, and Washington were updated by the authors)
GENERAL-PURPOSE AID[1]	General-purpose state aid to local governments (including municipality's share of direct aid to regional school districts) per capita infiscal 1983. Source: 1983 Cherry Sheets, Division of Local Services, Department of Revenue.
FEDERAL AID	General revenue sharing entitlements per capita in fiscal 1982. Source: Thirteenth Period Entitlements, Office of Revenue Sharing, Department of the Treasury.
PROPERTY TAX LEVY	Estimated potential property tax levy per capita in fiscal 1984 determined by multiplying full and fair cash valuation by the Proposition 2 1/2 mandated property tax rate limit. For 11 communities this limit is in excess of 2 1/2 percent; for 83 jurisdictions this limit is below 2 1/2 percent. Source: Property Tax Bureau, Department of Revenue.
MOTOR VEHICLE EXCISE	Estimated motor vehicle excise receipts per capita in fiscal 1982. Source: 1982 Tax Rate Recapitulation Sheets, Property Tax Bureau, Department of Revenue.
OWN-SOURCE REVENUE	Estimated receipts from the property tax levy and the motor vehicle excise per capita in fiscal 1984.

[1]General-purpose state aid to local governments includes the following: distributions for school aid (including municipality's share of school aid to regional school districts), additional assistance from the general fund, and lottery aid and reimbursements for loss of taxes on state-owned land and the urban redevelopment corporation excise (Chapter 121A). Special-purpose state aid includes all other distributions and reimbursements.

Table B-1

ILLUSTRATIVE CALCULATIONS OF STATE AID DISTRIBUTED BY AN INCREMENTAL COST-REVENUE FORMULA

Total Gap = Adjusted costs-available revenues-baseline gap (G*) x population

Aid Share for town i = $\frac{\text{Total gap for town i}}{\text{Sum of all total gaps}}$

MUNICIPALITY	(1) ADJUSTED COSTS[1]		(2) AVAILABLE REVENUES[2]		(3) REVENUE GAP (1)-(2)		(4) BASELINE GAP(G*)[3]		(5) ADJUSTED GAP[4] (3)-(4)	(6) TOTAL GAP (5)x population	(7) AID SHARE
Somerville	$1361	-	$ 694	=	$ 667	-	$ 324	=	$ 991	$76,675,652	2.58%
Lawrence	1248		765		483		324		807	50,982,225	1.73
Brockton	1206		832		374		324		698	66,430,056	2.22
Brookline	1134		1094		40		324		284	15,637,608	0.70
Gardner	1000		729		271		324		595	10,650,500	0.36
Dover	979		1813		-834		324		0	0	0.00

[1]Cost Index multiplied by estimated average state-wide spending per capita.
[2]Total state aid, federal aid, and own-source revenues.
[3]Policy parameter which determines how many communities receive incremental aid (e.e., have positive adjusted gaps).
[4]Negative revenue gaps are set at zero.

Table B-2

ILLUSTRATIVE CALCULATIONS OF STATE AID DISTRIBUTED BY A COMPREHENSIVE COST-REVENUE FORMULA

Total Gap = Adjusted costs - available revenues - baseline gap (G*) x population

Aid Share for town i = $\frac{\text{Total gap for town i}}{\text{Sum of all total gaps}}$

MUNICIPALITY	(1) ADJUSTED COSTS[1]		(2) AVAILABLE REVENUES[2]		(3) REVENUE GAP (1)-(2)		(4) BASELINE GAP(G*)[3]		(5) ADJUSTED GAP[4] (3)-(4)	(6) TOTAL GAP (5)x population	(7) AID SHARE
Somerville	$1361	-	$ 400	=	$ 961	+	$ 209	=	$ 1170	$ 90,525,240	2.77%
Lawrence	1248		411		837		209		1046	66,081,050	2.03
Brockton	1206		499		707		209		916	87,177,552	2.67
Brookline	1134		967		167		209		376	20,703,312	0.64
Gardner	1000		472		528		209		737	13,192,300	0.40
Dover	979		1725		-746		209		0	0	0.00

[1]Cost Index multiplied by estimated average state-wide spending per capita.
[2]Special-purpose state aid, federal aid, and own-source revenues per capita. (Does not include general-purpose state aid).
[3]Policy parameter which determines how many communities receive incremental aid (i.e., have positive adjusted gaps).
[4]Negative gaps are set at zero.