VARIATION IN URBAN TRANSIT COSTS AND REVENUES
BY TYPE OF SERVICE

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ABSTRACT

One of the major initiatives of current federal urban transportation policy is to promote private-sector involvement in planning, operating, and financing urban mass transit services. One means to rapidly expand private participation in the provision of urban transit service is for the public authorities that now operate almost all transit service in U.S. urban areas to contract with private firms to assume the operation of certain services. Many of the public authorities that now provide these services have objected that such contracting-out would "skim the cream" from their systems. By this, they apparently mean that private firms would agree to acquire only those services that earn revenues in excess of their operating costs, thus leaving public authorities with increased deficits and no opportunities to cross-subsidize them from "profitable" sources.

This research explores whether the public authorities that currently provide mass transit service in the nation's urban areas are able to operate any of those services "profitably," where that term is defined to maximize the possibilities for profitable service. Its major conclusion is that extremely few if any urban transit services now operated by public agencies in U.S. cities generate farebox revenues sufficient to cover even their direct, day-to-day operating expenses. It further concludes that farebox coverage of operating expenses appears to be lowest for exactly those services in which both actual and potential private participants have exhibited the greatest interest, so that there appears to be little risk that widespread contracting out of urban transit srevice will produce increased deficits for any of its current operators.

One of the major initiatives of current federal urban transportation policy is to promote private-sector involvement in planning, operating, and financing urban mass transit services, which have during the last two decades come to be almost universally owned and managed by government agencies.[1] The Federal Private Enterprise Participation Policy Statement, issued by the Urban Mass Transportation Administration (UMTA) during 1984, states in part that "When developing federally assisted mass transportation plans and programs, UMTA grantees should give timely and fair consideration to the comments on proposals of interested private enterprise entities in order to achieve **maximum feasible private participation**" (emphasis added).[2] Despite some very recent increases in participation by private transit operators, very little of the conventional transit service in the U.S. is now operated by private suppliers, either independently or under contract to public transit authorities and regional transportation agencies responsible for providing it.

One means to rapidly expand private participation in the provision of urban transit service is for the public authorities that now operate almost all of it to contract with private firms to assume the operation of certain services. The variety of potential candidates for such "contracting out" is wide, but the most logical starting points probably are some fixed-route bus operations, particularly peak-hour express routes and local suburban service, commuter railroad service, and various demand-responsive or "paratransit" services. While contracting out has already been extensively employed for demand-responsive service, and commuter rail service is commonly operated by railroad companies under contract to public transit authorities, only about 2% of all conventional bus transit service in the U.S. is currently operated by private firms on a contract basis.[3]

The "Cream-Skimming" Controversy

Some of the public authorities that now provide these services have objected that such contracting-out would "skim the cream" from their systems. By this, they apparently mean that private firms would agree to acquire only those services that earn revenues in excess of their operating costs, thus leaving public authorities with increased deficits and no opportunities to cross-subsidize them from "profitable" sources. Representative William Lehman, Chairman of the Transportation Subcommittee of the House Committee on Appropriations, voiced this concern during his Subcommittee's May, 1985 hearings, when he commented that privately operated transit services were desirable only "...as long as they do not drain off the best routes from the public transportation [operators] so that public transportation is just left with the more costly to operate type of routes."[4]

Some advocates of privatization have responded that public transit authorities may be unable to cover the costs of operating <u>any</u> of the services they currently supply, but that private suppliers might be able to operate some routes or types of service at considerably lower costs than the public agencies that currently provide them, thus reducing the subsidy levels necessary to maintain such services. In response to Representative Lehman's concern, for example, one of those testifying before the Subcommittee cautioned its members that "...public transit authorities lose money on both these ostensible 'cream' passengers and on the others that they carry...I think it is a mistake to accept uncritically the argument that by skimming off peak hour passengers, passengers on express-type services, and others for which higher fares are sometimes charged, that public transit operators would actually see their deficits grow."[5]

This paper explores the question of whether, in the parlance of the industry, there remains any 'cream to skim.' That is, it investigates whether the public authorities that currently provide almost all mass transit service in the nation's urban areas are able to operate any of those services "profitably." The next section presents a definition of this term that is intended to maximize the possibilities for identifying such profitable services. Subsequent sections then review the available empirical evidence on variation in transit costs and revenues by type of route and time period, in order to test whether any transit service currently generated farebox revenues sufficient to meet this definition of profitability.

When is Transit Service "Profitable?"

Meeting the economist's definition of profitability requires that a service generate revenues sufficient to cover its expenses for labor, energy, materials, and other operating inputs, as well as to produce some return to its invested capital. Further, for a service to be self-sustaining, this return must suffice to attract new capital at a rate that maintains the total investment necessary to operate it. In urban transit, however, a service is typically said to be profitable if it generates farebox revenues that exceed its direct operating expenses, without any allowance for the depreciation or interest costs for vehicles or fixed capital facilities dedicated to its provision.

Further, a service's direct operating expenses are often defined to exclude any allowance for administrative costs or other overhead-type expenses, while at other times they include a simple proportional allocation of these expense categories. This may occur because there are a number of difficult conceptual problems in allocating expenses that are genuinely common to more than one category of service, although it may also occur in response to the difficulty of taking the actions necessary to reduce these costs when service levels are curtailed.

Although the accounting systems of most public transit operators sometimes make the allocation of farebox revenues among types of service, specific routes, and occasionally even time periods of the day a relatively straightforward process, they generally do not permit ready identification of the costs of operating different categories of service. Judgemental procedures are generally required to allocate the expense categories appearing in transit operators' accounting systems among any desired subdivision of the agency's activities, such as operating divisions, individual routes, or time periods. Thus not only is the definition of what constitutes profitable service a dificult matter, but the actual measurement of whether individual service categories meet any particular definition is also problematic.

In an effort to minimize these potential difficulties, this study adopts a very narrow definition of the profitability of individual transit service categories. Specifically, it investigates the relationship between farebox revenues and direct, day-to-day expenses for various categories of transit service currently operated by a number of different public agencies. Direct operating expenses are defined to include only labor, energy, and materials costs for operating and maintianing vehicles, plus an allowance for investments in and use-related depreciation (as contrasted with depreciation that occurs solely because of the passage of time) of any vehicles that are dedicated to the provision of that service. All expenses for operation and maintenance of fixed facilities (such as garages, depots, stations, etc.) and rights-of-way, as well as all expenses for supervisory and administrative functions, are specifically excluded from the definition of direct costs employed here. The major reason for adopting such a conservative definition of costs is to match as closely as possible those expenses that would be instantaneously eliminated by a public agency that successfully contracted with a private supplier to take over a specific service it now operates. Any category of transit service that fails to meet the profitability test under this definition of costs necessarily contributes to increasing the financial deficit of its operator, and its elimination would thus unarguably reduce that deficit.

The Operating Ratio Complication

Somewhat surprisingly, contracting out or otherwise eliminating a service that now produces a deficit under this definition can actually reduce the fraction of its operator's expenses that is covered by fare revenues, while also raising the deficit per passenger on that operator's remaining services. (A service's farebox receipts expressed as a percentage of its operating expenses is commonly referred to as its operating ratio, although this actually corresponds to the reciprocal of the traditional accounting definition of that term. This measure is also often termed the farebox coverage ratio.) This result has occasionally been used to argue that transferring such services to even unsubsidized private providers will leave the public agency that now operates them in worse financial condition than if it continued to operate them and cover a low percentage of their expenses from farebox revenues. Nevertheless, it is important to recognize that exactly the opposite is true.

To see that this is the case, suppose a transit authority operates service on two routes, one offering peak hour express service at a fare of $1.00 per passenger and the other all-day local service at a fare of 50 cents per rider. Suppose each route costs the authority $1,000 per day to operate, and that each service attracts 600 paying riders each day. Thus the express service earns total daily revenues of $600, leaving a daily operating deficit of $400, and has a farebox coverage ratio of 60% (the $600 in daily fare revenue it generates expressed as a percent of its $1,000 daily operating expense). Similarly, the local route produces $300 in daily revenue, leaving a daily deficit of $700, and thus generates only 30% farebox coverage of operating expenses. In total, the operator of these two routes incurs a daily total deficit of $1,100, or about 92 cents per passenger, and covers 45% ($600 plus $300 in daily revenues from the two routes, divided by the $2000 total daily expense for the two routes) of its operating expenses from the farebox.

If the express service were to be assumed by an unsubsidized private operator, some financial statistics for the public agency that continued to operate the local route would indeed appear to be worse: farebox coverage of expenses would decline to the 30% figure of the local route, and the deficit per passenger would rise to about $1.17 (the $700 daily deficit incurred in operating the local route divided among the 600 passengers it carries). More important, however, the remaining total deficit would have declined from the initial $1,100 to the $700 figure generated by the local route, since the $400 daily deficit on the express route would have been eliminated. In fact, the public agency that formerly operated the express route could subsidize the private operator to which it was transferred or contracted at a rate of up to $399 daily and still reduce its total daily deficit for providing the two types of transit service.

The most visible transit services for which this example is relevant are probably the peak hour express services currently operated by many public transit agencies, often including commuter railroad service (much of which is already operated by private railroad companies under contract to public transit agencies). Considerably higher fares are typically charged for such services than for regular local bus service, and these premium fares are often sufficient to raise farebox coverage ratios on express service well above their operators' systemwide averages. Nevertheless, these services are often among the most important sources of their operators' total deficits, simply because their operating costs are so high. For example, one study found that express bus routes in Los Angeles covered nearly 40% of their operating costs from fare revenues, a figure exceeded at that time only on routes serving central city areas, but still accounted for nearly one-quarter of their operator's total deficit.[6] Thus contracting the operation of such services to lower-cost private providers might in some cases substantially reduce their current suppliers' total deficits.

Types of Transit Service Studied

One useful way to classify transit service is according to the orientation of routes over which vehicles operate and the time period during which service is provided. Table 1 illustrates how these two characteristics can be used to subdivide the service provided by a typical large urban transit authority into various categories. The costs of operating transit service are likely to differ considerably among these different categories, mainly because the productivity with which operators and vehicles can be utilized in each type of service vary widely. Among the most important factors responsible for this are peaking in scheduled service levels during morning and evening commuting hours on some routes, together with provisions of transit operators' labor contracts that restrict the duration of driver work shifts, the use of split shifts, and the hiring of part-time drivers. Other important sources of labor productivity differences among types of transit service are varying amounts of non-revenue service they require (due to vehicle "deadheading" and layover allowances, for example), variation among routes and time periods in the speeds at which transit vehicles can operate in revenue service, and differences among passenger trip lengths with route orientation and time periods.

In addition, the demand for transit service in most urban areas differs substantially among the types of routes shown in Table 1, as well as among the different time periods of the day and week it shows. Some transit operators also impose higher passenger fares for specific services or at certain times of the day, most commonly for radial express routes and during weekday peak hours, while others employ zone surcharges to impose higher fares for longer trips. Together, these

Table 1

Classification of Transit Service Types
by Time Period and Route Location

	Time Period During Which Service on Route Operates:		
Route Orientation	Weekday Peak	Midday and Night	Weekend & Holiday
CBD-Bound Radial	XX		
Intown Local	XX	XX	
Suburban Local		XX	XX
Crosstown or Inter-suburban			
Rail System Feeder	XX		

XX-denotes current participation or apparent interest by private transportation operators in providing this type of service.

factors introduce substantial variation in passenger volumes, average fares actually paid, and the resulting total farebox revenues among the various categories of transit service that are identified in Table 1. In conjunction with variation among these categories in the costs of operating service, these differences in revenue can produce substantial variation in farebox coverage of expenses and operating deficits among individual types of service. If there is any profitability or "cream to skim" within the financial structures of U.S. urban transit systems, it seems most likely to be revealed by an analysis of variation in operating costs and farebox revenues among the categories of transit service identified in Table 1.

Evidence on Variation in Transit Costs

A substantial amount of recent research has focused on assessing variation in the costs of supplying transit service of the different types identified in Table 1. It consists primarily of studies that judgmentally allocate transit agencies' itemized expense accounts among the different services they supply, usually by assigining individual accounts to output measures such as vehicle-hours or vehicle-miles of transit service.[7] This produces estimates of the unit costs for producing each of these outputs, which are then applied to the actual output levels (again, vehicle-hours and vehicle-miles are the most commonly employed of these "cost factors") entailed in operating a specific service in order to estimate its separate cost. Expenses for management, planning, administration, and other such "overhead" activities are sometimes allocated among individual categories of service, most commonly on the basis of the number of vehicles assigned to each route, time period, or combination of the two (such as the number of vehicles required to operate peak hour service on each route).

Table 2 summarizes the results of a number of these "cost allocation" studies that have been documented in recent publications. (Only those studies that describe their results in sufficient detail to allow the examination of cost and revenue variation by individual route, operating division, or service type were utilized in this research.) As the table indicates, virtually all of them report estimates of expenses per vehicle-hour and per vehicle-mile of service that were developed by allocating individual operating cost accounts to the output measure with which the authors of the various studies thought they were likely to vary most directly. These unit cost estimates are then applied to the actual numbers of those outputs used to operate different routes or services, which are also reported in Table 2. Finally, each researcher assigns administrative and other overhead costs to individual routes or services on the basis of some other variable, such as the number of vehicles operated in peak service, which is also reported in the table.

Several adjustments to the various authors' cost estimates reported in Table 2 were necessary to make them useful for investigating the profitability of transit services as defined for the prupose of this study. First, all administrative and other overhead expenditures that are allocated to individual routes or types of service by various researchers are subtracted from their cost estimates, since it is unlikely that these expenses would be immediately reduced in exact proportion to any reduction in vehicle requirements or other variables that resulted from a decision to contract out specific services. (In fact, it is not clear whether some of these expenses would be reduced at

Table 2

Development of Operating Cost Estimates for Various Urban Transit Services

Urban Area	Operating Agency	Researcher	Data Year	Type of Service	# of Routes	Unit Cost Factors Used: $/VH	$/VM	Other Factor	Daily Oper. Inputs Required VH	VM	Other Factor	Estimated Daily/Hourly Oper. Cost
Los Angeles	SCRTD	Gephart	1984	Express	1	33.09	0.99	138.73 PO*APB/TB[1]	49.8	1441	(10+10)(10/10)	5849/117.45
				Intown	1							
				Peak		30.27	1.14	107.30 PO*APB/TB	37.8	300	(7+0)(8/20)	1787/47.27
				Off-Peak		27.10	1.14	107.30 PO*BB/TB	60.5	393	(7)(12/20)	2538/41.95
				Suburban	1							
				Peak		30.27	1.14	107.30 PO*APB/TB	32.0	472	(5+2)(5.5/9.5)	1941/60.67
				Off-Peak		27.10	1.14	107.30 PO*BB/TB	47.6	415	(5+2)(4/9.5)	2079/43.68
Los Angeles	SCRTD	Wells, Williams	1982	Express								
				Subscription	8	27.90	1.22	109.07/PV-day[2]				4016
				Park & Ride	9	27.90	1.22	109.07/PV-day				34471
Los Angeles	SCRTD	Cox	1980	Express	?							72000
				Peak		20.64	0.79	68.92/PV-day				
				Non-Peak		15.86	0.79	68.92/PV-day				
				Intown	?							384400
				Peak		20.64	0.79	68.92/PV-day				
				Non-Peak		15.86	0.79	68.92/PV-day				
				Suburban	?							147100
				Peak		20.64	0.79	68.92/PV-day				
				Non-Peak		15.86	0.79	68.92/PV-day				
Orange County	OCTD	Wells, Williams	1982	Park & Ride	5	20.55	0.95	103.60/PV-day				3702
San Diego	SDTC	Cervero	1978	Radial	3							
				Peak		23.73	0.43	+3.4% capital[3]	185.0	3662	31*	6168/33.34
				Non-Peak		17.50	0.43	+0.6% capital	166.8	3258	15*	4346/26.05
				Intown	2							
				Peak		24.75	0.43	+3.4% capital	95.0	889	16*	2734/28.77
				Non-Peak		17.83	0.43	+0.6% capital	129.5	1204	12*	2844/21.96
				Suburban	5							
				Peak		23.67	0.43	+3.4% capital	101.0	1508	17*	3142/31.11
				Non-Peak		19.09	0.43	+0.6% capital	176.3	2655	16*	4534/25.72

Table 2 (continued)

Development of Operating Cost Estimates for Various Urban Transit Services

Urban Area	Operating Agency	Researcher	Data Year	Type of Service	# of Routes	Unit Cost Factors Used: $/VH	$/VM	Other	Daily Oper. Inputs Required VH	VM	Other	Estimated Daily/Hourly Oper. Cost
SF Bay Area	ACT	Cervero	1979	Express	3							
				Peak Only		18.62	0.29	+27.8% OH[4]	275.8	5861	69*	8735/31.67
				Radial	4							
				Peak		20.01	0.27	+27.8% OH	484.7	5846	122*	14412/29.73
				Non-Peak		17.32	0.27	+2.0% OH	676.8	8477	50*	14291/21.16
				Intown	3							
				Peak		19.46	0.27	+27.8% OH	108.9	1332	28*	3168/29.09
				Non-Peak		17.43	0.27	+2.0% OH	122.2	1568	9*	2604/21.31
				Suburban	5							
				Peak		18.71	0.23	+27.8% OH	242.9	4965	61*	7521/30.96
				Non-Peak		18.67	0.24	+2.0% OH	90.2	1223	7*	2017/22.36
				Rail Feeder	5							
				Peak		18.97	0.28	+27.8% OH	142.5	1762	36*	4085/28.67
				Non-Peak		17.97	0.28	+2.0% OH	138.6	1738	11*	3037/21.91
	SPRR	Dornan	1980	Commuter Rail	1	--	6.81	--	--	8105	--	55184
New York	NYCTA	Walder	1981	Peak-Only Express								
				Yukon	6	27.55	0.60	219.90/PV-day	814.6	15952	115	50871/62.45
				Castleton	3	26.82	0.86	189.08/PV-day	187.1	4051	30	14174/75.76
				Combined	9	27.41	0.65	213.52/PV-day	1001.7	20003	145	65045/64.93
	LIRR	Dornan	1980	Commuter Rail	?	--	6.87	--	--	162530	--	1116581
Boston	MBTA	Carey, Campbell	1981	Express	3							
				Peak		30.37	0.86	554.70/PV-day	60.2	761	8*	3110/51.67
				Non-Peak		27.04	0.86	0	40.3	480	4*	1222/30.33
				Radial	4	(hybrid radial trunk and rail feeder routes)						
				Peak		30.37	0.86	554.70/PV-day	147.4	1356	19*	6860/46.54
				Non-Peak		27.04	0.86	0	132.1	1216	12*	3592/27.19
				Crosstown	7	(circumferential routes; intown travel served by rail system)						
				Peak		30.37	0.86	554.70/PV-day	165.8	1424	21*	8040/48.49
				Non-Peak		27.04	0.86	0	101.6	873	10*	2740/26.97
				Suburban	2							
				Peak		30.37	0.86	554.70/PV-day	14.7	217	2*	743/50.52
				Non-Peak		27.04	0.86		5.8	87	1*	189/32.64
	B+MRR	Dornan		Commuter Rail	9	--	6.79	--	--	25875	--	175691

Table 2 (continued)

Development of Operating Cost Estimates for Various Urban Transit Services

Urban Area	Operating Agency	Researcher	Data Year	Type of Service	# of Routes	Unit Cost Factors Used: $/VH	$/VM	Other Factor	Daily Oper. Inputs Required VH	VM	Other Factor	Estimated Daily/Hourly Oper. Cost
Washington, D.C.	B+ORR	Dornan	1980	Commuter Rail	2	--	9.50	--	--	2316	--	22002
Pittsburgh	B+ORR	Dornan	1980	Commuter Rail	1	--	2.42	--	--	2664	--	6447
	P+LERR	Dornan	1980	Commuter Rail	1	--	18.00	--	--	280	--	5040
	Total			Commuter Rail	2	--	3.93	--	--	2944	--	11540
Detroit	GTWRR	Dornan	1980	Commuter Rail	1	--	10.22	--	--	830	--	8482

* Estimated from vehicle-hour data assuming (1) uniform within-peak service pattern and (2) no non-revenue service during peaks.

[1] PO indicates total daily bus "pull-outs," defined as the number of buses employed in morning peak service plus the number used to operate evening peak service that were not used for midday service. APB indicates "average peak buses," the average of the numbers needed for morning and evening peak period service, while BB indicates "base buses," the average number of buses used to provide midday base period service.

[2] PV-day indicates a daily dollar cost allocation per vehicle necessary to operate scheduled peak service on a route.

[3] Factors added to direct operating costs to account for estimated capital charges for vehicles and fixed facilities; thus for example, total operating costs in peak service are estimated to be 103.4% of direct operating expenses.

[4] Factors added to direct operating costs to account for estimated general overhead expenses; thus for example, total operating costs in peak service are estimated to be 127.8% of direct operating expenses.

Sources: Rex Gephart, "Development of a Bus Operating Cost Model Based on Disaggregate Data," Transportation Research Record 1011, 1984, pp. 16-23; Brad Williams and William Wells, "Economics of Commuter Express Bus Operations," Transportation Research Record 915, 1983, pp. 13-18; Wendell Cox, "Distribution of Public Transit Subsidies in Los Angeles County," Transportation Research Record 877, 1982, pp. 1-5; Robert B. Cervero, Martin Wachs, Renee Berlin, and Rex J. Gephart, Efficiency and Equity Implications of Alternative Transit Fare Policies, Report CA-11-0019, U.S. Urban Mass Transportation Administration, July 1980; Daniel L. Dornan, Analysis of Commuter Rail Costs and Cost Allocation Methods, Peat, Marwick, Mitchell & Co., Report TSC-1758-13, Transportation Systems Center, July 1983; Jay H. Walder, "Commuter Van Service on Staten Island," unpublished paper, Kennedy School of Government, Harvard University, April 1983; Ruth Carey and Bernard Campbell, Reducing the MBTA Deficit," unpublished paper, Program in City and Regional Planning, Harvard University, May 1983.

all if the amount of service contracted out represents a small part of the total now operated.)

Second, the various researchers' estimates of operating expenses per vehicle-hour and per vehicle-mile were also adjusted downward to eliminate all expenditures other than direct costs for operating the various individual services. As discussed previously, these are defined to include only driver and mechanic labor, energy, and materials expenses for operating and maintaining vehicles. Thus for example, all expenditures for supervision and administration of vehicle maintenance are excluded wherever they can be determined, as are all expenses associated with operating fixed facilities such as maintenance garages and vehicle storage areas. Again, the rationale for excluding even these "semi-direct" or "variable overhead" expenses, as they are often termed, is to produce an estimate of expenses that would vary immediately with changes in service levels. This in turn provides an estimate of the minimum cost saving that would immediately and directly result from any decision to reduce service levels, such as by contracting out.

A third adjustment is also required in order to make some researchers' estimates of the per-hour costs of operating bus transit service more accurately reflect differences in the effective wage rates and productivity levels of vehicle operators during peak and off-peak periods. This adjustment, which is commonly employed by transit analysts, raises operating expenses per vehicle-hour during peak periods to account for the fact that various pay provisions of drivers' labor contracts, such as minimum guarantees and pay premiums for long or split shifts, raise their effective hourly wage rates during peak periods.[8] It also raises estimated peak hourly costs to account for the effect of contractual restrictions on the number and duration of split shifts, which combine with peaking in the demand for transit service to reduce drivers' productivity (the number of hours of passenger-carrying service actually produced per hour for which a driver is paid) during peak periods. The combined effect of these two adjustments is typically to raise estimated expenses per vehicle-hour during peak periods by 15-20% above their overall average value for all time periods.[9] At the same time, both of these adjustments reduce the estimated costs of operating service during non-peak periods, most commonly to a level some 10-15% below their 24-hour average value.

Finally, an allowance for the capital costs of transit vehicles is added to the various researchers' estimates of transit operating expenses. This cost has two separate components, the first of which represents the actual depreciation of transit vehicles with accumulated usage. In contrast to passenger cars, depreciation of transit vehicles appears to be almost exclusively the product of actual use rather than simply of the passage of time, although common industry procedures governing the utilization of buses and the accounting of expenses make it difficult to recognize this.[10] The estimated allowance for vehicle depreciation, which amounts to about $0.375 per mile over the typical lifetimes of conventional transit buses, is added to the estimates of operating expenses per vehicle-mile.[11] This cost is allocated to vehicle usage in whatever category of service it occurs, since it could be reduced in exact proportion to any service reduction by redeploying vehicles to other service, holding them as spares, or selling them to other transit operators.

The other component of capital costs for vehicles represents the interest expense for financing their owners' investments in buses and rail vehicles. At current interest rates (approximately 7% after adjusting for anticipated inflation), this cost ranges from $25-28 per day for transit buses with typical initial purchase prices of $150,000 and utilization rates of 30-50,000 miles per year. All of this cost is allocated to peak-period service on the route or service category in question, because only by reducing peak-period service levels and vehicle requirements would the number of vehicles purchased, and thus total vehicle financing costs, actually be reduced. Although the costs of vehicle ownership to U.S. urban transit operators are heavily subsidized, particularly by the federal government, most large public transit authorities have bus purchase "needs" that more than exhaust their available capital subsidies under current allocations. Those that do face the full unsubsidized cost of financing capital investments in the acquisition of additional vehicles, and the savings in these costs that would result from reductions in peak service through contracting out are thus equal to the unsubsidized interest cost of financing additional bus purchases.

Table 3 summarizes the revised estimates of various researchers' reported cost figures that result from applying these various adjustments. Comparing the daily cost estimates for individual services originally reported in Table 2 with the revised values in Table 3 reveals that these adjustments increase some of the authors' reported cost estimates by 5-10%, primarily because the estimates in Table 3 incorporate some allowance for capital costs, but <u>reduce</u> other researchers' original operating cost estimates to about the same extent. These

Table 3

Adjustment of Various Researchers' Operating Cost Estimates to Consistent Basis

Operating Agency	Type of Service	# of Routes	Revised Cost Factors[1] $/VH	$/VM	$/Veh-Day	Daily Inputs VH	VM	Assigned Vehicles	Estimated Study Date Daily Cost
SCRTD	Peak Express	14	31.49	1.08	28.52				72000
	Intown	Many							384400
	Peak		28.80	1.19	28.52				
	Non-Peak		25.79	1.19	0				
	Suburban	Many							147100
	Peak		28.80	1.19	28.52				
	Non-Peak		25.79	1.19	0				
SDTC	Radial	3							12811
	Peak		21.44	0.77	28.37	185.0	3662	31	7666
	Non-Peak		15.81	0.77	0	166.8	3258	15	5146
	Intown	2							6276
	Peak		22.36	0.77	28.37	95.0	889	16	3263
	Non-Peak		16.11	0.77	0	129.5	1204	12	3013
	Suburban	5							8890
	Peak		21.39	0.77	28.37	101.0	1508	17	3804
	Non-Peak		17.25	0.77	0	176.3	2655	16	5086
ACT	Peak Express	3	18.62	0.67	27.87	275.8	5861	69	10985
	Radial	4							34131
	Peak		20.01	0.65	27.87	484.7	5846	122	16899
	Non-Peak		17.32	0.65	0	676.8	8477	50	17232
	Intown	3							6914
	Peak		19.46	0.65	27.87	108.9	1332	28	3765
	Non-Peak		17.43	0.65	0	122.2	1568	9	3149
	Suburban	5							11715
	Peak		18.71	0.61	27.87	242.9	4965	61	9273
	Non-Peak		18.67	0.62	0	90.2	1223	7	2442
	Rail Feeder	5							8507
	Peak		18.97	0.66	27.87	142.5	1762	36	4869
	Non-Peak		17.97	0.66	0	138.6	1738	11	3638
SPRR	Commuter Rail	1	--	5.79	--	--	8105	42 Loc 73 Coach	46928

[1] Author's reported unit cost factors adjusted downward to eliminate any "fixed overheads" included in reported estimates. Use-related vehicle depreciation allocated to vehicle-miles; interest costs included in vehicle-day unit cost and allocated entirely to peak service.

Table 3 (continued)

Adjustment of Various Researchers' Operating Cost Estimates to Consistent Basis

Operating Agency	Type of Service	# of Routes	Revised Cost Factors[1] $/VH	$/VM	$/Veh-Day	Daily Inputs VH	VM	Assigned Buses	Estimated Study Date Daily Cost
MBTA	Express	3							4655
	Peak		30.37	1.24	24.75	60.2	761	8	2970
	Non-Peak		27.04	1.24	0	40.3	480	4	1685
	Radial	4							11708
	Peak		30.37	1.24	24.75	147.4	1356	19	6628
	Non-Peak		27.04	1.24	0	132.1	1216	12	5080
	Crosstown	7							11151
	Peak		30.37	1.24	24.75	165.8	1424	21	7321
	Non-Peak		27.04	1.24	0	101.6	873	10	3830
	Suburban	2							1030
	Peak		30.37	1.24	24.75	14.7	217	2	765
	Non-Peak		27.04	1.24	0	5.8	87	1	265
B+MRR	Commuter Rail	9	--	6.79	--	--	25875	37 Loc 177 Coach	132739
SIRTOA	Peak Express	9	27.41	1.03	25.81	1001.7	20003	145	51858
	Yukon	6	27.55	0.98	25.81	814.6	15952	115	41043
	Castleton	3	26.82	1.24	25.81	187.1	4051	30	10815
LIRR	Commuter Rail	Many	--	6.87	--	--	162530	67 Loc 250 Coach 764 SP Car	785020
B+ORR	Commuter Rail	2	--	9.50	--	--	2316	5 Loc 32 Coach	20057
B+O, P&LERR	Commuter Rail	2	--	3.62	--	--	2664	4 Loc 15 Coach	10657
GTWRR	Commuter Rail	1	--	10.22	--	--	830	5 Loc 23 Coach	7528

[1] Author's reported unit cost factors adjusted downward to eliminate any "fixed overheads" included. Use-related vehicle depreciation allocated to vehicle-miles; interest costs included in vehicle-day unit cost and allocated entirely to peak service.

Source: Estimated from data reported in Table 2 using procedure described in text.

adjustments also tend to increase the estimated differential between peak and off-peak costs for operating the various services. More important, however, the adjusted costs reported in Table 3 represent more realistic estimates of those expenses that could be immediately eliminated by reducing service, such as would result from a decision to contract the operation of some route or entire category of service to a private operator. These revised estimates can then be compared to the farebox revenues generated by the various categories of service in order to assess whether any of them meet the test of profitability proposed here.

Farebox Revenues by Type of Transit Service

Variation in farebox revenues among transit services stems from two basic sources: variation in the demand for different types of service, which determines the number of riders that will use each type at any given fare level; and differences in fares charged among individual routes or types of service. Demand variation largely reflects the geographic distributions of residences, employment, and other urban land uses, which together with normal time patterns in social and economic activities produce substantial variation in urban travel patterns by location, direction, and time of day. In addition, many U.S. urban transit operators charge fares that vary by type of service, time of the day, or length of trip, although these differences are usually quite modest.[12] (Two prominent exceptions to this pattern are commuter railroad service in various urban areas and peak express bus service in New York City, for which sharply higher fares -- ranging from $1.00-3.10 -- are charged.)

The combined effect of differences in the demand for transit service by time of day and geographic orientation of route and variation in fare levels is to produce substantial differences in ridership and total revenues among different types of urban transit service. Table 4 reports estimates of average daily ridership, average fare revenue per passenger, and average daily total fare revenue generated by each of the transit services for which operating cost estimates were presented in Tables 2 and 3. As the figures in Table 4 indicate, there is considerable variation in farebox revenue among different types of transit routes or services and time periods of the day, even within individual transit systems. The table also shows that most of this variation is introduced by differences in the demand for different types of service, as reflected in the wide variation in ridership levels among route types and time periods, rather than by variation in fares charged for different types of service.

Part of the variation in average fare revenue per passenger among types of urban bus routes may also reflect differential levels of travel on specific routes by passengers who are entitled to fare discounts under their operators' fare policies. Some of these fare discounts are required as conditions for receiving federal transit operating assistance (notably half-fare discounts to elderly and handicapped passengers riding during off-peak periods), and the revenue estimates presented in Table 4 should ideally be adjusted to compensate for any revenue loss that results from such governmentally-mandated fare reductions. Nevertheless, most of the variation in revenue per passenger within individual transit systems probably reflects the effects of the various fare discounts they <u>voluntarily</u> choose to offer, rather than of those they

Table 4

Development of Farebox Revenue Estimates for Various Urban Transit Services

Urban Area	Operating Agency	Researcher	Year	Type of Service	# of Routes	Avg. Daily Ridership	Avg. Fare per Rider	Avg. Dail Fare Reven
Los Angeles	SCRTD	Cox	1984	Peak Express	14	41500	0.549	22800
				Intown	Many	881600	0.158	139200
				Suburban	Many	136600	0.276	37700
San Diego	SDTC	Cervero	1979	Radial	3	9862	0.345	3403
				Peak		8101	0.355	2876
				Non-Peak		1761	0.299	527
				Intown	2	11226	0.345	3873
				Suburban	5	5315	0.345	1834
SF Bay Area	ACT	Cervero	1979	Peak Express	3	4641	0.339	1573
				Radial	4	52663	0.289	15220
				Intown	3	3573	0.289	1033
				Suburban	5	3296	0.289	953
				Rail Feeder	5	7617	0.289	2201
	SPRR	Dornan	1980	Comm. Rail	1	20376	1.204	24553
Boston	MBTA	Carey, Campbell	1981	Express	3	3519	0.537	1890
				Peak		2708	0.537	1454
				Non-Peak		811	0.537	436
				Other Radial	4	14962	0.396	5925
				Crosstown	7	12446	0.396	4929
				Subrban	2	670	0.509	341
	B&MRR	Dornan	1980	Comm. Rail	9	37356	1.237	46215
New York	NYCTA	Walder	1981	Peak Express	9	19856	2.50	49665
				Yukon Depot	6	15150	2.50	37874
				Castleton	3	4716	2.50	11791
	LIRR	Dornan	1980	Comm. Rail	Many	269473	1.84	496167

Table 4 (continued)

Development of Farebox Revenue Estimates for Various Urban Transit Services

Urban Area	Operating Agency	Researcher	Year	Type of Service	# of Routes	Avg. Daily Ridership	Avg. Fare per Rider	Avg. Daily Fare Revenue
Washington, D.C.	B&ORR	Dornan	1980	Comm. Rail	2	3292	3.10	10198
Pittsburgh	B&ORR	Dornan	1980	Comm. Rail	1	1409	1.00	1412
	P&LERR	Dornan	1980	Comm. Rail	1	459	1.13	517
	Total				2	1868	1.03	1929
Detroit	GTWRR	Dornan	1980	Comm. Rail	1	2070	1.00	2070

Sources: Rex Gephart, "Development of a Bus Operating Cost Model Based on Disaggregate Data," Transportation Research Record 1011, 1984, pp. 16-23; Brad Williams and William Wells, "Economics of Commuter Express Bus Operations," Transportation Research Record 915, 1983, pp. 13-18; Wendell Cox, "Distribution of Public Transit Subsidies in Los Angeles County," Transportation Research Record 877, 1982, pp. 1-5; Robert B. Cervero, Martin Wachs, Renee Berlin, and Rex J. Gephart, Efficiency and Equity Implications of Alternative Transit Fare Policies, Report CA-11-0019, U.S. Urban Mass Transportation Administration, July 1980; Daniel L. Dornan, Analysis of Commuter Rail Costs and Cost Allocation Methods, Peat, Marwick, Mitchell & Co., Report TSC-1758-13, Transportation Systems Center, July 1983; Jay H. Walder, "Commuter Van Service on Staten Island," unpublished paper, Kennedy School of Government, Harvard University, April 1983; Ruth Carey and Bernard Campbell, Reducing the MBTA Deficit," unpublished paper, Program in City and Regional Planning, Harvard University, May 1983.

are required to provide. The most important of these are the substantial effective discounts most U.S. transit systems now offer to their regular riders -- particularly regular peak hour commuters, the passengers most costly for them to serve -- in the form of unlimited-use weekly or monthly passes that are typically priced well below the equivalent of one round tip per weekday. Substantial fare discounts for students, youth, and various other groups are also commonplace.[13] Although some of these serve laudable social purposes, others -- particularly the discounting of weekly or monthly commuter passes -- are not necessarily desirable from a social viewpoint, and entail substantial revenue losses to the large number of transit authorities that currently offer them.

Assessing the "Profitability" of Transit Services

Table 5 combines the adjusted estimates of daily direct operating expenses for different types of service operated by various U.S. transit authorities, previously reported in Table 3, with the daily farebox revenue estimates from Table 4. This produces estimates of the average daily deficit that is directly attributable to each of 26 specific categories of service operated by transit authorities in eight of the nation's major urban areas. Table 5 also reports the equivalent deficit per passenger for each category of transit service, as well as the percentage of its direct operating costs that is covered by the passenger fare revenues it generates.

The most striking finding from the table is that none of the categories of transit service reviewed in this study produces farebox revenues sufficient to cover even the direct, day-to-day operating

Table 5

Deficit Estimates for Various Urban Transit Services

Urban Area	Type of Service	# of Routes	Estimated Average Daily: Cost	Revenue	Deficit	Deficit/ Passenger	Revenue as a % of Cost
Los Angeles	Peak Exp.	14	$ 61900	$ 22800	$ 39100	$ 0.94	36.8%
	Intown	Many	330600	191400	139200	0.16	57.9%
	Suburban	Many	126500	37700	88800	0.65	29.8%
San Diego	Radial	3	12811	3403	9408	0.95	26.6%
	Peak		7666	2867	4799	0.59	37.4%
	Non-Peak		5146	527	4619	2.62	10.2%
	Intown	2	6276	3873	2403	0.21	61.7%
	Suburban	5	8890	1834	7056	1.33	20.6%
San Francisco-Oakland	Peak Exp.	3	10985	1573	9412	2.03	14.3%
	Radial	4	34131	15220	18911	0.36	44.6%
	Intown	3	6914	1033	5881	1.65	14.9%
	Suburban	5	11715	953	10762	3.27	8.1%
	Rail Feeder	5	8507	2201	6306	1.91	25.9%
	Comm. Rail	1	46928	24533	22395	1.10	52.3%
Boston	Express	3	4655	1890	2765	0.79	40.6%
	Peak		2970	1454	1516	0.56	49.0%
	Non-Peak		1685	436	1249	1.54	25.9%
	Radial	4	11708	5925	5783	0.39	50.6%
	Crosstown	7	11151	4929	6222	0.50	44.2%
	Suburban	2	1030	341	689	1.03	33.1%
	Comm. Rail	9	132739	46215	86542	2.32	34.8%
New York	Peak Exp.	9	51858	49665	2193	0.11	95.8%
	Comm. Rail	Many	785020	496167	288853	1.07	63.2%
Washington, D.C.	Comm. Rail	2	20057	10198	9859	2.99	50.8%
Pittsburgh	Comm. Rail	2	10657	1929	8728	4.67	18.1%
Detroit	Comm. Rail	1	7528	2070	5456	2.64	27.5%

Source: Computed from data reported in Tables 3 and 4.

expenses incurred by the public authority that currently provides it. Most services cover far less than half of their direct expenses, as the right-hand column of the table indicates, thus producing per-passenger deficits that are most commonly within the $0.50-2.00 range, but reach nearly $3.00 in several instances. The implication of these figures is unmistakable: even under the narrow, extremely conservative definition of transit costs employed in this study, there are apparently few if any examples of profitable service operated by the public authorities that now provide most U.S. urban transit service. Put simply, there is apparently very little or no "cream to skim" from current public transit operations.

Table 5 reports that commuter railroad and peak-period express bus service in New York City apparently come the closest to covering their direct operating expenses, but only at quite high average fares ($1.84 and $2.50, as reported in Table 4), and only under definitions of operating expenses that exclude large overhead outlays that are almost completely dedicated to the provision of these services. Aside from these two examples, only a handful of other services generate fare revenues that cover even half of their narrowly-defined operating expenses. As Table 5 indicates, farebox coverage ratios for the remaining services are about evenly distributed over the range from 10-50%, while per-passenger deficits are scattered widely over the range from about $0.20 up to nearly $3.00. (Because costs per passenger carried differ substantially among the categories of transit service studied, there is no necessary connection between the farebox coverage ratio and deficit per passenger for an individual service type, although Table 5 does show that there is a general relationship between the two.)

Differences in Farebox Coverage by Service Type

Table 6 combines the typology of transit service presented in Table 1 with the estimates of farebox coverage of operating expenses reported in Table 5, in order to summarize variation in expense coverage by type of transit service. For each combination of transit route orientation and time period during which service operates, Table 6 shows the range of farebox coverage ratios developed from the cost and revenue estimates constructed in this study, as reported in Table 5. While almost every category of service for which multiple estimates are available shows a fairly wide range of variation in farebox coverage of expenses, the distribution of estimates within specific categories suggests some interesting patterns.

The most important of these is that farebox coverage generally tends to be lowest for peak-period express, suburban local, and rail station feeder services (some routes serve a combination of these last two functions), while it tends to be highest for intown and crosstown local bus routes. Normal variation in the costs incurred in operating these different types of transit service reinforces this pattern of farebox coverage, thus producing the largest deficits per rider on peak express and suburban local service, and the smallest deficits per rider on intown services, with deficits on crosstown bus routes most often falling in between.

Like the finding that there are apparently no "profitable" services currently operated by public transit authorities, this pattern of variation in farebox coverage ratios and deficits per passenger has an extremely important implication for federal policies that seek to promote private participation in urban transit. It is that the deficits

Table 6

Farebox Revenue as a Percent of Direct Expenses[1] for Various Types of Urban Transit Service

	Time Period During Which Service Operates:		
Route Orientation	Weekday Peak	Other Hours[2]	All Hours
CBD-Bound Radial			
Express Bus	14-96%	26%	41%
Local Bus	37%	10%	27-51%
Commuter Rail	18-51%		35-63%
Intown Local			15-62%
Suburban Local			8-33%
Crosstown or Inter-suburban			44%
Rail System Feeder			26%

[1] Direct operating and maintenance expenses plus use-related vehicle depreciation only. Includes no allowance for fixed facilities, managerial personnel, or administrative functions.

[2] Including weekday midday, night, weekend, and holiday service.

Source: Table 4 (figures rounded to nearest whole percent).

now incurred by public transit authorities appear to be largest on exactly those types of service that private transportation suppliers have shown the most interest in assuming on a for-profit basis or providing under contract to their current operators. This includes peak-period express bus services, which charter and intercity bus operators already operate, both for profit and under contract to public agencies, in many of the nation's larger urban areas; suburban local service, which is successfully provided on a demand-responsive basis by taxi companies and passenger van operators in some urban areas; and rail station feeder service, now provided in a few cities with large rapid transit systems by profit-seeking private passenger van owners who operate in apparent violation of local regulatory restrictions.

Summary

The research reported here demonstrates that there are apprently extremely few if any urban transit services now operated by public agencies in U.S. cities that generate farebox revenues sufficient to cover even their direct, day-to-day operating expenses. Most types of service provided by large public transit authorities now generate farebox revenues that cover less than half of their direct operating expenses, thus producing per-passenger deficits ranging from 50 cents to $3.00. Hence even under the extremely conservative definition of directly attributable costs employed in this study, there is apparently very little if any "cream to skim" from current public transit operations.

More important, farebox coverage of operating expenses appears to be lowest -- and deficits per passenger highest -- for exactly those services in which private participants have exhibited the greatest interest. Thus there appears to be little risk that widespread contracting out of urban transit service will produce increased deficits for its current operators. Moreover, deficits appear to be largest exactly where the opportunities to reduce them through contracting out or other arrangements involving increased private participation are greatest.

NOTES

1. During 1965, less than half of all transit vehicles were owned by public agencies, but by 1983 such agencies owned 93% of the vehicles, provided 95% of all service, and carried 95% of all transit passengers; see Amerian Public Transit Association, Transit Fact Book 1985, Table 4, p. 17.

2. "Contracting Cuts Costs," Metro, September/October 1985, p. 86.

3. Ibid., p.84.

4. Hearings before Subcommittee on the Department of Transportation and Related Agencies of the Committee on Appropriations, U.S. House of Representatives, May 1, 1985, Part 7, pp. 645-646.

5. Ibid., p. 646.

6. Wendell Cox, "Distribution of Public Transit Subsidies in Los Angeles County," Transportation Research Record 877, 1983, pp. 1-5.

7. For useful reviews of these procedures see Robert McGillivray, Michael Kemp, and Michael Beesley, Urban Bus Transit Costing, Publication 1200-72-1, Washington, D.C., The Urban Institute, September 1980; and Simpson & Curtin Division of Booz, Allen & Hamilton, Inc. Bus Route Costing: A Review, Report to U.S. Urban Mass Transportation Administration, May 1981, especially Chapter 3.

8. This adjustment was originally reported in Walter Cherwony and Shubash Mundle, "Peak-Base Cost Allocation Models," Transportation Research Record 663, 1978, pp. 52-56.

9. Ibid., p. 55.

10. For a brief but lucid discussion of this problem, see John M. Reilly, "Transit Costs During Peak and Off-Peak Hours," Transportation Research Record 625, 1977, pp. 24-25.

11. Computed as "straight-line" depreciation of a new bus costing $150,000 over a 400,000 mile useful lifetime.

12. During 1981, only 9% of U.S. transit systems charged higher fares during peak travel hours (with an average differential between peak and off-peak fares of about 27%), while 37% of transit operators imposed higher fares for longer trips, and 38% charged higher fares for premium services such as express routes; see John A. Dawson, "Segmentation of the Transit Market," Transportation Quarterly, Vol. 37 No. 1, January 1983, p. 82.

13. For example, in St. Louis about 13% of riders are elderly, while over 20% are eligible for youth or student fares; in Philadelphia, elderly and student passengers represent 7% and 12% of total ridership. In cities such as Los Angeles and Seattle, however, these percentages

13. (continued) were approximately reversed. For a discussion of the effects of fare discounts on transit systems' revenues, see Don H. Pickrell, The Causes of Rising Transit Operating Deficits, Report MA-11-0037, U.S. Urban Mass Tansportation Administration, July 1983, Chapter 6.