schedules and other operating data and (b) transfer discounts.

4. All transit districts and municipal operators should promote the expansion of private commuter express bus operations by (a) not contesting PUC certificate applications unless the proposed service would have a serious negative impact on the public system, (b) not expanding public commuter express services in areas where private operations appear feasible, and (c) assisting private operators in identifying new commuter express bus markets.

5. Expansion of privately operated services will need promotional, informational, and coordinative support, which might well be provided by Commuter Computer.

This paper documents the potential economic advantages of giving the private bus operator a much larger role in providing commuter express services. Rapid implementation of these recommendations has the potential to increase transit service while reducing annual operating subsidies paid by the public.

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Sources of Rising Operating Deficits in Urban Bus Transit

DON H. PICKRELL

Annual operating expenses incurred by U.S. urban transit systems rose more than $5 billion from 1960 to 1980, of which a rapidly declining fraction was covered by farebox receipts. As a result, the industrywide operating deficit approached $4 billion by the end of this period. Although rail transit systems first incurred large operating losses, by 1980 the motor bus segment of the U.S. public transit industry accounted for three-quarters of its aggregate deficit. Recent growth in bus transit operating deficits can be traced to escalating costs per unit of service, rapid service expansion despite declining utilization of existing service levels, and decisions to simplify and reduce fare structures. A detailed examination of each of these sources of rising operating losses is presented, and attempts are made to assess both their individual contributions to deficit growth and their respective underlying causes. Following this examination, an illustration of how these developments interacted to produce the explosive growth in bus transit operating deficits that occurred during the 1970s is given. Specific recommendations are made for bringing growing losses under control.

By many measures, the decade of the 1970s was a pivotal episode in the history of the American public transit industry. After declining steadily for more than 25 yr, total U.S. transit ridership began to climb slowly after 1972 and continued to grow throughout the remainder of the decade; by 1980, the annual number of riders carried by U.S. transit systems returned to the level of the early 1960s. Similarly, after nearly 30 yr of decline, the number of vehicle miles operated by the industry increased dramatically during the 1970s, so that by the end of the decade, nationwide transit service was restored to its level of 25 yr earlier. Much of this revitalized service was provided by using new, higher-capacity vehicles traveling at faster speeds and offering new amenities such as more spacious seating and air conditioning. By 1980, transit vehicles operated over nearly 125,000 track and route miles in the United States, more than a quarter of which were added during the 1970s. Thus despite the tremendous growth in urbanized land area that occurred during this time, both the density and coverage of transit routes in most major U.S. cities reached new postwar highs by 1980 (1).

Other developments, however, were less encouraging: Total operating expenditures incurred by U.S. urban transit systems rose more than $4.5 billion over the decade, of which a rapidly declining fraction was covered by farebox receipts. As a result, the industrywide difference between fare revenue and operating expenditures fell from a surplus of slightly more than $100 million in 1970 to a deficit approaching $4 billion by 1980 (1,2). The most alarming aspect of this growth was that operating costs and deficits not only grew quickly in the early part of the decade, when service and ridership continued their long-term decline, but rose even more rapidly as patronage and service grew throughout the remainder of the decade. By 1980, the motor bus segment of the U.S. urban public transit industry accounted for nearly 70 percent of service offered and total passengers carried nationwide, as well as three-quarters of the aggregate deficit incurred by U.S. public transit operators.

The recent explosion in bus transit operating deficits can be traced to four basic sources: escalation in the unit costs of providing transit service, rapid service expansion despite declining demand for and utilization of existing service levels, and operators' decisions to simplify and reduce transit fare structures. The effects of these trends on urban bus transit finances in the United States over the period from 1960 to 1980 are given below (computed from Tables 1-3):

Factor	Percentage of 1960 to 1980 Decline in Net Operating Income
Increasing real expenditure per seat mile of service	31
Growth in seat miles of service provided	24
Declining passenger miles carried per seat mile of service provided	14
Declining real fare revenue per passenger mile carried	31

Even after adjustment for inflation, rising unit operating costs were responsible for nearly one-third of the $3.2 billion drop in aggregate operating income over the two decades studied, and increases in the level of service provided contributed about another quarter. The remainder of the drop in aggregate operating income resulted from declining demand for transit service together with reductions in fares at which it was offered. Because fare levels clearly affect the use of transit services that are supplied, it is impossible to fully separate the influences of declining demand and fare reductions on transit operators' deteriorating fi-

nances; one estimate of the relative contributions of these two factors was presented above. The following sections examine each of these sources of rising bus transit deficits in detail, concluding with specific recommendations for bringing growing losses under control.

UNIT-COST ESCALATION AND ITS CAUSES

The most widely discussed cause of rising deficits in urban transit is escalation in the costs per unit of transit service provided. Nevertheless, after adjustment for the effects of inflation, operating expenditures per seat mile among bus transit operations actually fell during most of the 1960s and rose only slowly through 1975. These early reductions in unit operating costs were achieved largely through continued reequipping of bus fleets with higher-capacity vehicles in conjunction with slight increases in average vehicle operating speeds. Together these developments reduced the quantity of labor and other operating inputs required per seat mile of service sufficiently to offset the effects of rising wage rates and other input prices. Over the next 5 yr, however, rapid increases in labor compensation rates and fuel prices raised real expenditures per seat mile nearly 50 percent (3-5, Table 3-16; 6).

For the period 1960 to 1980 as a whole, rising unit costs for drivers and other labor were responsible for more than three-quarters of the total escalation in operating expenses per seat mile of bus service; increasing fuel costs accounted for most of the remainder. Unit labor costs increase when either the rate of labor compensation rises or the amount of labor required to produce a seat mile of service increases. Table 1 (2,3,7), which reports estimates of trends in each of these factors over the period studied, shows that after increasing slowly from 1960 to 1970, labor compensation rates--including wages, salaries, and fringe benefits--rose substantially during the next decade. Thus even after adjustment for the effect of rapid price inflation, annual compensation per employee in 1980 was nearly 80 percent above its estimated 1960 level (2,3,7).

Table 1 also reports that the annual number of seat miles produced per employee increased somewhat during this period, allowing some of this increase in compensation rates to be absorbed. During most of this period, labor productivity in the transit industry was apparently declining slowly as changes in the structure of demand for transit service--increased peaking during commuting hours and growing imbalances in directional flows of passengers--together with increasingly restrictive work rules governing driver assignments and maintenance procedures made it more difficult for transit operators to fully utilize drivers, mechanics, and other workers (8, pp. 22-25). By itself, this decline in labor productivity would have raised the amount of labor necessary to produce each seat mile of service; however, it was almost exactly offset by the industry's continuing acquisition of larger vehicles together with a slight increase in the average speed at which transit buses operated, both of which reduced the amount of labor time required to produce each seat mile of bus service (6). On balance, the annual number of seat miles produced per employee rose about 10 percent over the two decades; hence the entire increase in labor expenses per seat mile during this period resulted from escalation in wage and fringe benefit rates, nearly three-quarters of which occurred after 1970.

Table 1. Changes in compensation, productivity, unit labor costs, and unit operating expenditures for U.S. bus transit systems.

Year	Annual Compensation per Employee ($1980)	Annual Seat Miles per Employee (000s)	Labor Expense per Seat Mile ($1980)	Total Operating Expense per Seat Mile ($1980)
1960	14,560	564.4	0.0258	0.0361
1970	17,690	665.0	0.0266	0.0339
1980	25,930	620.8	0.0418	0.0569

Table 2. Estimates of seat miles of service supplied, passenger miles carried, and percentage of seat miles occupied for U.S. urban bus transit operations.

Year	Seat Miles Supplied (000,000s)	Passenger Miles Carried (000,000s)	Percentage of Seat Miles Occupied
1960	56,674.0	18,743.2	33.1
1965	60,597.4	17,470.1	28.8
1970	61,125.1	16,879.7	27.6
1975	70,074.5	17,820.5	25.4
1980	79,834.7	21,535.0	27.0

The other important component of rising operating expenditures per seat mile, increasing outlays for motor fuel, resulted from the two major oil price increases imposed during the 1970s by the oil producers' cartel, which together raised the average price paid by U.S. bus operators for diesel fuel nearly eightfold between 1970 and 1980 (3,9). The effect of rising fuel prices was aggravated by the increasing fuel consumption per seat mile of transit buses, which rose nearly 25 percent from 1960 to 1980, despite continuing increases in their average seating capacity (1,3,6). Nevertheless, some of this deterioration in fuel economy probably resulted from developments that upgraded the quality of transit service, including features such as air conditioning and more spacious seating, as well as from improvements in vehicle performance and safety characteristics. Hence, it can probably be regarded as a less serious source of unnecessary operating cost increases than rising labor compensation rates.

EXPANDING TRANSIT SERVICE AND DECLINING UTILIZATION

Rising real expenditures per seat mile were translated into even faster growth in outlays per passenger mile, because the fraction of available seat miles actually occupied by passengers fell slowly over most of the period studied. Table 2 (3-6; 10, Tables E and F; 11, p. 20; 12, Tables 3-21, C-36, C-40, and C-47) indicates that growth in the average seating capacity of buses more than offset early reductions in the number of bus miles operated, so that aggregate seat miles of bus transit service provided nationwide rose slowly through 1970. At the same time, the number of passengers carried fell steadily, so that despite the apparent lengthening of typical bus transit trips, the number of passenger miles traveled on urban bus transit systems declined slowly. The result was a significant reduction in the fraction of bus service that was actually used by passengers, from about one-third in 1960 to slightly more than one-quarter 10 yr later.

This fraction declined further after 1970 as earlier cuts in vehicle miles of service began to be rapidly restored with the advent of government operating-subsidy programs, whereas ridership continued to fall. After 1975, however, ridership grew significantly, and the upward trend in the average length of passengers' trips accelerated slightly; these two factors combined to produce a substantial increase in the number of passenger miles carried by

bus transit systems. Although the level of service offered continued to grow, primarily as a result of rapid increases in bus miles operated, the fraction of bus transit seat miles actually occupied rose slightly from 1975 to 1980. This increase in utilization was superficially encouraging, but it probably occurred in response to widespread reduction in transit fares (average bus fares fell more than 25 percent on a per-mile basis between 1975 and 1980, after adjustment for the effects of inflation) in combination with rapid escalation in the real costs of operating private automobiles, which rose nearly 40 percent over the same period [3, 13 (adjusted to 1975 and 1980 values by using gasoline price data for those years reported as part of the consumer price index)].

The decline in transit utilization occurred partly because important economic and demographic trends caused significant reductions in the demand for public transit service while the spatial and temporal structure of transit was altered in ways that also made high utilization more difficult for transit operators to achieve. The most important of these trends was probably the ongoing dispersion of employment, residential development, and population-serving activities within U.S. metropolitan areas, which sharply reduced the number of trips for which public transit could offer costs and service levels that made it competitive with the private automobile. More than half of the population of major U.S. metropolitan areas lived in their densely developed central cities in 1960, yet by 1975 this figure had fallen to only about one-third; the remainder lived in much lower-density surrounding suburbs. Similarly, the fraction of metropolitan-area residents working in central city areas fell from nearly two-thirds in 1960 to just over one-half by 1975 and has probably continued to fall since that time. Partly as a result of these developments, the number of transit work trips within the central areas of major U.S. cities, the traditional stronghold of transit service and ridership, fell by more than half during the same period (14, Table 216, p. 526; 15, Table D, p. 3).

Much of this dispersion was the product of growing urban populations and rising personal incomes, which increased the demand for dwelling space and other amenities provided by lower-density residential locations. At the same time, the evolving technology and industrial mix of urban economic activity combined to produce similar, although somewhat less rapid, employment decentralization within U.S. urban areas. Rising incomes also increased the demand for total travel as well as for the particular characteristics offered by automobile transportation, including its minimal access and waiting times, scheduling and routing flexibility, guaranteed comfortable seating, and privacy. This was reflected in explosive growth in automobile ownership and use in urban areas as well as in urban residents' apparent willingness to finance substantial investments in road and highway capacity (16). Thus although total urban travel volumes grew rapidly throughout the postwar era, transit ridership continued to decline, at least until comparatively recently.

In addition to reducing total transit ridership, the ongoing decentralization of urban activities and growing demand for automobile transportation apparently left much of it concentrated on a relatively few specific types of routes. Because the geographic dispersal of residences proceeded more rapidly than that of jobs during the period, the number of work trips made from suburban areas into central cities increased substantially. In the radial corridors that carried much of this growing volume of commuting, public transit most often continued to offer travel times, service frequencies, and costs that made it competitive with private automobile commuting, particularly in older, congested urban areas that had low levels of street and highway capacity. Thus the only growing category of transit work trips in U.S. metropolitan areas after 1970, when the long-term decline in transit ridership was finally arrested, included those into central cities from their surrounding suburban areas, which grew about 5 percent in the first five years of the decade (15, Table D, p. 3).

Public transit travel also remained attractive to low-income residents of the densely populated centers of urban areas, whose automobile ownership levels and valuations of travel time tend to be lower and where high congestion levels and parking charges raise the cost of automobile travel (17, Table 2, p. 11). Transit service also remained less costly to provide in such areas because the greater variety of trip purposes and destinations it served resulted in passenger flows that were more evenly distributed along individual routes and throughout the day. On most other types of transit service, however, such as intersuburban or crosstown routes, the process of metropolitan decentralization and the accompanying dispersion of trip origins and destinations made it increasingly difficult for transit operators to offer service levels and fares that were competitive with the speed, scheduling flexibility, and low cost of automobile travel, particularly where it was accompanied by ambitious increases in street and highway capacity, as was common in newly developed suburban areas.

Still, the utilization of transit service declined even more rapidly than these developments in the demand for public transportation would by themselves have suggested, because operators' service policies failed to recognize and respond to them. From 1960 to 1980, when the number of urban travel corridors along which it could compete effectively with automobile travel probably declined significantly, aggregate route mileage served by bus transit in the United States increased 28 percent (1,2). Because the total number of vehicle miles operated declined slightly over the same period, the average level of service operated per route mile, an index of the frequency of typical bus transit service, fell significantly, especially after 1970 as the availability of government operating subsidies increased rapidly. Thus instead of carefully identifying types of routes where service that was sufficiently frequent to achieve acceptable utilization could be maintained at reasonable operating costs, transit operators apparently expanded service into widespread new markets. On such routes, most of which probably served suburban areas with lower densities of employment and population as well as high levels of car ownership and automobile accessibility, the service levels typically provided were thus unlikely to achieve satisfactory ridership, at least at fares that reflected the costs of providing them.

Urban decentralization, rising automobile ownership, and other accompanying developments also made it more difficult for transit operators to maintain high utilization levels by increasing the degree of peaking in demand while aggravating imbalances in the spatial patterns of ridership. In conjunction with rising income and automobile ownership levels, widespread relocation of retail and other population-serving activities into lower-density areas significantly reduced the number of nonwork trips for which public transit was used. At the same time, because it less drastically reduced the number of

work trips for which transit travel remained competitive with automobile commuting, the effect of metropolitan decentralization on the use of public transit for travel to work was probably much less pronounced. For example, the number of work trips made by public transit in Chicago fell less than 10 percent between 1956 and 1970, yet the number of transit trips for all other purposes declined nearly one-third (18, Table 2.6). Because trips to work are usually more concentrated during morning and evening travel hours than those for other purposes, the changing mix of travel purposes for which public transit was used probably resulted in a significant increase in the fraction of all transit trips that took place during peak periods (10, Tables E and F; 11, p. 20). Increasing participation in the labor force also aggravated the degree of peaking in transit ridership because some of those who formerly used public transit service during off-peak hours for shopping, personal business, and other nonwork travel shifted to peak-hour transit commuting; most important, the labor-force participation rate among adult women rose from only a third in 1960 to slightly more than half by 1980 (19, Table B-32, p. 270).

Because transit operators tended to expand vehicle fleets to accommodate ridership increases that were concentrated during a few hours of the day and union work rules restricted the assignment of operators to shifts encompassing morning and evening peaks, the overall utilization of capital and labor inputs fell significantly. This increase in peak vehicle and labor requirements was probably aggravated by the fact that commuting trips are not only longer on average than trips for other purposes but were also increasing in length during this period in response to the decentralizing forces at work in urban areas as well as other developments such as the increasing number of multiple-worker households. The accompanying increase in the fraction of commuting trips on many routes probably also tended to concentrate ridership in a single direction at any hour, further complicating the problem of designing routes and schedules to maintain satisfactory utilization of drivers and equipment as well as reasonable passenger loads.

CHANGES IN TRANSIT FARE POLICY

Another major source of escalating transit deficits was the failure of fares to reflect the rapidly escalating real costs of providing transit service: After increasing slightly from 1960 to 1970, inflation-adjusted fare revenue per passenger mile fell by nearly half during the subsequent decade. This resulted from a combination of failure to raise fares to compensate for rapid general price inflation and lengthening of typical transit trips together with decisions by transit operators to stabilize--or in some cases even to reduce--overall fare levels, offer substantial fare reductions for specific groups of riders, and eliminate surcharges for more costly trips. Table 3 (3; 10, Tables E and F; 11, p. 20; 12, Tables 3-21, C-36, C-40, and C-47) documents the combined effects of the first two of these factors; it reports that the average fare per passenger more than doubled over the period studied when measured in current dollars yet fell steadily after 1970 when adjusted for the effects of inflation. As the table also suggests, another important reason for the decline in real fare revenue per passenger mile was the steady increase in the average length of bus trips over these two decades (from about 3.5 miles in 1960 to slightly more than 5 miles by 1980) (2,10-12). Thus, even had the average fare per passenger kept pace with inflation during this period, fare revenue per passenger mile would have declined by nearly one-third.

Table 3. Changes in unit-fare revenue yields for U.S. urban bus transit service.

	Revenue per Passenger Carried		Revenue per Passenger Mile Carried	
Year	Current Dollars	1980 Dollars	Current Dollars	1980 Dollars
1960	0.180	0.471	0.051	0.135
1965	0.205	0.493	0.054	0.130
1970	0.294	0.579	0.072	0.141
1975	0.320	0.469	0.071	0.104
1980	0.375	0.375	0.077	0.077

The rapid decline in inflation-adjusted fares may initially have been an unintentional development, stemming from transit operators' delayed response to the onset of rapid inflation and cost escalation in the early 1970s. Its persistence, however, clearly reflected their decisions to exploit the growing availability of government operating subsidies to defray cost increases and permit fares to be stabilized or even reduced. Indeed, this was an explicit goal of the federal operating-subsidy program, under which funds were distributed beginning in 1974, and it partly motivated some state and local assistance programs before that time. Declining revenue yields also reflected the widespread advent of selective fare reductions for several classes of riders, most commonly the elderly and the handicapped, although many transit operators extended discounts to students, children, and frequent riders (through monthly pass programs) as well. Although some of these developments in fare policy were motivated by important social concerns about the mobility of deserving groups, they proved extremely costly to transit operators in terms of the revenue loss they entailed and were certainly one important cause of the precipitous decline in fare revenue after 1970.

Still another cause of declining revenue yields was the widespread absence or even elimination of fare premiums for services that were particularly costly for transit operators to supply; this included zone penalties and other forms of distance-based fares as well as peak-hour fare surcharges. Because typical transit trips became considerably longer, the widespread elimination of distance-based fare surcharges was apparently an important cause of declining farebox yields per passenger mile of travel. Further, although peak-hour fare surcharges have apparently never been common in U.S. transit systems, most of the few cities that once imposed peak fares eliminated them during the latter part of the 1970s (20, Tables 6-8; 21). With a rising fraction of ridership probably concentrated during peak travel hours, the absence of fare premiums that reflected the significantly higher costs of expanding peak service was another important cause of the failure of fare revenues to keep pace with the rapidly escalating costs of providing transit services.

COMBINED EFFECTS ON TRANSIT FINANCES

As a consequence of these trends in operating costs, service utilization, and fare revenue, inflation-adjusted operating income per passenger mile carried by U.S. bus transit systems declined slowly throughout the 1960s (Table 4). This occurred largely because falling utilization of the level of transit service offset the economies in operating expenditures per seat mile achieved by the industry sufficiently to actually raise expenses per passenger mile. Hence despite a modest increase in real fare

Table 4. Changes in operating expenditures, revenue, and net operating income for U.S. urban bus transit systems.

Year	Operating Expenditure per Passenger Mile ($1980)	Fare Revenue per Passenger Mile ($1980)	Net Operating Income per Passenger Mile ($1980)	Total Net Operating Income ($000,000s 1980)
1960	0.1092	0.1346	0.0245	479.2
1965	0.1103	0.1298	0.0195	311.9
1970	0.1228	0.1412	0.0194	251.5
1975	0.1507	0.1041	-0.0456	-739.5
1980	0.1912	0.0765	-0.1147	-2,754.9

Note: Computed from data in Tables 1-3.

revenue per passenger mile, the gap between unit revenue and expenditures narrowed significantly. During the 1970s, real costs per seat mile grew rapidly, particularly during the latter half of the decade. Although the fraction of service utilized also rose after 1975, thus absorbing some of this unit-cost increase, expenses per passenger mile still escalated nearly 60 percent from 1970 to 1980. Coupled with the sharp decline in fare revenue, this produced a dramatic reversal in unit operating income: By 1975, bus transit operators on average lost 4.6 cents per passenger mile carried, a figure that jumped to 11.5 cents by 1980.

Table 4 also indicates that after declining slowly from 1960 to 1970, industrywide total operating income dropped by nearly a billion dollars in the next 5 yr, primarily because of this sharp reversal in operating income per passenger mile. After 1975, total net operating income plummeted another $2 billion because losses per passenger mile nearly tripled, whereas service expansions and fare reductions together increased the total number of passenger miles carried by more than one-third. Thus at the same time that input prices were escalating rapidly and important economic and demographic developments reduced the demand for urban transit travel, bus operators continued to implement massive service expansions while offering fare concessions intended to increase ridership. One predictable result was the swift increase in its aggregate deficit, which, as given in Table 4, approached $3 billion by 1980.

CONTROLLING TRANSIT DEFICITS

This analysis suggests that transit operators and urban transportation planners face several important challenges. First is the necessity of bringing the recent explosive growth of transit operating costs under control, particularly the labor-cost component. As indicated earlier, rising labor expenses accounted for about two-thirds of the recent escalation in unit operating costs for bus transit, which in turn was attributable to rising wage and fringe-benefit rates. Faced with almost certain curtailment of the growth in government operating subsidies for transit, management must adopt more aggressive and responsible positions in future wage negotiations in order to bring the rate of wage increases into line with labor productivity improvements in the industry. Another important avenue for controlling labor costs is improving the productivity of operator labor, primarily by changing the restrictive rules that currently complicate the assignment of driver work shifts and result in considerable inadequate use of paid driver time. For example, Chomitz and Lave (22, Tables E-4, E-5, and E-6) estimate that extending the 12-hr maximum on driver work shifts that governs many transit systems' driver assignments to 13 hr could reduce labor costs by as much as 20 percent, whereas requiring pay premiums after 12-hr rather than 10-hr driver shifts could reduce labor costs up to 7 percent. Similarly, permitting more widespread use of part-time drivers could bring important cost savings, because their shifts would include considerably fewer paid hours during which they were inadequately used than is currently the case for full-time operators. Although the potential productivity improvements and resulting cost savings from each of these work-rule changes depends on the degree of peaking in daily ridership patterns faced by individual transit systems as well as on certain other factors, these estimates do illustrate that significant cost reductions could result from relatively minor modifications.

Labor requirements entailed in providing transit service could also be reduced by the continued acquisition of larger buses, which have historically been a valuable means for reducing labor input per seat mile produced. In particular, the use of currently available double-deck and articulated buses, which feature seating capacities in the range of 60 to 80 passengers, on routes with high passenger volumes could provide important labor-cost savings without unacceptable reductions in service frequencies. Of course, any potential labor-cost increases from measures that in effect substitute capital for labor in transit operations must be balanced against the potentially higher capital costs they entail, such as those for new, larger buses. Increasing the speeds at which buses operate in revenue service could also produce some further economies in the use of driver labor. Here, local transportation planners have an important role to play, because this could be accomplished most immediately by using traffic engineering modifications and transit vehicle priority measures that improve bus operating speeds and minimize the interference they experience from other vehicles on urban streets. In addition, increased use of urban expressway and freeway rights-of-way by transit vehicles may be feasible on many routes, such as those connecting suburban areas to each other or to downtown areas, and could lead to significant reductions in vehicle round-trip times and thus driver hour and vehicle fleet requirements.

A second major challenge is to make service policies more responsive to the changing patterns of transit demand in order to improve the utilization of services that continue to be provided. This will require transit planners and operators to understand the continuing economic, demographic, and technological forces that alter the spatial and temporal patterns of transit ridership as well as to more aggressively adapt service policies to those changing patterns. It will also demand much greater willingness to reduce services for which demand is declining than the industry has historically demonstrated, although the task would be eased considerably by fare levels that more realistically reflected the costs of providing lightly used services. Although the continuing failure to reorient services to respond to changing demand circumstances has been motivated by understandable political and social concerns, maintaining or extending transit service in markets where attractive service levels are costly to operate and often lightly ridden appears to have been an important cause of the intensifying financial difficulties faced by transit operators.

On the positive side, it seems likely that ridership on some other types of routes could be increased by well-planned service improvements. The best example of these is probably the provision of more high-speed, direct express or limited-stop bus service from suburban residential areas to employ-

ment and commercial activity centers, particularly in the downtown districts of major U.S. cities. Along such routes, transit vehicles are often able to provide service that is competitive with automobile travel, in terms of both door-to-door travel times and passenger comfort levels. Although the demand for such service is likely to be concentrated during peak travel hours, making it costly to provide, travel by automobile in such corridors often entails high costs as well, because of the prevalence of congestion and high parking charges at the trip destination. Hence many more travelers than currently do so might be willing to use reliable, high-quality service of this type, even at the relatively high fares that would be necessary to cover the increased costs for providing these improved service levels.

Finally, the fare-setting policies of most transit agencies need serious revision if the contribution of current fare structures to escalating deficits is to be reversed. Transit operators must first begin to bring the overall level of fares into closer conformity with the cost of providing transit service; as presented in Table 4, the typical bus passenger now pays only about 40 percent of the operating cost that his or her trip imposes. Fare-setting practices should also more fully recognize the important variation in the costs of accommodating passengers who travel on different types of routes, at different hours of the day, and for different distances. Doing so will require transit operators to implement more sophisticated cost estimation techniques and to adopt surcharges for particularly costly types of transit service, despite the fact that they may be even less popular politically than general fare increases. The most important of these surcharges is probably higher fares for peak-hour travel, since the vehicles and driver shifts that must be dedicated exclusively to peak-period service make it particularly costly to provide. Peak-fare surcharges would not only help to defray these higher costs but should also help to shift some use to times of the day at which vehicle and driver capacity is now inadequately used, thereby reducing peak vehicle and driver requirements and thus the total cost at which given levels of service can be provided. Further, peak-period transit ridership probably consists largely of work commuters, relatively few of whom are poor, whereas off-peak riders probably include many who do have low incomes; hence higher peak-hour fares would transfer to riders having greater average incomes some of the added costs they impose and perhaps actually reduce the cost burden borne by some riders who are less able to pay.

Another important form of surcharge for more costly service that should be relied on more heavily by transit operators is distance-based fares; higher fares are charged for longer trips through the use of zone-fare systems or mileage supplements to basic fare levels. The previous analysis demonstrated that recent growth in the length of typical transit trips has been another important cause of the widening gap between operating expense and fare revenue collected per passenger, which could be narrowed substantially by charging fares that vary at least roughly with distance traveled. In addition, imposing considerably higher fares for longer trips might allow those for very short trips to be reduced, which on some routes could lead to significant increases in ridership and revenue without necessitating added service or expenditures. Implementing distance-based fares should also be eased by widespread experience with their use, both in the United States and other nations, and the ready availability of a variety of proven technologies--ranging from manual to fully automated--for charging them. Again, at the same time that they transfer more of the burden of financing particularly costly forms of transit service to those who use them, distance-based surcharges could actually reduce the fare burden borne by lower-income riders, who typically make somewhat shorter trips than higher-income passengers (23, Chapters 5 and 7).

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REFERENCES

1. Transit Fact Book. American Public Transit Association, Washington, DC, 1970, 1978-1979, 1981.
2. National Urban Mass Transportation Statistics 1980. U.S. Department of Transportation, June 1982.
3. Transit Operating Report. APTA, Washington, DC, 1960, 1965, 1970, 1975.
4. Transit Operating Statistics Report. APTA, Washington, DC, 1980.
5. Economic Characteristics of the Urban Public Transit Industry. Institute for Defense Analyses, Alexandria, VA, 1972.
6. Control Data Corporation and Wells Research Corporation. Trends in Bus Transit Financial and Operating Characteristics 1960-75. U.S. Department of Transportation, Rept. DOT-P-30-78-43, 1977.
7. Union Wages and Hours: Local Transit Operating Employees. Bureau of Labor Statistics, U.S. Department of Labor, 1970.
8. J.R. Meyer and Jose A. Gomez-Ibanez. Improving Urban Mass Transportation Productivity. UMTA, Rept. MA-11-0026, Feb. 1977.
9. Quarterly No. 1-D Diesel Fuel Price Report, Volume 5, No. 4. APTA, Washington, DC, Feb. 1981.
10. Selected Characteristics of Travel to Work in the United States. In Current Population Reports, Series P-23, Nos. 68, 72, and 105, U.S. Bureau of the Census, 1975, 1976, 1977.
11. Nationwide Personal Transportation Survey, Volume 8. U.S. Department of Transportation, 1969.
12. H.S. Levinson. Characteristics of Urban Transportation Demand. Wilbur Smith and Associates, New Haven, CT, April 1978.
13. Costs of Owning and Operating an Automobile. U.S. Department of Transportation, 1976, 1980.
14. Detailed Characteristics of the Population. In U.S. Census of Population, U.S. Bureau of the Census, Rept. PC(1)-1D, 1960.
15. The Journey to Work in the United States: 1975. In Current Population Reports, U.S. Bureau of the Census, Series P-23, No. 99, 1975.
16. A. Downs. The Automotive Population Explosion. Traffic Quarterly, Vol. 33, No. 3, July 1979, pp. 347-362.
17. Household Vehicle Ownership. In 1977 Nationwide Personal Transportation Survey, U.S. Department of Transportation, Rept. 2, Dec. 1980.
18. J.R. Meyer and J.A. Gomez-Ibanez. Autos, Transit, and Cities. Harvard Univ. Press, Cambridge, MA, 1981.
19. Economic Report of the President. U.S. Government Printing Office, Feb. 1982.