U.S. Department of Transportation

The Causes of Rising Transit Operating Deficits

July 1983

The cover photo shows one of the buses of Seattle's METRO system. Working with the Amalgamated Transit Union, Seattle implemented a program to hire part-time operators, resulting in savings of four to ten percent of operator wage costs.

The Causes of Rising Transit Operating Deficits

Final Report
July 1983

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16. Abstract

This report presents detailed estimates of the contribution by various factors to growth in operating deficits among U.S. urban transit systems between 1970 and 1980, as well as an extensive analysis of the causes underlying each of these factors. They include increases in operating expenditures per unit of transit service, increases in the aggregate level of service supplied, declining utilization of transit services, and reduced fare revenue per passenger carried. The report also examines variation in the growth of transit operating losses and the relative importance of its different sources among U.S. urban areas. Finally, it offers detailed recommendations for actions by transit operators, transportation planners, and government officials to control rapidly rising deficits.

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EXECUTIVE SUMMARY

THE CAUSES OF RISING TRANSIT OPERATING DEFICITS

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The Problem of Rising Transit Deficits

By almost every measure, the 1970s were a pivotal episode in the history of the United States' urban transit industry. After declining steadily for over twenty-five years, nationwide transit ridership climbed slightly during 1973, and continued to grow throughout the remainder of the decade. Similarly, after thirty years of consistent decline, the level of nationwide transit service was restored during the 1970s nearly to its level of twenty years earlier. Much of this revitalized service was provided using new, high-capacity vehicles traveling at rapid speeds and offering improved amenities such as air conditioning and more spacious seating. 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 after 1970.

At the same time, other developments in the industry were less encouraging. Total operating expenditures incurred by U.S. 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, by 1980 -- only fifteen years after first failing to meet its operating budget through fare revenues alone -- the industry's operating deficit grew to almost $3.5 billion. During the 1970s, operating losses spread from a handful of rail transit systems in the nation's oldest and largest urban areas, to systems operating all modes of transit service in virtually every U.S. city. Perhaps most alarming, operating costs and deficits grew quickly not only in the early years of the decade, as ridership continued to decline, but rose <u>even more rapidly</u> after the prolonged declines in service and ridership were reversed.

This report presents detailed estimates of the contributions by various factors to recent growth in transit operating deficits, as well as an extensive analysis of the causes underlying each of these factors. (For example, declining labor productivity was an important <u>source</u> of rising expenditures and deficits, but the <u>causes</u> of declining productivity include changes in patterns of transit ridership and increasingly restrictive labor agreement provisions.) The report also examines variation in the growth of transit operating losses and the relative importance of its different sources among U.S.

urban areas. Finally, it offers detailed recommendations for actions that should be taken by transit operators, local transportation planners, and government officials to control skyrocketing transit deficits.

Major Research Findings

Rising Unit Labor Costs. Rapidly increasing labor costs per vehicle-mile of transit service were the most important single source of escalating transit deficits between 1970 and 1980, accounting for more than 43% of the inflation-adjusted growth in the industry's operating losses. Rising labor costs per vehicle-mile reflected growth in labor compensation rates that substantially outpaced increases in the cost of living, together with increases in the amount of labor used per vehicle-mile of transit service produced. Escalating total compensation per labor-hour accounted for slightly more than 25% of the growth in industry-wide operating deficits, while declining labor productivity was responsible for another 18%.

Increasing labor compensation was mainly the result of rapid escalation in basic wage and salary rates paid to drivers, mechanics, operations supervisors, and administrative employees. This trend was aggravated by widespread introduction of automatic cost-of-living escalators in wage rates, which often indexed wage increases to volatile indicators of inflation such as the Consumer Price Index for the nation's largest urban areas. Pay premiums to vehicle operators in the form of higher overtime pay rates, minimum pay guarantees for short work assignments, and premiums for split shifts also became more generous over this period, partly to compensate drivers for excessively long shifts or fragmented work assignments. At the same time, the monetary equivalent of fringe benefit compensation grew even more rapidly than basic wage and salary levels.

Increases in the quantity of labor required to produce each vehicle-mile of transit service reflected the declining productivity with which transit managers utilized drivers, mechanics, and supervisory employees. At the same time, labor productivity in many administrative and management functions apparently also declined significantly. One important cause of these declines was probably the changing structure of transit demand, including increased peaking during commuting hours, growing imbalances in directional flows of passengers, and lengthening passenger trips. Its effects were aggravated by increasingly restrictive labor agreement provisions governing the assignment of vehicle operators to work shifts, such as limitations on the overall duration of split shifts and maximum allowable percentages of split shifts. The increasing complexity of maintenance procedures and labor agreement provisions that complicated the scheduling and assignment of tasks also contributed to the declining efficiency of labor utilization. Finally, the growing complexity of some administrative functions such as route planning, service scheduling, and developing driver and vehicle assignments may also have been responsible for some of the decline in labor productivity.

Increases in Energy Prices and Consumption Rates. Rising costs for vehicle propulsion energy also contributed significantly to escalation in unit costs and thus rising transit losses, accounting for nearly 10% of growth in the nation's aggregate operating deficit over the decade. Most of the increase in unit energy expenses stemmed from explosive growth in the prices transit operators paid for motor fuel and electric power, which resulted from major price increases imposed during the decade by the international oil producers' cartel. Together, these raised the average price paid by U.S. transit operators for diesel fuel and electric power nearly four-fold between 1970 and 1980, even after adjusting for the effects of rapid inflation throughout the remainder of the economy.

The effect of these price increases was accentuated by slight increases in energy consumption rates of transit buses and rail vehicles. Some of this deterioration in energy efficiency probably resulted from the introduction of features such as air conditioning and more spacious seating, as well as improvements in vehicle performance and safety characteristics. Because these developments improved the quality of transit service, however, the decline in transit vehicle energy efficiency was probably a less serious source of unnecessary operating cost and deficit growth than others such as rising fuel and power costs or increasing unit labor expenses.

Expansion of Transit Service. Expansion of the aggregate level of nationwide transit service was responsible for another 16% of growth in operating deficits between 1970 and 1980. Transit service was increased partly in response to the dispersion of population, employment, and other activities within U.S. cities, which was accompanied by widespread extension of bus (and in a few cases, rail) transit routes into their rapidly growing suburban areas. In addition, large-scale shifts of population to regions of the nation where urban transit service levels had been historically low, principally the south and west, occurred during the 1970s. These were often accompanied by substantial increases in service levels intended to serve the growing population and transportation demands of urban areas in these regions.

Route extensions and increases in transit service frequencies also occurred partly in response to government policy initiatives, which promoted transit use in an attempt to further environmental, energy, and transportation policy goals. Although transit service increases proved relatively ineffective in promoting these goals, every level of government continued to offer expanding levels of operating assistance to transit suppliers during this period, with the clear intention of reversing the historical decline in the level of service they provided.

Declining Utilization of Transit Service. Deteriorating utilization of urban transit service was another source of the industry's growing operating losses, although its contribution amounted only to about 2% of total deficit growth. The number of passengers carried per vehicle-mile of transit service, the index of utilization used in this study, declined about 4% over the decade. This occurred because important economic and demographic trends reduced the demand for public transit service, while altering its spatial structure and time patterns in ways that made satisfactory utilization difficult for transit operators to maintain. Most important among these was the continuing decentralization of employment, population, and related activities within U.S. metropolitan areas, which reduced the opportunities for public transit to compete effectively with private automobile travel. In addition, transit service utilization declined even more rapidly than these changes in urban activity patterns would have suggested, because transit operators' service policies often failed to recognize and respond to them.

Reduced Fare Revenue per Passenger Carried. Finally, a substantial decline in average fare revenue per passenger carried accounted for the remaining 28% of the overall increase in transit operating deficits between 1970 and 1980. Transit fares declined because many operators failed to raise basic fares sufficiently to compensate for inflation, while introducing substantial discounts for specific groups of riders and eliminating fare surcharges for more costly trips. Transit operators' reluctance to raise even basic adult fares during this period reflected their decisions to exploit the growing availability of government operating subsidies to defray cost increases and stabilize or even reduce inflation-adjusted fares. These decisions complied with an explicit goal of the federal operating subsidy program, which distributed assistance payments beginning in 1975, as well as of some state and local assistance programs before that time.

Declining revenue per passenger also reflected the widespread advent of selective fare reductions, most commonly for the elderly and handicapped, although many transit operators extended discounts to students, children, and frequent riders (through weekly or monthly pass programs) as well. While some of these fare reductions were motivated by important social concerns about the mobility of deserving groups, they proved costly because of the reduction in passenger revenue they produced, and were certainly a critical reason why fare policies contributed so importantly to rising operating deficits. Another reason revenue yields declined was because many transit operators eliminated fare premiums for services that were particularly costly to supply, including higher peak hour fares, transfer charges, and zone surcharges or other forms of distance-based fares. With typical transit trips becoming longer, the conversion of some major transit systems to grid-type bus route networks, and a rising fraction of ridership concentrated during morning and evening rush hours, widespread elimination of these fare surcharges was another important cause of the decline in average fare revenues.

Variation in Deficit Growth among Urban Areas. At the same time, there were substantial differences among urban areas in the extent of deficit growth and the contributions of various factors to it. More than 40% of the $3.1 billion increase in the nationwide operating deficit between 1970 and 1980 occurred in the five U.S. cities with older rail transit systems (New York, Chicago, Philadelphia, Boston, and Cleveland). In contrast, the three cities where new rail systems were constructed during the decade (San Francisco-Oakland, Washington, D.C., and Atlanta) together accounted for only about 5% of nationwide deficit growth. Another 31% of increased losses was incurred among the 22 cities with 1980 populations over one million where only bus transit service operated, reflecting the rapid service expansions and growth in unit costs that took place in many of them. Finally, the remaining 23% of growth in nationwide losses was spread widely among bus transit systems operating in nearly 200 U.S. cities with populations under one million.

Rapidly rising costs per vehicle-mile of transit service were consistently responsible for one-third to one-half of the increase in transit operating deficits except in the five cities with older rail transit systems, where they accounted for well over half of the growth in operating losses. Similarly, expanding levels of transit service were instrumental in raising operating losses in nearly every category of urban areas analyzed, accounting for at least one-quarter of deficit growth except in those same five cities, where combined bus and rail transit service actually declined slightly. Finally, just as it was for the nation's transit industry in the aggregate, declining fare revenue per passenger was the other major source of rising operating losses in most urban areas, although its importance varied considerably. The contribution of declining utilization of transit service was relatively minor in most urban areas, although its small estimated effect is partly due to the stimulus to transit ridership provided by substantial fare reductions and increases in the cost of auto travel during the decade.

Comparative Roles of Structural and Policy Changes. The most surprising finding from this analysis is that the major source of the U.S. transit industry's financial deterioration throughout the automobile era, the continuing decline in transit service utilization, contributed so little to the rapid escalation of operating losses during the 1970s. The research reported here indicates that the declining number of passengers carried per vehicle-mile of transit service was responsible for by far the smallest share of deficit growth among the several factors identified. Instead, rapidly rising labor compensation and energy prices, declining labor productivity, expansion in the level of transit service, and reduction and simplification of transit fares together accounted for virtually all of the increase in transit operating losses from 1970 to 1980.

This finding is extremely important because it suggests that skyrocketing deficits were largely the product of changes in factors under the direct control of transit operators and transportation policy-makers themselves. Some of these developments, particularly the sharp reversal in the historical decline of service levels and the stabilization of what had been rapidly rising transit fares, clearly reflected transit operators' responses to rapid growth in the availability of government operating assistance. Certain other changes -- mainly the sharp increase in energy costs -- that also absorbed an important share of operating assistance were largely outside the control of either the industry or government policy.

Nevertheless, the explosive recent growth in transit operating deficits owes more to the policies of both government transportation agencies and transit operators than to the continuing changes in urban development that have fostered the industry's long-term decline. At the same time as they offered rapidly growing employee compensation and accepted declining labor productivity, most transit operators continued to implement widespread service expansions, while simplifying and sharply reducing fares in an effort to increase ridership. Although these initiatives were motivated partly by an expanding conception of the potential role of transit in serving varied goals of social, environmental, and energy policies, they combined with rising labor costs to produce astoundingly rapid growth in the industry's operating losses.

Major Recommendations

Controlling Labor Costs. Public transit operators, urban transportation planners, and government transportation policy officials together face several important challenges, one of which is clearly to bring the explosive growth of transit labor costs under control. Transit managers and local political officials must adopt more aggressive and responsible positions in future labor negotiations, including bringing wage and salary increases into line with standards such as improvements in labor productivity or compensation for similar work in the private economy. Because fringe benefits paid to transit employees have also escalated dramatically in recent years, bringing their growth into closer conformity with that in other sectors of the economy is another important avenue for controlling transit operating expenses. At the same time, transit operators should pay closer attention to the cost implications of various pay premium provisions included as part of labor agreements, chiefly those for split shifts, overtime, night, and weekend work, both during the negotiation of specific labor agreement provisions and in the scheduling of vehicle operator work shifts.

Another critical strategy for controlling labor costs is to improve labor productivity in transit operations, primarily by changing the restrictive labor agreement provisions that currently complicate the assignment of driver work shifts and result in considerable underutilization of paid driver time. These include restrictions on the length of unpaid breaks in drivers' work shifts, the maximum overall duration of split shifts, and the fraction of driver shifts that can be split. Various other measures could also reduce the number of paid labor-hours required to produce a given schedule of transit service. Reducing the unusually high levels of operator absenteeism experienced by many U.S. transit systems to more acceptable levels could substantially reduce the number of drivers who must be paid to remain available to assume the shifts vacated by absent drivers. Labor productivity could also be improved by wider use of currently available 60-80 passenger double-deck and "articulated" buses on routes with high passenger volumes, where their substitution for conventional vehicles would not produce unacceptable reductions in service frequencies.

Rationalizing Transit Services. A second major challenge is to make transit service planning more responsive to changing patterns of urban travel demand, in order to improve the utilization of services that continue to be provided. This will require transit operators and planners, as well as transportation policy-makers, to understand more completely the economic, demographic, and technological forces that continue to alter the spatial and temporal patterns of transit ridership. Adapting service policies to changing demands for transit travel will require much greater willingness to reduce services on which ridership is declining than planners and operators have recently demonstrated. However, this task would be eased considerably by fare levels that more realistically reflected the costs of providing lightly-used services, particularly on routes where fares have been kept low in an effort to forestall ridership losses resulting from declining demand for transit service.

The continuing failure to reorient urban transit services in response to changing demand circumstances has been motivated by understandable political and social concerns. Nevertheless, maintaining or extending transit service in markets where attractive service levels are costly to operate and often lightly ridden has been a central cause of the intensifying financial difficulties faced by transit operators. With public willingness to continue subsidizing expanding operating deficits in serious doubt, service decisions by transit planners and the local political officials to whom they are frequently responsible must become more sensitive to the changing character of transit demand if the industry is to remain a viable element in the nation's urban transportation system.

Revising Transit Fare Structures. The fare structures of most urban transit systems also need serious revision if the recent explosive growth of their operating deficits is to be brought under control. Transit operators must first bring the overall level of fares into closer conformity with the cost of providing transit service, since the typical transit passenger now pays less than 40% of the operating cost his 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. The most important of these selective fare changes 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. Another important form of surcharge for particularly costly service that should be relied upon more heavily by transit operators is distance-based fares, whereby higher fares are charged for longer trips through the use of zone charges or mileage supplements to basic fare levels.

Reconsidering Government Transportation Policies. The alarming deterioration in the financial condition of the U.S. pubilc transit industry during the past decade also raises serious challenges to government policies toward urban transportation. With accumulating evidence that growth in the availability of government operating assistance may itself be a primary cause of the escalation in costs and deficits, one of these challenges is clearly to reassess the design and operation of government subsidy programs for transit at the federal, state, and local level. Local and state government agencies involved in transportation finance should very carefully evaluate decisions to earmark specific tax sources for transit assistance, since those decisions often exempt operating subsidies from much of the fiscal scrutiny normally applied to annual budget appropriations.

Similarly, state and federal transit assistance programs that distribute operating subsidies according to formulae that fail to take financial or operating performance of their recipients into account need to be seriously reconsidered. The distribution formulae for these programs should be revised to establish specific incentives for transit operators to reduce operating expenses per passenger (or passenger-mile) carried, as well as to cover a larger share of those expenses from farebox revenues. Of course, those operators who are most successful in doing so will incur the lowest deficits per passenger, and will thus display the least "need" for operating assistance. Although this is an unfortunate complication, it is certainly preferable to the current subsidy distribution process, which in effect rewards transit operators in proportion to escalation in their operating expenses and the fare reductions they must make to achieve acceptable utilization of their services.

Even if the distribution of operating subsidies can be rationalized to provide incentives for improved cost control and passenger-carrying productivity, their effectiveness is likely to be limited as long as subsidies continue to be offered only for conventional mass transit service operated by public authorities. Changes in the underlying cost structure of urban transit operations, together with continued evolution in urban travel demands, suggest that some of the role historically served by conventional bus and rail transit could be served more effectively and at lower cost by other travel modes. Further, in some urban travel corridors private operators of conventional transit service may be able to provide it at more reasonable costs than those now incurred by public transit authorities. Thus the most important challenge for government policies toward the nation's urban transit industry may be to reduce rather than to increase reliance on heavily subsidized conventional mass transit service.

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Chapter 1

THE PROBLEM OF RISING URBAN TRANSIT OPERATING DEFICITS

By almost every measure, the 1970s were a pivotal episode in the history of the United States' urban transit industry. After declining steadily for over twenty-five years, nationwide transit ridership climbed slightly during 1973, and continued to grow throughout the remainder of the decade. By 1980, the annual number of transit riders in the nation's urban areas returned nearly to its level of fifteen years earlier. Similarly, after thirty years of consistent decline, the number of vehicle-miles operated by the industry increased significantly during the 1970s. Thus by the end of the decade nationwide transit service had been restored nearly to its level of twenty years earlier.[1]

Much of this revitalized service was provided using new, high-capacity vehicles traveling at rapid speeds and offering improved amenities such as air conditioning and more spacious seating. By 1980, transit vehicles operated over nearly 125,000 track and street miles in the United States, more than a third of which were added after 1970. Thus despite tremendous growth in urbanized land area during the decade, the coverage provided by transit routes in many major U.S. cities reached new highs by 1980.[2]

At the same time, however, other developments in the industry were less encouraging. Total operating expenditures incurred by U.S. 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, by 1980 -- only fifteen years after first failing to meet its operating budget through fare revenues alone -- the industry's operating deficit approached $3.5 billion.[3] During this period, operating losses spread from a handful of rail transit systems in the nation's oldest and largest urban areas, to systems operating all modes of transit service in virtually every U.S. city.

In 1970, transit systems in New York, Boston, and San Francisco together accounted for most of the approximately $200 million nationwide operating deficit. Yet by 1980, the total deficit was spread among several hundred systems providing transit service in every metropolitan area in the United States.[4] Even more alarming, operating costs and deficits grew quickly not only in the early years of the decade, as ridership continued to decline, but rose even more rapidly after the prolonged declines in service and ridership were reversed.

These escalating deficits were funded through a combination of first local, and later state and federal government assistance. By 1980, the combined contribution to transit operating budgets by all levels of government in the United States exceeded $3.6 billion, of which nearly half was provided by local government agencies in most major urban areas.[5] Rapid growth in government support no doubt alleviated pressures to curtail service and raise fares, which had intensified throughout the 1960s. In so doing, it may have furthered some goals sought by urban transportation policy, such as reducing air pollution and energy consumption levels generated by urban transportation, or improving the mobility of urban residents who depend on public transit service for much of their travel.

Despite past willingness to increase subsidy levels, this alarming deterioration in the industry's underlying financial condition raises serious questions about whether conventional mass transit service can achieve these goals at reasonable costs to riders and taxpayers, who ultimately bear them in some combination. Further, voters' growing reluctance to endorse continued growth in expenditures by any level of government raises equally serious questions about how rapidly, and indeed whether, public financing of transit deficits can continue to grow.

IDENTIFYING THE CAUSES OF DEFICIT GROWTH

The growing fiscal burden imposed on all levels of government by the commitment to public financing of transit operating deficits is certainly one important reason for attempting to identify the causes of their explosive growth. Subsidies to maintain widespread transit service at nominal fares have proven to be a costly instrument for advancing the goals of transportation policy for every level of government that has offered them. As a result, there is growing pressure to evaluate more carefully whether financing conventional mass transit service can effectively further these policy goals at tolerable levels of taxation and government expenditure. Identifying the causes of rapid deficit growth is clearly an important first step in this process of reassessing the desirability of continuing to finance escalating deficits.

Another important reason to identify specific factors responsible for growing deficits is that different causes are likely to imply sharply varying prescriptions for bringing losses in the transit industry under control. One critical distinction is between factors stemming from changes in the industry's operating environment and the effects of transit operators' decisions about fare and service policies. Differentiating between these two basic sources of deficit growth is critical, because fundamental changes in the market for mass transit service are largely the result of powerful demographic and economic forces. These are difficult to modify either through government policies, such as urban land use controls, or service deployment decisions by transit operators themselves.

In contrast, service and fare levels are controlled directly by operators, often in conjunction with local political authorities, and are also influenced by government transportation policies. Thus despite the political complications posed by the involvement of government officials in fare and service decisions, their effects on transit operating costs and deficits are likely to be more easily reversed than those of fundamental changes in urban travel patterns and demand for transit service.

Similarly, it is important to identify the role played by structural -- and therefore largely unavoidable -- sources of escalation in the costs of providing transit service, such as fuel price increases and labor productivity declines caused by peaking in transit demand. Their effects on operating expenditures should be distinguished from unnecessary and thus potentially reversible sources of cost escalation. These include such factors as increases in wage rates and pay premiums beyond those necessary to compensate operators for undesirable work schedules, unnecessarily protective or restrictive rules governing the assignment of operators to specific work shifts and tasks, or diminished incentives for efficient operations stemming from government subsidies. While transit operators will probably continue to face some unavoidable escalation in operating costs, they should be able to exercise improved control over these and other sources of unnecesary or excessive cost increases.

A final reason for measuring the relative contributions of specific factors to deficit increases arises because mass transit operating deficits have been almost completely funded by direct government subsidies. The resulting equality between deficits and subsidy payments implies that the sources of deficit growth correspond to the specific functions or purposes served by subsidy payments. Detailed knowledge about the distribution of subsidy benefits by actual purpose, whether intended or unanticipated, is important in evaluating the accomplishments and shortcomings of transit operating subsidy programs. In addition, it may suggest ways in which the distribution of subsidy payments under such programs should be revised in order to improve their effectiveness in assisting transit operators and users.

ORGANIZATION OF THE REPORT

The remaining chapters of this report identify specific sources of growth in urban mass transit operating deficits, and explore their underlying causes or explanations. The report also assesses their implications for revising transit operators' fare-setting and service planning practices, as well as for redesigning programs and policies of government transportation agencies. Chapter 2 presents estimates of the contributions of several basic factors to rising transit operating deficits. These include escalation in the unit costs of providing transit service, including those for labor, fuel and power, and various other operating inputs; extension of transit routes and service areas; declining utilization of transit service levels; and reduction and simplification of transit fare structures. Estimates of the contributions by each of these factors to rising deficits over the period from 1970 to 1980 are reported for the entire U.S. urban public transit industry, and their implications for the pruposes served by subsidy payments are explored.

Chapter 3 analyzes variation among urban areas in the contributions by these factors to growth in transit deficits. It attempts to identify systematic differences in the relative importance of various sources of deficit growth among transit systems or cities having different characteristics. Variations among several different groups of urban areas are examined, based on the modes of transit service offered and city size. Significant differences in the combinations of factors contributing to deficit increases among these groupings are highlighted and analyzed further.

Chapter 4 investigates the underlying causes of growth in unit operating expenses for providing transit service, a major cause of rising industry-wide operating deficits. It describes the development and calibration of a statistical model relating variation in unit operating expenditures among an extensive sample of urban bus transit systems to differences in factors hypothesized to affect cost levels. These include rising prices for labor and fuel inputs, constraints on the utilization of operator labor, characteristics of the service offered, and the possible weakening of incentives for operating efficiency by the guaranteed availability of government subsidies. The statistical estimates of the model's parameters are then used to analyze the contributions to recent operating cost increases by each of the factors it incorporates.

Chapter 5 identifies the underlying causes of the continuing decline in utilization of urban mass transit service. It documents the ongoing dispersion of residences and workplaces in U.S. metropolitan areas, and the resulting evolution in patterns of urban travel. The implications of these developments for the changing geographic and temporal structure of demand for urban transit service are then explored. The effects of economic and demographic forces such as continuing growth in personal incomes, rising auto ownership levels, and changing household structures on the demand for mass transit service are also explored. Finally, this chapter investigates the consequences for transit utilization of the apparent failure of transit service policies to recognize and respond to these ongoing changes in the structure of demand for public transportation.

Chapter 6 investigates why transit fare revenue yields failed to keep pace with the rapid escalation in operating expenses entailed in carrying transit passengers. This chapter relies on an analysis of changes in basic fare levels, the structure of fare surcharges, and average revenue yields for transit systems in the nation's largest metropolitan areas. Growing insistence on undifferentiated fare structures, even within large urban transit systems providing a wide variety of types of service, has apparently been a critical source of the recent decline in unit fare revenues. Other causes of the growing gap between unit operating expenses and fare revenues include operators' failure to raise basic fare levels except to compensate for inflation, together with their recent implementation of substantial fare discounts for groups comprising a surprisingly large fraction of total riders.

Chapter 7 examines the implications of findings detailed in previous chapters for reforms in transit operators' management and service decisions, changes in local transportation planning practices, and the revision of national urban transportation policies. At the level of local transit operators and political officials who oversee their decisions, these recommendations focus on controlling unit operating expenses, improving the service planning process, and rationalizing fare-setting practices. At the same time, governments should redesign their operating assistance programs to require better cost control, more rational service planning, and increased reliance on farebox revenues, as well as to encourage the supply and use of non-conventional modes of urban transit service. Chapter 7 also advocates reconsidering the effectiveness of operating subsidies to conventional urban mass transit as an instrument of government transportation policy.

FOOTNOTES TO CHAPTER 1

1. American Public Transit Association, Transit Fact Book 1981, Table 11, p. 55, and Table 13, p. 58.

2. American Public Transit Association, Transit Fact Book 1979, pp. 66-70; and U.S. Urban Mass Transportation Administration, National Urban Mass Transportation Statistics: Second Annual Report, Section 15 Reporting System, July 1982, Table 1.13.1, p. I-51.

3. American Public Transit Association, Transit Fact Book 1981, Table 5, p. 46, and Table 6, p. 47.

4. U.S. Department of Transportation, Feasibility of Federal Assistance for Urban Mass Transportation Operating Costs, November 1971, Table II-5, p. 12, and Table II-6, p. 14; and U.S. Urban Mass Transportation Administration, National Urban Mass Transportation Statistics: Second Annual Report, Section 15 Reporting System, July 1982, Table 2.01.1, pp. 2-10 to 2-16, and Table 2.08.1, pp. 2-38 to 2-49.

5. American Public Transit Association, Transit Fact Book 1981, Table 4, p. 44. This figure excludes government assistance for capital purchases.

Chapter 2

SOURCES OF GROWTH IN TRANSIT OPERATING DEFICITS

This chapter explores the contributions to growth in transit operating losses from changes in several factors that affect the industry's operating expenditures and total revenues. These include operating expenses per unit of service it provides, the aggregate level of transit service supplied, passenger utilization of available service, and fare revenue per passenger carried. The analysis encompasses the major modes of urban transit operating within U.S. cities (motor bus, trolley coach, rapid rail, and light rail or streetcar) over the period from 1970 to 1980. It identifies factor price, productivity, and service level changes that contributed to operating cost increases during this period, and assesses how extensively declining utilization of transit service together with falling average fares contributed to declining transit revenues.

From the viewpoint of cost and revenue accounting, changes in these factors can be interpreted as the sources or components of growth in transit operating deficits. It is important to distinguish these findings from the underlying causes of growth in the various components of operating expenditures, as well as from the fundamental reasons why transit service utilization and fare revenues have fallen. Although these are certainly critical questions, it is first important to assess the relative importance of each of these major sources of diverging transit industry operating expenses and revenues. While the underlying causes of rising operating costs, declining transit utilization, and falling average revenues are explored subsequently, the current chapter focuses on estimating the relative importance of the major factors contributing to recent escalation in aggregate transit industry operating losses.

AN ACCOUNTING "MODEL" OF TRANSIT OPERATING DEFICITS

The definition of the transit operating deficit used here is:

(2.1) Operating Deficit = Operating Expenditures - Passenger Fare Revenues.

Industry-wide transit operating expenditures exceed fare revenues over the entire period studied, so it is convenient to express the deficit directly rather than as a negative value for net operating income as it is usually defined.

As used here, total operating expenditures encompasses vehicle operations, maintenance of vehicles and facilities, and administrative functions. It specifically excludes any operating taxes or license fees levied on transit systems, as well as estimates of capital stock depreciation and amortization of capital investments. Thus it includes only expenses related to operating transit services, with no provision for the associated capital expenses for vehicle fleets, rights-of-way, or fixed facilities such as stations, vehicle depots, and maintenance facilities.

This convention is used partly because of the specialized nature of some transit capital facilities, such as underground or elevated rights-of-way, and the associated difficulties in determining their opportunity costs and depreciation rates. It also recognizes the historical involvement of government in financing transit system capital investments, which has made it extremely difficult to obtain the data necessary to construct estimates of amortization and depreciation of capital investments. Nevertheless, capital costs for providing transit service are both real and substantial, and it is important to recall that they are a significant element of the full costs of transit service, despite their typical omission from estimates of operating losses such as those reported here.

As indicated by expression (2.1), revenues include passenger fares from regularly scheduled passenger (and unavoidably, some charter) service. They exclude other forms of operating revenue such as fares from demand-responsive transportation services, as well as all forms of nonoperating revenue, including operating assistance payments from government agencies. As the definitions of expenditures and revenues suggest, this analysis attempts to isolate operating losses incurred on regularly scheduled, fixed-route transit services.

Unit Versus Total Operating Expenditures

Operating expenditures are the product of two components, the average expenditure per unit of service provided, and the total number of such units supplied. Thus a second useful relationship is:

(2.2) Operating Expenditure = Operating Expense per Unit of Service
x Number of Units Produced.

A variety of basic units of transit service can be used, but the most common is vehicle-miles.

While vehicle-miles has the advantage of ready historical availability, its use also presents certain disadvantages in intermodal or historical comparisons of expenditure and service levels. These arise because the passenger-carrying capacity of transit vehicles differs widely among the conventional modes, as well as because typical capacities of vehicles used to provide the same mode of service have increased slowly over time. Thus a more informative measure of the level of service provided would be miles of passenger-carrying capacity, where capacity is defined to include seating capacity plus an allowance for normal standing loads. Unfortunately, consistent estimates of this concept of capacity are difficult to obtain, not only historically but also among transit systems for any single point in time. Hence, this study relies primarily on vehicle-miles as a measure of transit service supplied.

The Composition of Unit Operating Expenses

Operating expenditures per unit of service can be separated into distinct categories corresponding to the various operating inputs utilized in the production of transit service. The most important of these is labor, including vehicle operators, maintenance workers, supervisory employees, and administrative personnel. In 1980, wage, salary and fringe benefit payments to transit workers accounted for nearly 80% of nationwide operating expenditures for urban transit service. Fuel and electric power expenses represent about another 10%

of total operating expenditures, with a variety of other materials, supplies, and services accounting for the remainder of expenses.[1]

Historically, transit operating expenditures have been reported by the specific function for which they are incurred, such as vehicle operations or maintenance of vehicles and facilities, each of which combines these basic inputs in different combinations. However, the composition of expenditures by operating input purchased reveals more clearly the effects of specific sources of escalating operating expenses, including rising costs for individual inputs such as labor and energy, and changes in the efficiency with which they are utilized by transit operators.

Thus unit operating expenditures can be expressed as the sum of expenses for various inputs:

(2.3) Operating Expenditures per Unit of Service Produced =

Labor Expense per Unit of Service

+ Propulsion Energy Expense per Unit of Service

+ Miscellaneous Other Expenses per Unit of Service.

Labor and propulsion energy expenses are each the product of the price per unit purchased and the efficiency with which that input is utilized:

(2.4) Labor Expense per Unit of Service =

Cost per Unit of Labor Purchased x

Number of Units of Labor Consumed per Unit of Service Produced

(2.5) Propulsion Energy Expense per Unit of Service =

Cost per Unit of Energy Purchased x

Number of Units of Energy Consumed per Unit of Service Produced.

As with the measurement of transit service, a variety of units are available to measure the quantities of operating inputs consumed per unit of output. The usual unit for measuring labor services is the labor-hour; however, estimates of labor-hours used are not generally reported by individual transit systems. Similarly, labor expenses -- which include wage or salary payments as well as fringe benefits -- have not been reported by individual transit operators until recently. Thus estimates of these two components of unit labor expenses can be constructed only for the entire transit industry. Energy used to operate transit vehicles is reported in conventional units, such as gallons of fuel for gasoline and diesel-powered vehicles and kilowatt-hours for electrically-powered vehicles, so that unit energy costs and consumption rates can be readily estimated.

Fare Revenues

Passenger fare revenues, the remaining component of the operating deficit in expression (2.1), can be similarly disaggregated into separate factors in order to identify other sources of rising operating deficits. The simplest division is between the quantity of transit service actually purchased by passengers and the average price paid for each unit:

(2.6) Passenger Fare Revenue =

Number of Units of Transit Service Purchased

x Average Revenue per Unit Purchased.

Again, various units can be used to measure the quantity of transit service purchased, but the only measure reliably reported by the transit industry is passengers carried.

<u>The Role of Transit Service Utilization</u>

In turn, the level of transit service purchased depends partly on the total quantity that is supplied. This interdependence arises because variations in total output reflect changes in either the frequency or availability of transit service, both of which can affect total transit ridership. In order to separately identify their effects on total consumption of transit service, ridership is expressed in terms of the level of service provided and the intensity with which each unit of service is utilized:

(2.7) Number of Units of Transit Service Purchased =

Number of Units of Service Supplied

x Units of Service Purchased per Unit Supplied.

Although it is common in other transportation industries to measure utilization by the fraction of available seat-miles that is actually occupied by passengers, transit service utilization is usually measured by the number of passengers boarding per vehicle-mile operated since passenger- and seat-mile estimates are generally unavailable. When using this measure of utilization, it is important to distinguish between initial passenger boardings, which represent originating trips, and those by transferring or continuing passengers. This study employs estimates of originating passenger trips only. Because fare structures commonly offer free or reduced-fare transfers, this distinction is important for accurate revenue accounting on a passenger-trip basis.

USING THE MODEL TO ANALYZE SOURCES OF OPERATING DEFICIT GROWTH

Expressions (2.1) through (2.6) can be used to estimate the contribution to growth in the aggregate operating deficit by each of the factors they include. First, the actual values of the total deficit and each of the factors appearing in expressions (2.1) through (2.6) must be estimated for both the beginning and end of the period under study. The second step is to estimate what the aggregate deficit would have been at the end of the period if a single factor -- for example, the aggregate level of transit service, which appears in expressions (2.2) and (2.6) -- had remained at its original level, while all other factors continue to take their actual values for the end of the period.

This provides an estimate of how large the industry's aggregate operating deficit would have been had that factor remained stable at its level of the beginning of the period, thus making no contribution to rising deficits over the interval being examined. Using this hypothetical lower level of the aggregate operating loss, it is then possible to estimate how much the actual change in that individual factor contributed to growth in the total deficit. This estimate is given by the difference between the actual deficit at the end of the period and the estimated deficit with that individual factor held constant at its original level.

Conceptually, this procedure equates the contribution of each factor appearing in expressions (2.1) through (2.6) to the amount by which the end-period total deficit would have been reduced if that factor had not contributed to growth in operating losses. This is clearly not the only procedure that could be used to estimate the sources of rising deficits; instead, for example, all factors except one could be held constant at their initial (rather than final) values, with each in turn allowed to rise to its actual final value. Nevertheless, these methods produce closely comparable estimates of the distribution of deficit growth among individual sources, so the choice between them does not critically affect the general results of this analysis.

These steps can be repeated to estimate the contributions of changes in each individual factor to deficit growth during the period in question. Because of mathematical interaction among some individual factors affecting the total deficit when they change simultaneously, the sum of these partial estimates will not exactly equal the actual change in the aggregate deficit. Thus their separate proportional contributions to rising deficits can be estimated by the fraction of their combined total that is accounted for by each one taken separately.

Potential Problems with the Procedure

Some important cautions must still be observed in interpreting these estimates, because of possible behavioral interactions among the individual components of the aggregate deficit. One of these, the previously discussed effect of changing service levels on aggregate ridership, is captured by disaggregating total ridership into the overall level of service and its utilization, as in expression (2.6). Interaction between unit operating costs and aggregate transit service could also arise if individual transit operators vary the service levels they provide in response to changes in its unit costs. Over the most recent decade, however, extremely rapid growth in the availability of government operating subsidies intended to finance service extensions and permit fares to remain well below costs has probably severely weakened any relationship of this nature.

Theoretically, such interaction would also result if scale economies or diseconomies occur in providing transit service, whereby unit operating expenses necessarily change as service levels vary because of the underlying structure of their production technologies. However, there is little convincing evidence that such economies exist, particularly in urban bus transit operations.[2] In any case, scale economies are likely to occur only when total expenditures -- including those for capital -- are considered, since they typically arise from spreading fixed costs of initial capital investments over increasing levels of output.

A more likely interaction among the model's variables stems from the effect of fares on the utilization of transit services. In expression (2.6), average fare revenue per passenger measures both the overall level and structure of transit fares, and is thus likely to directly affect utilization, as measured by passengers carried per vehicle-mile of service. Yet when the contribution of fare reductions to deficit growth is estimated by allowing average fare revenue to change while holding utilization constant, this interaction is ignored.

One consequence of this procedure will be to overestimate the contribution of fare reductions to deficit growth, while underestimating that of declining utilization of urban transit service. This problem can theoretically be corrected by incorporating the sensitivity of transit utilization to changes in the average fare by including an estimate of fare elasticity in expression (2.6). However, it is difficult to infer the necessary aggregate, long-run value of such a parameter, since most available elasticity estimates apply to short-run responses to changes in fares for individual services in specific urban areas. Consequently, considerable judgement should be exercised in interpreting the contributions of fare reductions and declining utilization of transit service to deficit growth that are estimated without accounting for this potential interaction.

ESTIMATES OF THE SOURCES OF RISING TRANSIT DEFICITS

The procedure outlined here was used to estimate the contributions of several major factors to growth in nationwide transit operating losses from 1970 to 1980. During this period, the aggregate operating deficit of the U.S. public transit industry as defined by expression (2.1), measured in constant 1980 dollars to eliminate the effect of inflation, rose from about $300 million to nearly $3.5 billion.[3] Each factor responsible for rising operating losses represents a change in one of the variables appearing in expressions (2.1) through (2.6); these include rising prices for the industry's major operating inputs, labor and fuel, changes in the efficiency with which they are utilized, transit service extensions, reduced utilization of transit service, and declining fare revenue per passenger carried. This chapter estimates and analyzes the sources of growth in combined operating losses for all modes of urban mass transit in the U.S., while Chapter 3 explores variations in the relative importance of various sources of deficit growth among transit systems operating in different urban areas of the nation.

Definition and Measurement of Variables

The basic unit of transit service used in this analysis is the vehicle-mile; thus unit operating expenditures in expressions (2.2) through (2.4) are measured in dollars per vehicle-mile, while the level of transit service is measured in total vehicle-miles. In order to more precisely estimate the effect of changing efficiency of labor utilization on operating expenses, the aggregate number of labor-hours used to supply transit services was estimated from transit industry employment data, together with estimates of average weekly hours worked by transit employees in a sample of U.S. cities.[4] Gallons of diesel fuel and gasoline, as well as kilowatt-hours of electric power are used to measure enegy consumed in vehicle operations.

Transit service utilization is measured by initial passenger boardings per vehicle mile, which corresponds to the number of transit trips originating per unit of service supplied. Boardings by transfering passengers are excluded as completely as possible, in order to avoid "double-counting" of actual passenger trips. In terms of commonly reported estimates of transit ridership, this definition corresponds to "originating" or "linked" passenger trips.[5] Similarly, fare revenue per unit of service consumed is measured by average revenue per originating passenger trip, in order to estimate the typical fares actually paid by transit passengers for their complete trips, whether or not they entail transfers and any associated extra charges. Table 2.1 reports the basic data used for this analysis, as well as the sources from which the individual figures are computed or estimated.[6] Table 2.2 shows the results obtained by applying the procedure for estimating sources of deficit growth outlined in the previous section to the basic data reported in Table 2.1. It presents estimates of the contribution of individual sources to actual growth in industry-wide operating losses between 1970 and 1980.[7]

Rising Unit Labor Costs

As Table 2.2 indicates, rapidly rising unit labor costs were by far the most important single source of increasing transit deficits over the most recent decade, accounting for more than 40% of the inflation-adjusted growth in the industry's operating losses. Rising labor costs per vehicle-mile reflected growth in labor compensation rates that substantially outpaced increases in the cost of living during this period, together with increases in the amount of labor

Table 2.1

Changes in Factors Affecting Transit Expenses, Revenue, and Deficits

Factor	1970 Value	1980 Value	% Change
Operating Expense per Vehicle-Mile (1980$)	$1.89	$2.89	52.9%
Labor Expense (1980$)	$1.33	$2.12	59.4%
Compensation per Labor-Hour (1980$)	$8.69	$11.47	32.0%
Labor-Hours per Vehicle-Mile	0.153	0.185	20.9%
Fuel and Electric Power Expense (1980$)	0.11	0.29	163.6%
Miscellaneous Other Expenses (1980$)	0.45	0.48	6.7%
Vehicle-Miles Operated (Millions)	1,883.1	2,095.0	11.3%
Total Operating Expenses (Millions of 1980$)	$3,559.5	$6,050.1	70.0%
Total Passenger Trips Originating (Millions)	5,932	6,358	7.2%
Passenger Trips Originating per Vehicle-Mile	3.15	3.03	-3.8%
Average Fare Revenue per Originating Passenger (1980$)	0.54	0.40	-25.9%
Total Fare Revenue (Millions of 1980$)	$3,225.7	$2,568.2	-20.4%
Total Operating Deficit (Millions of 1980$)	$333.8	$3,481.9	---[a]

[a]Calculated percent change exceeds 900%, but is misleadingly large because 1970 value is small.

Sources: American Public Transit Association, Transit Fact Book 1981, Tables 5, 6, 8, 11, 13, and 17; U.S. Department of Transportation, National Urban Mass Transportation Statistics, 1980; U.S. Bureau of Labor Statistics, Union Wages and Hours: Local Transit Operating Employees, various years; and U.S. Council of Economic Advisers, Economic Report of the President, February 1982, Table B-38.

Table 2.2

Estimated Percent of 1970-80 Growth in Transit Operating Deficits Attributable to Various Sources

Source	Estimated % of 1970-80 Deficit Growth Attributable to Source		
Rising Operating Expenses per Vehicle-Mile	54.7%		
Labor Expenses		43.3%	
Increasing Compensation per Labor-Hour			25.3%
Declining Labor Productivity			18.0%
Fuel and Power Expenses		9.8%	
Miscellaneous Expenses		1.6%	
Increases in Vehicle-Miles Operated	15.9%		
Declining Passenger Trips Originating per Vehicle-Mile	1.9%		
Lower Average Fare Revenue per Originating Passenger	27.5%		
Total	100.0%		

Source: Computed from data reported in Table 2.1 according to procedure described in text.

used per vehicle-mile of transit service produced. Rising labor compensation rates accounted for slightly more than 25% of the growth in industry-wide operating deficits, while declining efficiency of labor utilization was responsible for another 18%.

Increasing labor compensation was partly the result of rapid escalation in basic wage and salary rates paid to drivers, mechanics, operations supervisors, and administrative employees. Their effect on total compensation rates was aggravated by widespread introduction of automatic cost-of-living escalators in wage rates, which often indexed wage increases to volatile indicators of inflation such as the Consumer Price Index for the nation's largest urban areas. Pay premiums to vehicle operators in the form of higher overtime pay rates, minimum pay guarantees for short work assignments, and premiums for split shifts also became more generous over this period, partly in an effort to compensate drivers for excessively long shifts or fragmented work assignments. At the same time, the monetary equivalent of fringe benefit compensation apparently grew even more rapidly than basic wage and salary levels.

Increases in the quantity of labor used to produce each unit of transit service reflected the declining efficiency with which transit operators were able to utilize driver, mechanic, supervisory, and administrative labor over the 1970s. One important cause of this decline was probably the changing structure of transit demand, including increased peaking during commuting hours, growing imbalances in directional flows of passengers, and lengthening passenger trips. Its effects were aggravated by increasingly restrictive labor agreement provisions governing the assignment of vehicle operators to work shifts, such as limitations on the overall duration of split shifts and maximum allowable percentages of split shifts. Complications in the scheduling of maintenance activities and the assignment of specific maintenance tasks, again the result of both the increasingly complex scheduling of transit services and restrictive labor agreement provisions, also contributed to the decline in efficiency of labor utilization. Finally, the growing complexity of some administrative functions such as route planning, service scheduling, and developing driver and vehicle assignments may also have been responsible for some of the decline in labor productivity.

Increases in Energy Prices and Consumption Rates

Table 2.2 indicates that rising costs for vehicle propulsion energy also contributed significantly to escalation in unit costs and thus rising transit losses, accounting for nearly 10% of growth in the nation's aggregate operating deficit over the decade. Most of the increase in unit energy expenses stemmed from explosive growth in the prices transit operators paid for motor fuel and electric power, which resulted from major price increases imposed during the decade by the oil producers' cartel. Together, these raised the average price paid by U.S. transit operators for diesel fuel and electric power nearly four-fold between 1970 and 1980, even after adjusting for the effects of rapid inflation throughout the remainder of the economy.

The effect of these price increases was aggravated by slight increases in energy consumption rates of transit buses and rail vehicles. Some of this deterioration in this energy efficiency probably resulted from the introduction of features such as air conditioning and more spacious seating, as well as improvements in vehicle performance and safety characteristics. Because these developments improved the quality of transit service, however, the decline in transit vehicle energy efficiency was probably a less serious source of unnecessary operating cost and deficit growth than others such as than rising fuel and power costs or increasing unit labor expenses.

Expansion of Transit Service

Table 2.2 also indicates that increases in the aggregate level of transit service were responsible for a significant share (15.9%) of the growth in operating deficits between 1970 and 1980. Expanding transit service occurred partly in response to the dispersion of population, employment, and other activities within U.S. cities, which was accompanied by extension of bus (and in a few cases, rail) transit routes into their expanding suburban areas. In addition, large-scale shifts of population to regions of the nation where urban transit service levels had been historically low, principally the south and west, occurred during the 1970s. These were often accompanied by substantial increases in transit service levels intended to serve the growing population and transportation demands of urban areas in these regions.

Route extensions and increases in transit service frequencies also occurred partly in response to government policy initiatives, which promoted transit use in an attempt to further environmental, energy, and transportation policy goals. Although the effectiveness of transit service increases in promoting these goals is debatable, every level of government began offering substantial operating assistance to transit suppliers during this period, with the clear intention of reversing the historical decline in the level of service they provided.

Declining Utilization of Transit Services

Table 2.2 shows that deteriorating utilization of transit service was another source of growing operating losses, although its contribution was minor by comparison to other factors. The number of passengers carried per vehicle-mile of transit service declined partly because important economic and demographic trends reduced the demand for public transit service, while altering its spatial structure and time patterns in ways that made satisfactory utilization difficult for transit operators to maintain. Most important among these was the continuing decentralization of employment, population, and related activities within U.S. metropolitan areas, which sharply reduced the opportunities for public transit to compete effectively with private automobile travel.

Much of the dispersion of employment resulted from the evolving technology and industrial composition of urban economic activity, which made centralized plant and office locations with ready access to major transportation facilities less attrative. At the same time, rising personal incomes increased the demand for dwelling space and other amenities provided by lower-density residential locations. Rising incomes also increased urban residents' valuations of the advantages offered by auto transportation, such as its scheduling convenience, minimal access times, and relatively high travel speeds, thereby increasing its competitive advantage over public transit for most urban travel.

In addition to reducing the demand for transit service, dispersion of urban activities and rising auto ownership apparently left most transit ridership concentrated within central city areas or on radial corridors connecting them with surrounding suburbs. These developments also reduced transit utilization by increasing the concentration of demand during peak hours and aggravating directional imbalances in ridership, particularly in radial corridors where transit continued to offer travel times and service frequencies that made it competitive with automobile commuting.

Finally, transit service utilization may have declined even more rapidly than these changes in urban activity patterns would have suggested, because transit operators' service policies often failed to recognize and respond to them. Despite a sharp reduction in the number of urban travel corridors where transit could compete effectively with automobile travel, aggregate transit route mileage in the U.S. increased substantially between 1970 and 1980. Because the accompanying increase in the number of vehicle-miles operated was relatively modest, the average frequency of transit service fell somewhat, suggesting that service was being spread more thinly over an expanding geographic area. Thus instead of carefully identifying 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. Because many of these new routes covered suburban areas with lower density concentrations of residences and employment than transit had historically served, the expanded level of service was often poorly utilized.

Reduced Fare Revenue per Passenger Carried

Table 2.2 also shows that a fall in average inflation-adjusted fare revenue per passenger carried accounted for approximately the remaining one-quarter of the overall increase in transit operating deficits between 1970 and 1980. Transit fares declined because many operators failed to raise basic fares sufficiently, introduced substantial fare discounts for specific groups of riders, and eliminated fare surcharges for more costly trips. Operators' persistent failure to raise even basic adult fares during this period, except to match general price inflation, reflected their decisions to exploit the growing availability of government operating subsidies to defray cost increases and stabilize or even reduce inflation-adjusted fares. This was an explicit goal of the federal subsidy program, which distributed operating assistance beginning in 1974, as well as of some state and local assistance programs before that time.[8]

Declining revenue yields also reflected the widespread advent of selective fare reductions, most commonly for the elderly and handicapped, although many transit operators extended discounts to students, children, and frequent riders (through weekly or monthly pass programs) as well. While some of these fare reductions were motivated by important social concerns about the mobility of deserving groups, they proved costly because of the reduction in passenger revenue they produced, and were certainly a critical reason why fare policies contributed so importantly to rising operating deficits.

Still another reason revenue yields declined was because many transit operators' eliminated fare premiums for services that were particularly costly to supply, including higher peak hour fares, transfer charges, and zone surcharges or other forms of distance-based fares. With typical transit trips becoming longer, the conversion of some major transit systems to grid-type bus route networks, and a rising fraction of ridership concentrated during morning and evening rush hours, widespread elimination of fare surcharges for longer trips, transfers, and peak hour travel was another important cause of the decline in average fare revenues.

COMPARATIVE ROLES OF STRUCTURAL AND POLICY CHANGES

The most surprising finding from this analysis is that the major source of the U.S. transit industry's financial deterioration throughout the automobile era, the continuing decline in transit service utilization, contributed so little to the rapid escalation of operating losses during the 1970s.[9] As Table 2.2 indicated, the falling number of passengers carried per vehicle-mile of transit service was responsible for the smallest share of deficit growth among the several factors identified. Instead, rapidly rising expenses for operating inputs, expanded service levels, and reduction and simplification of transit fares together accounted for virtually all of the increase in transit operating losses from 1970 to 1980.

This finding is extremely important because it suggests that skyrocketing deficits were largely the product of changes in factors under the direct control of transit operators and transportation policy-makers themselves. Some of these developments probably reflected transit operators' responses to rapid growth in the availability of government operating assistance, particularly the sharp reversal in the historical decline of service levels, as well as the stabilitzation of what had been rapidly rising transit fares. While other changes -- mainly the sharp increase in energy costs -- also absorbed an important share of operating assistance, they were largely outside the control of either the industry or government policy, and also affected competing travel modes in ways that may have actually helped the transit industry.

Although certainly unintended, the largest source of escalating losses over the decade, rapidly growing labor costs for providing transit service, should have been at least partly avoidable. Why transit employees were able to command dramatic increases in compensation during a period of deteriorating industry finances has been the subject of frequent debate. One view generally holds that unionized labor unscrupulously capitalized on its political power and the rapid expansion of operating subsidies to demand recurring wage and fringe benefit increases. Others note that recent growth in transit workers' pay rates have not significantly exceeded those for other municipal employees in large cities, although these in turn have certainly outpaced wage growth in private sectors of the economy.[10]

Transit managers and local political officials who oversee their activities must certainly bear much of the responsibility for acquiescing to generous labor compensation increases at a time when severe economic pressures threatened the industry's continued financial viability. Yet at the same time, rapid expansion of the availability of operating assistance severely weakened the incentives managers faced to restrict growth in rates of pay and utilize labor productively. Thus the design of government subsidy programs, under which nearly all operating assistance was distributed without regard to cost control or effective service deployment, is perhaps equally accountable for unnecessary labor cost escalation.

Whatever the resolution of this particular issue, the major point is that recent growth in transit operating deficits owes more to the policies of both government transportation agencies and transit operators than to the continuing changes in urban development that have fostered the industry's long-term decline. Thus at the same time as it accepted rapidly growing employee compensation and declining labor productivity, the transit industry continued to implement widespread service expansions, while simplifying and sharply reducing fares in an effort to increase ridership. Although these initiatives were motivated partly by an expanding conception of the potential role of transit in serving varied goals of social, environmental, and energy policies, they produced astoundingly rapid growth in the industry's operating losses.

IMPLICATIONS FOR THE DISTRIBUTION OF OPERATING SUBSIDY PAYMENTS

Because growth in transit operating deficits during the 1970s was almost exactly matched by increases in government subsidies paid to transit operators, the sources of growth in transit operating deficits correspond approximately to the distribution of government operating subsidy payments among the various purposes they served. Table 2.3

Table 2.3

Transit Operating Assistance Payments by
Level of Government, 1970-80 (millions of current dollars)

Year	Local	State	Federal	Total
1970	$231.0	-	-	$231.0
1971	299.5	10.5	-	310.0
1972	279.7	54.1	-	351.8
1973	398.3	138.5	-	536.8
1974	667.4	381.2	-	985.6
1975	699.4	406.6	301.8	1,407.8
1976	857.4	367.1	422.9	1,647.3
1977	841.1	478.4	584.5	1,904.1
1978	977.8	564.3	689.5	2,231.7
1979	1,416.9	637.7	855.8	2,910.4
1980	1,703.9	820.4	1,093.9	3,618.1
Total, 1970-80	$8,372.4	$3,858.8	$3,912.4	$16,134.6

Sources: American Public Transit Association, Transit Fact Book, various years.

reports trends in operating assistance payments by level of government during this period, as well as their cumulative ten-year total. As it indicates, more than $16 billion in operating subsidies was distributed by local, state, and the federal government from 1970 through 1980.

Because the estimates of the contributions of various factors to deficit growth presented earlier were computed by comparing their specific values only for 1970 and 1980, rather than from their year-to-year changes over that period, they do not correspond exactly to the <u>cumulative</u> contributions of those sources to the total transit operating deficit incurred over the decade. Nevertheless, the distribution of deficit growth among the sources identified previously conveys some important information on the purposes actually served by government operating subsidies. Table 2.4 presents estimates of the distribution of subsidy payments among specific functions or purposes corresponding to the individual sources of subsidy growth identified in Table 2.2. A number of important inferences are suggested by interpreting the sources of deficit growth from the viewpoint of the recipients or beneficiaries of operating subsidies.

Increases in Transit Employee Compensation

First, Table 2.4 indicates that more than one-quarter of operating assistance financed wage, salary, and fringe benefit increases for transit workers that significantly outpaced escalation in the cost of living over the period studied. This was suggested by the preceding analysis, which indicated that even after adjusting for inflation, rising labor compensation in the transit industry was the

Table 2.4

Estimated Percent of Goverment Operating Assistance Payments Serving Specific Purposes

Purpose	Estimated % of Operating Assistance Used for Purpose
Financing Wage and Salary Increases in Excess of Cost-of-Living Escalation	25.3%
Compensating for Declining Labor Productivity	18.0%
Absorbing Higher Energy Expenses	9.8%
Maintaining and Extending Transit Services	15.9%
Reducing Inflation-Adjusted Transit Fares	27.5%

Source: Estimated from entries reported in Table 2.2.

largest single component of the rapid increase in operating deficits during the period studied. Thus a significant share of government assistance that was intended to maintain transit service and stabilize fares instead financed an improving standard of living for transit workers. The desirability of this result depends partly on whether transit employees received acceptable compensation prior to the advent of government operating subsidy programs, itself a judgemental issue. In any event, although this was certainly an unintended consequence of rapid growth in operating assistance during the 1970s, it perhaps should have been a forseeable one.

Further, the fact that declining output per unit of labor service consumed another 18% of increased operating assistance suggests that transit employees may have benefited from subsidies in other, more subtle ways. Certainly some of this decline in the efficiency of labor utilization resulted from changes in the structure of transit ridership, such as its increased concentration during peak hours or on certain types of routes. Yet it probably also resulted partly from the imposition of more restrictive labor agreement provisions governing the duration and complexity of vehicle operators' and other employees' work assignments. In either case, the result was to reduce the onerousness of typical work schedules, which in effect represented an improvement in job quality that supplemented the increasing financial attractiveness of transit employment.

Extending and Improving Urban Transit Service

Increases in the overall level, as well as perhaps some aspects of the quality of urban transit service, also absorbed a significant share of operating assistance during this period. Table 2.4 indicates that nearly 16% of deficit growth was attributable to increases in the extent and frequency of transit service. In addition, although the increase in fuel and power consumption rates of transit vehicles accounted for only a small share of deficit growth, some of it probably resulted from equipping new vehicles with amenities such as air conditioning that increased the quality of service they provided, as discussed previously.

On a less positive note, however, the decline in passengers carried per unit of transit service during the 1970s suggests that some of this increasing service level remained underutilized. In fact, the changes in service and ridership that were reported in Table 2.1 suggest that only about 60% of transit service added over the decade would have been necessary to accommodate increased ridership if the number of passengers carried per vehicle-mile had remained at is 1970 level. While urban residents no doubt attach some value to the availability of even unutilized transit service, increasing the amount of it provided was probably not an intended result of government operating assistance programs.

Reducing and Simplifying Transit Fares

Finally, only slightly more than one-quarter of government operating assistance apparently funded reductions in fares paid by transit passengers. As discussed previously, this included stabilizing or in some cases even reducing inflation-adjusted basic fare levels, initiating selective fare discounts, and eliminating or reducing distance surcharges, peak fare premiums, and transfer charges. As Table 2.1 indicated, the average inflation-adjusted fare actually paid per passenger trip declined significantly as a result of these developments.

Although this was an explicitly intended effect of government operating assistance, the accompanying increase in transit ridership was fairly small by comparison to the reduction in fares. This suggests that most of the benefits from lower fares represented fare savings to riders who were demonstrably willing to pay the higher fares that prevailed at the beginning of the decade. At the same time, however, powerful economic and demographic trends reduced the demand for transit travel, so that these fare reductions may have prevented even greater declines in the utilization of transit service then actually occurred.

Dilution of the Benefits from Transit Subsidies

Overall, this analysis suggests that only about 40% of the massive levels of government operating assistance during the 1970s reached transit users in the forms of new transit trips and lower fares. This occurred because most of it was absorbed by rising labor compensation rates, skyrocketing fuel prices, falling labor productivity, and the maintenance of unutilized transit service. Some of the developments that contributed to this situation, such as the formation of the oil producers' cartel and continuing evolution in patterns of transit demand, may have been unforseeable or at least unavoidable. Nevertheless, their role in "siphoning off" operating subsidies was less important than growth in transit worker incomes and declining labor productivity, both of which should have been largely avoidable.

In any case, these developments together severely compromised the effectiveness of the rapid infusion of government operating assistance, which was primarily intended to stem the historical decline in transit service levels and stabilize rapidly rising fare levels. While some of the growth in operating subsidies -- again, the best estimate appears to be about 40% -- did result in expanded service levels and reductions in fares, this is still an alarmingly low level of program effectiveness. Further, the accompanying increase in ridership was comparatively modest: the number of passenger trips carried by U.S. urban transit systems grew only about 7% over the decade, as Table 2.1 indicated previously. Thus a disappointingly small share of total operating subsidies was ultimately translated into direct benefits to transit riders, particularly those who were not previously transit users.

FURTHER EXAMINATION OF THE SOURCES OF DEFICIT GROWTH

While the analysis of contributions by different factors to rising transit operating deficits reported in this chapter is revealing, it also raises several further issues. For example, the relative importance of different sources of rising deficits identified here may vary among transit systems according to the type of service they offer, or certain characterics of the urban areas in which they operate. In addition, rising costs entailed in the provision of transit service were clearly an important source of escalating total costs and deficit levels, yet it is important to know why their recent growth was so rapid. Similarly, the reasons for the continuing decline in transit service utilization are important to explore, since service extensions during a period of declining demand for transit travel were another important cause of rapidly spreading operating losses. Finally, the nature of changes in transit fare structures that contributed to the sharp decline in revenue yields warrants further exploration. In an effort to identify important patterns and assess the basic causes underlying the sources of rising deficits identified here, subsequent chapters examine each of these issues in detail.

FOOTNOTES TO CHAPTER 2

1. Urban Mass Transportation Administration, National Urban Mass Transportation Statistics: Second Annual Report, Section 15 Reporting System, July 1982, Table 1.08.1, p. 1-30; and American Public Transit Association, Transit Fact Book 1981, Figure II, pp. 48-49.

2. See N. Lee and I. Steedman, "Economies of Scale in Bus Transportation," Journal of Transport Economics and Policy, January 1970 (Volume 4, Number 1), pp. 15-28; Gary C. Nelson, "An Econometric Model of Urban Bus Transit Operations," in Institute for Defense Analyses, Economic Characteristics of the Urban Public Transportation Industry, February 1972, pp. 4-1 to 4-84; and Control Data Corporation and Wells Research Corporation, Trends in Bus Transit Financial and Operating Characteristics 1960-75, Report DOT-P-30-78-43, U.S. Department of Transportation, pp. 6-9 to 6-16.

3. Computed from financial statistics for individual transit operators reported in American Public Transit Association, 1970 Transit Operating Report and 1980 Expense Recovery Ratios Report; and Urban Mass Transportation Administration, National Urban Mass Transportation Operating Statistics: Second Annual Report, Section 15 Reporting System, July 1982, Table 2.01.1, pp. 2-10 to 2-16, and Table 2.08.1, pp. 2-38 to 2-49. These data were supplemented with figures from American Public Transit Association, Transit Fact Book 1981, Table 10, p. 54, Table 11, p. 55, Table 13, p. 58 and Table 14, p. 60; and Control Data Corporation and Wells Research Corporation, Trends in Bus Transit Financial and Operating Characteristics 1960-75, Report DOT-P-30-78-43, U.S. Department of Transportation, Table 7-10, p. 7-18.

4. For a similar approach see John R. Meyer and Jose A. Gomez-Ibanez, Improving Urban Mass Transportation Productivity, Report MA-11-0026, U.S. Department of Transportation, Urban Mass Transportation Administration, February 1977, Table A-1, p. 207.

5. See American Public Transit Association, Transit Fact Book 1981, Table 10, p. 54, and Table 11, p. 55.

6. The basic source of data for these computations is the annual reports of financial data and operating statistics filed by approximately 100 individual transit systems belonging to the American Public Transit Association, and published in its Operating Statistics Report and Expense Recovery Ratios Report (formerly combined as the Transit Operating Report). These are supplemented with the extensive reports of financial and operating data made annually beginning in 1979 by approximately 300 individual transit systems to the U.S. Urban Mass Transportation Administration, which are published as National Urban Mass Transportation Statistics.

7. Dollar values for 1970 were converted to 1980 values using the change in the Implicit Price Deflator for the Gross National Product, the broadest indicator of general price inflation throughout the private and government sectors of the economy.

8. Urban Mass Transportation Administration, "Operating Assistance for Transit: An Evaluation of the Section 5 program," December 1979, p. 11.

9. For extended discussion of the historical decline in utilization of urban transit service in the U.S., see Arthur Saltzman and Richard J. Solomon, "Historical Overview of the Decline of the Transit Industry," Highway Research Record, 1971, pp. 1-11; and John R. Meyer and Jose A. Gomez-Ibanez, Autos Transit, and Cities, Cambridge, Massachusetts, Harvard University Press, 1981, Chapters 2 and 3.

10. A recent study by the Urban Mass Transportation Administration reports that average compensation of transit employees, including wages and fringe benefits, rose about 2.6% annually in real terms during the middle 1970s, which was below the nationwide rates of increase for firemen, police, and electric utility employees; see U.S. Department of Transportation, Urban Mass Transportation Administration, "Operating Assistance for Transit: An Evaluation of the Section 5 Program," December 1979, pp. 32-33. Over this same period, however, real earnings throughout the private nonagricultural sector of the economy actually fell slightly; see Economic Report of the President, February 1982, Table B-38.

Chapter 3

VARIATION IN DEFICIT GROWTH AND ITS SOURCES AMONG TRANSIT SYSTEMS

A variety of reasons suggest that both the magnitude of deficit growth and the relative importance of its various sources differed among individual transit systems during the previous decade. First, differences in the composition of operating expenditures between rail and bus transit suggest that the sources of growing losses in cities served jointly by the two modes are likely to differ from those in areas where only bus service is operated. In addition, there may be significant differences in the sources of deficit growth between cities served by older, conventional heavy rail transit and those where new, advanced technology rapid rail transit systems have recently been built.

Because of the changing distribution of the nation's population among urban areas of different sizes and geographic regions during the most recent decade, the relative importance of different sources of increasing losses may also differ among cities of different sizes and locations. Varying rates of growth in labor compensation, degrees of peaking in transit service, and constraints on labor productivity among transit systems of different sizes, for example, suggest that rates of cost escalation and its contribution to rising deficits may vary systematically with the population of urban areas in which they operate. At the same time, changes in transit service levels and fare-setting policies may have differed markedly among urban areas of different sizes and growth characteristics. This chapter examines recent variation in the growth of transit operating losses and the relative importance of its different sources among urban areas with varying populations and different modes of transit service.

DIFFERENCES IN FACTORS AFFECTING DEFICIT GROWTH

Tables 3.1 and 3.2 report changes between 1970 and 1980 in four major factors affecting operating deficits for transit systems operating in seven groups of U.S. urban areas, classified by mode of service operated and 1980 population of the areas they serve. Changes in these factors were identified in the previous chapter as the major sources of operating deficit growth throughout the nation's urban transit industry during this period: rising operating expenditures per vehicle-mile, increasing total vehicle-miles of service, declines in passenger trips originating per vehicle-mile of service, and lower fare revenue per passenger trip carried. Table 3.1 reports changes in their values between 1970 and 1980 for five cities having combination bus and rapid rail transit systems before 1970, and three urban areas where rapid rail service was added between 1970 and 1980. Approximately 200 other U.S. cities were served exclusively by bus transit throughout the decade; Table 3.2 reports estimated changes in these same four factors for 5 subgroups of these urban areas, based on their 1980 populations. These estimates were constructed from a sample of

Table 3.1

Changes in Factors Affecting Deficits
for U.S. Bus-Rail Transit Systems

Factor	5 Cities with Rail Transit Before 1970[a]			3 Cities Adding Rail Transit Since 1970[b]		
	1970	1980	% Change	1970	1980	% Change
Expenditure per Vehicle-Mile (1980 $)	$2.83	$3.84	35.7%	$1.77	$3.22	81.9%
Vehicle-Miles Operated (millions)	685.7	655.5	-4.4%	106.9	182.3	70.9%
Passengers Carried per[c] Vehicle-Mile	3.75	3.68	-1.9%	2.98	3.15	5.7%
Fare Revenue per Passenger (1980 $)	$0.67	$0.46	-31.3%	$0.45	$0.35	-22.2%

[a] New York, Chicago, Philadelphia, Boston, and Cleveland.
[b] San Francisco-Oakland, Washington, D.C., and Atlanta.
[c] Originating passenger trips only.

Sources: American Public Transit Association, 1970 Transit Operating Report, 1980 Operating Statistics Report, and 1980 Expense Recovery Ratios Report; Urban Mass Transportation Administration, National Urban Mass Transportation Statistics: 1980; and annual reports of the individual transit operating authorities.

Table 3.2

Changes in Factors Affecting Deficits for U.S. Bus Transit Systems Operating in Cities of Varying Populations[a]

Factor	Cities over 2 Million[b]			Cities 1-2 Million[c]			Cities 0.5-1 Million[d]			Cities 0.25-0.5 Million[e]			Cities under 0.25 Million[f]		
	1970	1980	% Change	1970	1980	% Change	1970	1980	% Change	1970	1980	% Change	1970	1980	% Change
Expenditure per Vehicle-Mile (1980$)	$1.83	$2.66	45.4%	$1.58	$2.42	53.2%	$1.41	$2.02	43.3%	$1.29	$1.81	40.3%	$1.12	$1.64	46.4%
Vehicle-Miles Operated (Millions)	108.2	177.9	64.4%	340.7	440.8	29.4%	150.5	186.7	24.1%	175.5	232.7	32.6%	155.9	180.6	15.8%
Passengers Carried per Vehicle-Mile	2.60	1.97	-24.2%	3.58	3.14	-12.3%	2.95	2.76	-6.4%	2.33	2.30	-1.3%	2.34	2.18	-6.8%
Fare Revenue per Passenger (1980$)	$0.64	$0.45	-29.7%	$0.48	$0.36	-25.0%	$0.51	$0.31	39.2%	$0.50	$0.23	-54.0%	$0.42	$0.27	-35.7%

[a]Provisional population estimates for SMSA's in 1980.
[b]Los Angeles, Detroit, Houston, and Dallas.
[c]Estimated from a sample of 13 of the 18 cities in this size category.
[d]Estimated from a sample of 18 of the 24 cities in this size category.
[e]Estimated from a sample of 24 of the 55 cities in this size category.
[f]Estimated from a sample of 19 of the approximately 100 cities in this size category.
[g]Originating passenger trips only.

Sources: American Public Transit Association, 1970 Transit Operating Report, 1980 Operating Statistics Report, 1980 Expense Recovery Ratios Report, and 1980 Urban Area Population Estimates; and Urban Mass Transportation Administration, National Urban Mass Transportation Statistics: 1980.

approximately 90 bus transit systems for which financial and operating data for both 1970 and 1980 could be obtained.[1]

As these tables indicate, there were substantial differences in the magnitude of changes in these critical variables among transit systems operating different modes of service, as well as among cities of varying sizes. Table 3.1 shows that after adjusting for inflation, operating expenditures per vehicle-mile of all transit service increased slightly more than one-third between 1970 and 1980 among the 5 cities with existing rail service (New York, Chicago, Philadelphia, Boston, and Cleveland), yet rose by more than 80% in the 3 cities (San Francisco, Washington, D.C., and Atlanta) that added rapid rail service during the decade. Of course, part of the latter increase was attributable to the introduction of rail service itself, since the advanced-technology vehicles used in their new rail systems have higher operating expenses on a per-mile basis than transit buses.[2] Changes in the level of transit service supplied in these urban areas also differed significantly: while total vehicle-miles operated by all modes fell slightly in cities with older rail transit systems, the combined level of bus and new rail vehicle-miles increased more than 70% in the three cities where rail service was added.

Table 3.1 also indicates that passenger trips caried per vehicle-mile of transit service, one indicator of how intensively their transit services were utilized, remained remarkably stable in the 5 cities with older bus-rail systems. At the same time, this measure actually increased slightly in cities where new rail systems began service during the decade. Again, this development may have been due to the introduction of rail service in their most heavily traveled corridors, where passenger boardings per vehicle-mile would have been expected to exceed those for the bus routes it replaced. Finally, in inflation-adjusted terms, average fare revenue per passenger declined sharply in the older cities served by both bus and rail transit; in comparison, reductions in average fare revenue were proportionately smaller in cities inaugurating new rail service, although fares there were considerably lower at the outset of the decade.

Table 3.2 illustrates that for cities served exclusively by bus transit, expenditures per vehicle-mile consistently rose somewhat more than 40% among urban areas of widely varying populations. Bus transit systems together expanded service by slightly more than 20% over the decade, with particularly large increases paralleling population growth in the four largest cities they served (particularly in Los Angeles, Houston, and Dallas). Service levels also expanded unusually rapidly in cities with 1980 populations of 250-500 thousand; the 24 systems in cities of this size range for which 1970 and 1980 operating statistics were available together expanded vehicle-miles of service nearly 33%.

At the same time, Table 3.2 shows that passengers carried per bus-mile fell during the decade among most single-mode bus transit systems, although there were pronounced differences in this measure of the change in utilization among cities of different sizes. Boardings per vehicle-mile fell sharply in the four largest cities where bus transit operated exclusively (principally in Detroit and Los Angeles), and only slightly less sharply in the sample of 13 cities with populations between 1 and 2 million. In medium-sized urban areas--those between 0.5 and 1 million in 1980 population--the decline in utilization was somewhat less pronounced: from 2.95 to 2.76 passengers per bus-mile of these 24 cities together. In the sample of bus systems serving urban areas with under 500,000 residents in 1980, utilization remained surprisingly stable, falling less than 2%.

In bus systems serving some very large cities, as well as those with 1980 populations below 1 million, significant real fare reductions took place during the decade. In many of these cities, fares were probably reduced even in absolute terms (that is, prior to adjusting for inflation), in an effort to promote ridership on newly-instituted or rapidly expanding transit services. The smallest fare reductions among bus transit systems occurred in cities in the 1-2 million population range, although these were still significant, averaging 25% among the 13 cities in this size category in cities for which both 1970 and 1980 data were available.

Although these variations are revealing by themselves, they also suggest that there were substantial differences among urban areas in deficit growth and the contributions of various factors to it. Table 3.3 reports the estimated distribution of growth in the nation's aggregate transit operating deficit among the 7 urban area groups identified in Tables 3.1 and 3.2. As it indicates, more than 40% of the increase in the nationwide operating deficit occurred in the five cities with older rail transit systems. In contrast, the three cities where new rail systems were constructed during the decade accounted

Table 3.3

The Distribution of Deficit Growth Among Urban Area Groups

Urban Area Group	Growth in Combined Operating Deficit 1970-80 (millions of 1980 dollars)	% of Nationwide Deficit Growth
5 cities with rail[a] transit before 1970	$1,189.8	40.5%
3 cities adding rail[b] transit after 1970	155.1	5.4%
4 bus-only cities[c,h] over 2 million	297.5	10.1%
18 bus-only cities[d,h] 1-2 million	615.7	21.0%
24 bus-only cities[e,h] 0.5-1 million	231.6	7.9%
55 bus-only cities[f,h] 0.25-0.5 million	276.2	9.4%
Approx. 100 bus-only[g,h] cities under 0.25 million	168.5	5.7%
Total	$2,934.4	100.0%

[a]New York, Chicago, Philadelphia, Boston, and Cleveland.
[b]San Francisco-Oakland, Washington, D.C., and Atlanta.
[c]Los Angeles, Detroit, Houston, and Dallas.
[d]Estimated from a sample of 18 transit systems reporting 1970 and 1980 data.
[e]Estimated from a sample of 24 transit systems reporting 1970 and 1980 data.
[f]Estimated from a sample of 19 transit systems reporting 1970 and 1980 data.
[g]Estimated from a sample of 13 transit systems reporting 1970 and 1980 data.
[h]Populations reported by the 1980 U.S. Census.

Sources: Computed from data reported in Tables 3.1 and 3.2.

for only about 5% of nationwide deficit growth. Nearly another one-third of increased losses were incurred among the 22 cities with 1980 populations over one million where only bus transit service operated, reflecting the rapid service expansions and growth in unit costs that took place in many of them. Finally, the remaining 23% of the growth in nationwide losses was spread widely among bus transit systems operating in nearly 200 U.S. cities with populations under one million.

Using the procedure described in Chapter 2, growth in operating deficits in each of the categories of urban areas identified in Tables 3.1 and 3.2 can be estimated and allocated among the same four major sources identified for the transit industry as a whole. Table 3.4 reports the estimated percent of growth in operating losses between 1970 and 1980 within each urban area category that was attributable to rising unit operating expenditures, service extensions, declining utilization of transit service, and reductions in inflation-adjusted fares. It illustrates that each of these major sources of industry-wide growth in transit operating deficits also contributed substantially to rising operating losses among transit systems in virtually every size of urban area and type of transit system.

Rapidly rising costs per vehicle-mile of transit service were consistently responsible for one-third to one-half of the increase in transit operating deficits, except in cities with older rail transit systems, where they accounted for well over half of the growth in operating losses. Similarly, expanding levels of transit service provided was instrumental in raising operating losses in nearly every

Table 3.4

Estimated Percentage Distribution of 1970-80 Growth in Transit Operating Deficits Among Various Sources, by Mode of Transit and Urban Area Size

Urban Area Group	Estimated % of 1970-80 Growth in Operating Deficits Attributable to: Rising Unit Costs	Service Expansion	Declining Utilization	Fare Reductions
5 Cities with rail[a] transit before 1970	58%	--	2%	40%
3 Cities adding rail[b] transit after 1970	47%	43%	--	10%
4 All-Bus Cities[c] Over 2 Millionc	33%	41%	11%	14%
18 All-Bus Cities[d] 1-2 Million	46%	30%	10%	14%
24 All-Bus Cities[d] 0.5-1 Million	38%	24%	4%	35%
55 All-Bus Cities[d] 0.25-0.5 Million	32%	28%	--	40%
Approx. 100 All-[d] Bus Cities Under 0.25 million	30%	31%	3%	35%

[a] New York, Chicago, Philadelphia, Boston, and Cleveland.
[b] San Francisco-Oakland, Washington, D.C., and Atlanta.
[c] Los Angeles, Detroit, Houston, and Dallas.
[d] Population as of the 1980 Census.

Source: Estimated from data reported in Tables 3.1 and 3.2 according to procedure described in Chapter 2.

category of urban areas analyzed. Increases in the number of vehicle-miles operated accounted for at least one-quarter of deficit growth, except in the five older areas where rapid rail transit service historically operated, where service actually declined slightly. Finally, just as it was for the nation's transit industry in the aggregate, declining fare revenue per passenger was the other major source of rising operating losses in most urban areas, although Table 3.4 shows that its importance varied considerably. The contribution of declining utilization of transit service appears to have been relatively minor in most types of urban areas, yet its small estimated effect is partly due to the stimulus to transit ridership provided by substantial fare reductions and increases in the cost of auto travel during this period.

DIFFERENCES IN THE IMPORTANCE OF COST ESCALATION

Despite these similarities in the sources of deficit growth among cities, some important differences in their individual roles are revealed by Table 3.4; the following sections examine these sources in detail in the five cities with older rail transit systems, escalation in expenses per vehicle-mile operated was by far the most prominent source of rising deficits, accounting for nearly 60% of the substantial increase in their combined losses. Because buses have slightly higher operating expenses per vehicle-mile in these cities than do rail vehicles, and the fraction of their total vehicle-mileage operated by buses increased slightly over the decade, some of this increase can be attributed simply to changes in service patterns.[3] Still, most of the variation in cost escalation among urban areas is apparently attributable to differences in the ability of transit employees to negotiate compensation increases and protective work rule concessions in the collective bargaining process (a point analyzed in detail in Chapter 3). Thus in the five cities with older rail systems, where public employee unions are politically influential and have extensive negotiating experience, and large numbers of commuters still depend on transit service for travel to work, cost escalation not surprisingly played its most pronounced role in raising transit deficits.

Partly because of the considerably higher operating costs for new rail transit systems, escalating unit costs also contributed heavily to deficit growth in the three cities where rail service was added to existing bus transit systems during the decade. Nevertheless, operating expenses per vehicle-mile of bus transit service also rose rapidly in these these cities, as well as in cities with 1980 populations of 1-2 million that were served only by bus transit. Thus in both of these groups of cities, unit cost escalation was again a prominent source of deficit growth, accounting for nearly half of the increase in operating losses. Unfortunately, the diversity of this latter group of 18 cities on such dimensions as geographic location, rate of population growth or decline, and potential sources of transit employee union strength make it difficult to generalize about why cost escalation contributed so much to growing losses among transit operators serving them. Finally, in the largest cities with all-bus transit systems, as well as in cities with 1980 populations under one million, Table 3.4 indicates that rising unit operating expenses were consistently responsible for a somewhat lower share of deficit growth. Nevertheless, as Table 3.2 previously reported, unit operating expenditures still rose by at least 40% over the decade in each of these urban area groups. Thus its apparently more minor role in deficit escalation probably owes to the ambitious service extensions and fare reductions that were implemented in many of these cities. By contributing so extensively to rising operating losses by themselves, these developments reduced the fraction of deficit growth that was explained by what was still, by any absolute standard, very rapid growth in unit operating expenditures.

VARIATION IN THE IMPORTANCE OF SERVICE EXTENSIONS

Table 3.4 also reveals wide variation in the contribution of transit service expansion to escalating losses among urban area sizes and transit system types. As it indicates, the five cities with older rail transit systems together actually reduced combined bus and rail service slightly over the decade, reflecting their stable, or in some cases even declining, population and employment levels. The three cities building new rail systems clearly did so as part of broad expansions of areawide transit service, as evidenced by the substantial contribution of service expansions to their escalating operating losses. Similarly, service expansion contributed heavily to deficit growth in the largest cities served exclusively by bus transit, where (except for Detroit) population, employment, and developed land area grew rapidly during the decade.

Expanding bus transit service also consistently accounted for one-quarter to one-third of increased operating losses in cities of widely varying sizes, including those as large as 2 million 1980 residents. The substantial expansions of transit service in these cities partly reflected the relative ease with which bus service could adapt to changing urban development patterns. At the same time, the massive infusion of government transit operating assistance into many of these cities probably also promoted their rapidly expanding service levels.

DIFFERENCES IN THE CONTRIBUTIONS OF FARE POLICY CHANGES

The contribution of fare policy changes to escalating operating losses also varied in important ways among urban areas, according to the results reported in Table 3.4. Although transit fares were higher throughout the decade in the five cities historically operating rail transit service than in most other urban areas, their substantial reduction still accounted for some 40% of the growth in their operating losses over the decade. Partly because of these substantial fare reductions, however, utilization of transit service remained fairly stable in these areas. Thus its estimated contribution to deficit growth was small, although it is important to recall that the method used probably underestimates the effects of declining utilization by omitting the effect of fares on ridership. In contrast, changes in fare levels played a relatively minor role in cities where rail transit service was initiated during the decade. This occurred mainly because average fare levels were already so much lower in those cities (particularly in San Francisco) at the outset of the decade than in most other major urban areas, and were reduced only slightly further -- to about the nationwide average -- by 1980.

Among cities served exclusively by bus transit, the contribution of fare policy changes to escalating operating losses also varied considerably during the decade. Generally, fare reductions were a relatively minor source of increasing deficits in cities over 1 million in 1980 population, at least compared to the substantial contributions made by rising operating expenses and service expansions. Partly as a result of these more modest fare reductions in larger cities, however, utilization of their transit services declined substantially, thus contributing significantly to their escalating operating losses. In many smaller cities served by bus transit systems, where inflation-adjusted fare revenue per passenger often fell by more than 50%, changing fare policies accounted for a third or more of growing operating losses. This development probably reflects the substantial fare reductions necessary to maintain what was already comparatively low utilization of transit service in these cities at the outset of the decade. As the relatively small contribution of changing utilization to deficit growth among bus transit systems serving these smaller urban areas indicates, fare reductions were moderately successful in preventing significant further declines in the utilization of transit services.

INTERPRETING PATTERNS OF DEFICIT GROWTH

While this analysis reveals substantial differences in the contributions to deficit growth by various factors among urban areas, most of these differences are readily understandable. The major problem faced by cities with older rail transit systems was dramatic escalation in the unit costs of providing transit service, particularly its labor cost component. Yet while expenses per passenger carried rose rapidly in these systems, average fares were reduced in an effort to support declining ridership, promote local transportation policy objectives, and protect disadvanatged groups from rising prices for an "essential" public service. In other cities, the construction of new rail systems was only one component of rapid expansion in the overall transit service levels they provided. In conjunction with substantial increases in operating expenses for bus service, the extremely high operating costs of these technically sophisticated, high-capacity rail systems raised total expenditures for providing transit service in these cities dramatically. Thus despite a slight improvement in utilization of transit services and only modest reductions in fare levels, operating losses on their expanding services also increased rapidly.

At the same time, cities relying exclusively on bus transit service apparently exploited the inherent flexibility of its routing and scheduling to adapt service patterns to rapidly changing distributions of population, employment, and urban development. This required substantial expansions of total vehicle-miles of service, the costs of which were compounded by escalation in expenses per vehicle-mile that were typically only slightly less rapid than in the nation's largest cities. Maintaining reasonable utilization levels on this expanded level of service, however, often necessitated sharp reductions in fares, because auto travel in smaller urban areas was generally rapid, convenient, and inexpensive. While these fare concessions were effective in stabilizing the historical declines in transit utilization, their contribution to rising operating deficits in many of the nation's smaller and medium-sized urban areas was substantial. In contrast, in the largest cities served by bus transit systems, fare reductions were considerably smaller, but partly as a result, declining utilization of the service levels they supplied became an important source of escalating losses.

FOOTNOTES TO CHAPTER 3

[1] These data are reported in American Public Transit Association, 1970 Transit Operating Report, 1980 Operating Statistics Report, and 1980 Expense Recovery Ratios Report; and U.S. Department of Transportation, National Urban Mass Transportation Statistics: Second Annual Report, Section 15 Reporting System, July 1982.

[2] For these 3 cities together, operating expenditures in 1980 averaged \$4.41 per vehicle-mile for rail vehicles, but only \$2.88 for transit buses.

[3] In these 5 cities in 1970, rail operating expenditures averaged \$2.68 per vehicle-mile (expressed in 1980 dollars) while those for buses averaged \$3.06. In 1980, the comparable figures were \$3.76 for rail and \$3.91 for bus. This difference is due largely to the greater labor intensity of bus operations, in conjunction with the particularly high labor compensation rates prevailing there. In 1970, 38.5% of the total vehicle-miles of transit service operated in these 5 cities was bus service; by 1980, that figure had risen to 42.9%.

Chapter 4

THE CAUSES OF RISING UNIT OPERATING EXPENDITURES

The analysis of factors contributing to rising operating deficits presented in Chapter 2 illustrated the critical role played by escalating unit costs of providing transit service. Rising costs per vehicle-mile were the most important single source of increased operating losses during the 1970s, accounting for more than half of their growth within the U.S. urban transit industry. This chapter examines the underlying causes of escalation in transit operating expenses, using a cross-sectional statistical analysis of variation in the unit costs of providing bus service among an extensive sample of U.S. urban transit systems.

In addition to their sizeable contribution to the recent growth in transit deficits, there are other important reasons for examining the causes of cost escalation. First, more detailed knowledge of the structure of production costs may reveal avenues for improved control over expenditures, which is clearly one challenge facing transit operators. For example, the contribution of increasing labor compensation identified in Chapter 2 suggests that bringing its growth into line with some index of acceptable or necessary increases could produce important cost savings.[1]

Further, in contrast to the records achieved in other transportation industries, labor productivity in urban transit operations has continued to decline in recent years, despite extensive modernization of the industry's capital stock.[2] While some of this continuing decline may be attributable to changes in the structure of demand for transit service, such as increased peaking during commuting hours, other factors affecting labor utilization may be subject to more control by transit managers. Identifying such factors should offer important avenues for controlling future growth in transit operating costs.

The interaction of rising costs per unit of transit service with increased service levels also illustrates the importance of understanding the reasons for their rapid growth. Unit cost escalation compounds the effect of service increases on total operating expenditures, thus increasing operating deficits generated by transit service extensions. By doing so, unit cost escalation also compromises the effectiveness of government operating assistance programs that are intended to finance improvements in transit services or fare reductions. As Chapter 2 illustrated, the absorption of subsidies by rapid cost increases has been a major reason for their ineffectiveness in promoting expanded transit service and ridership.

A MODEL OF UNIT OPERATING EXPENDITURES IN URBAN TRANSIT

Actual expenditures per unit of transit service represent the combined effects of the industry's basic cost structure, together with other factors introduced by the urban environment in which transit service is produced and delivered. The underlying cost structure of urban transit operations is influenced by such factors as the specific technology employed, characteristics of the capital stock with which the the operating inputs are combined, and prices paid per unit of each operating input required. A variety of factors can raise actual expenditures above the minimum level dictated by this basic cost structure, including characteristics of the service that is actually provided, institutional arrangements complicating the utilization of labor inputs, and political factors affecting management incentives for operational efficiency.

The Underlying Structure of Transit Operating Costs

The range of production technologies in urban transit corresponds mainly to the modes of service that are commonly supplied. Rail transit service, for example, generally combines exclusive, steel tracked rights-of-way and high capacity vehicles with electric power and labor to produce relatively high speed service on fixed routes. In contrast, urban bus transit service typically shares surface rights-of-way with automobile and truck traffic, on which standardized vehicles operate with a relatively flexible route structure. Depending on the mode of service operated, fixed facilities of varying levels of complexity are also necessary for vehicle storage and servicing, as well as to house supervisory or administrative functions. Probably the most important dimension of the quality of the capital stock affecting the structure of transit costs is the condition of the rights-of-way and vehicles utilized. This depends on their initial design characteristics, their age or cumulative usage, and the level of maintenance historically applied.

The major operating input used to produce transit service is labor, which is used primarily for vehicle operations, but also employed extensively in maintenance and administrative functions.

Thus the most important input prices are wage or salary rates paid for labor services of various types, including those of vehicle operators, maintenance mechanics, supervisory workers, and administrative employees. Energy, which is utilized chiefly for vehicle propulsion, represents the largest other single category of transit operating inputs. Hence, prices paid per unit of propulsion energy -- per gallon of motor fuel or kilowatt-hour of electric power -- also affect the basic cost structure of transit operations. Prices for a variety of other inputs used in relatively small amounts, such as replacement parts or consumable maintenance supplies, have a comparatively minor effect on operating costs.

Factors Affecting Actual Operating Expenditures

Among the factors most likely to modify the basic cost structure of transit operations are certain characteristics of the service actually provided. Probably the most important of these is peaking in the daily time profile of transit service, which occurs in response to urban residents' scheduling of their travel activities. Because transit operators generally expand vehicle fleets and labor forces to accommodate high ridership levels that are concentrated during a few hours of each weekday, overall utilization of both capital and operating inputs is often low. Higher peak vehicle and labor requirements are aggravated because peak period travelers tend to make longer, more complex journeys than riders traveling at other hours of the day. In addition, passenger flows on many transit routes are often concentrated in a single direction during peak travel periods. These complications tend to increase vehicle capacity and labor requirements entailed in providing peak hour service, while further reducing the average intensity with which capital and operating inputs are utilized throughout the day.

The effect of peaking in demand for transit travel on input requirements is often exacerbated by constraints on the assignment of operators imposed by specific provisions of transit labor agreements. Many contracts include provisions specifying pay premiums that must be paid to vehicle operators whose work shifts are "split" into two parts (separated by an unpaid break) in order to encompass both morning and evening peak travel periods. Limits on both the length of the intervening break in split shifts and the overall duration of operators' work shifts, intended to protect them from unduly onerous working conditions, are also commonly specified. A maximum fraction of operator shifts that can be split is also specified in some labor agreements. Finally, restrictions on the use of part-time vehicle operators, a common response to recurring peaking in service demands, are also widespread.

In conjunction with peaking of demand during two widely separated periods of the day, these provisions can sharply increase the number of driver pay hours that must be purchased to produce a corresponding time pattern of transit service. This occurs because transit systems' contracts require them to purchase excess hours of labor, which are available only during non-peak periods, in conjunction with the maximum labor requirement necessary to accomodate peak passenger demands. At the same time, pay premium provisions in most labor agreements further increase pay rates for some labor-hours when split shifts are employed to provide peak period service. This interaction between peaking in demand and labor agreement provisions can raise operating expenditures to levels substantially above those suggested by the underlying technology of transit operations and basic wage rates.

Actual unit operating expenditures for transit service may also be affected by the widespread availability of government operating assistance. Because operating subsidies are commonly distributed without considering the productivity or cost performance of transit operators, their availability severely weakens the incentives for efficient utilization of inputs and other aspects of cost control that managers would ordinarily face. Thus labor productivity and utilization of other inputs may decline as customary levels of operating assistance are eventually viewed as normal revenue sources by transit systems that regularly receive them. This is particularly likely to occur where operating subsidies are financed by mechanisms that effectively guarantee a predetermined level of assistance to individual transit operators.

One example of this practice is the distribution of federal operating assistance among urban areas under the Section 5 program on the basis of their comparative populations and population densities. A potentially more damaging example is the increasingly common earmarking or dedication of specific local tax sources, such as regional sales tax increments or special property tax assessments, for automatic payment as operating assistance to designated transit systems. Arrangements such as these may affect not only the productivity with which their recipients employ inputs used in providing transit service, but also the prices they pay for those inputs. The most visible and costly effects of this type are likely to be unnecessarily high wage rates and poor labor productivity, both of which can substantially raise unit operating expenditures because of the significant share represented by labor compensation.

SPECIFICATION OF AN EXPENDITURE MODEL

In order to test the influence of these various factors on the structure of unit operating expenditures for urban transit service, a statistical model was specified and calibrated to actual expenditure data for a sample of individual transit firms. Another major objective was to assess the importance of various causes of recent escalation in transit operating expenditures. Because information on some of the factors hypothesized to affect transit expenditures has only recently become available, this analysis relies mainly on inferences drawn from examining variation among individual transit systems' unit cost levels during a single, recent year. As a result, although it does provide important insights into the structure of cost variation among transit systems operating in different urban environments, its implications about the contributions of various factors to recent cost escalation are somewhat tentative.

Definition and Measurement of Expenditures

The model hypothesizes a linear relationship of operating expenditures per unit of transit service to the combination of factors discussed in the previous section. The dependent variable encompasses expenditures for operating inputs only, including labor services, vehicle propulsion energy, and other inputs used to operate transit vehicles and provide related functions such as vehicle maintenance, operation of fixed facilities, and administration. It thus excludes costs related to depreciation or amortization of vehicles, rights-of-way, and fixed facilities, as well as taxes or license fees levied on transit operators by local government. Two different definitions of unit operating expenditures are employed, dollars per vehicle-hour and dollars per vehicle-mile, which are related by the avaerage speed of vehicle operations.

Input Price Variables

The first two explanatory variables included in the model measure prices of the major inputs used in operating transit service, labor and energy. Labor compensation is measured by the base hourly wage rate paid to vehicle operators at the highest seniority level, excluding the value of fringe benefits and any premium pay provisions. While this wage rate applies to only a fraction of an individual system's total work force, it does appear to act as a benchmark in determining compensation rates paid to drivers of lower seniority, maintenance workers and operations supervisors, as well as some administrative employees. Premium pay rates are also commonly expressed as a multiple of drivers' basic hourly wage rates. Hence it is probably the best readily available indicator of variation in overall wage structures among transit systems, as well as of increases over time in labor compensation rates in the industry.

Because this analysis focuses on unit operating expenditures for bus transit service, diesel fuel is the primary form of vehicle propulsion energy. Energy prices are measured as the price paid per gallon of diesel fuel by individual transit systems, imputed from their reports of total fuel expenses and gallons consumed. There are two basic sources of variation in fuel prices among transit firms. First, many are exempted from motor fuel taxes levied by the states in which they operate, which range up to fourteen cents per gallon, while others are still required to pay them. Second, because the data for individual systems are for fiscal years ending during 1980, they encompass a period when fuel prices were rising rapidly in the wake of the 1979 Iranian revolution and subsequent rise in world energy prices. As a result, transit systems having slightly different fiscal calendars paid considerably different average prices per gallon of diesel fuel during their respective fiscal years.

Capital Stock Characteristics

The only readily available measure for the condition of capital inputs employed by bus transit operators is the age structure of their individual vehicle fleets. No detailed information on either the quantity or condition of urban street and highway systems on which vehicles operate, the other major capital input used to produce bus transit service, is readily obtainable. While the age of vehicles is probably not an ideal index of the quality of capital inputs, its utility is improved by the fact that new vehicle technologies are fairly uniform throughout the industry at any date. Differences in fleet ages are thus likely to capture one major source of variation in vehicle operating efficiency and mechanical reliability, although their effect may be complicated by differing annual utilization levels or widely varying maintenance policies that substantially modify the normal relationship between vehicle age and performance.

Another, more subtle effect of changes in vehicle design standards over time may also compromise the accuracy of fleet age as an index in the condition of vehicle fleets. More recent transit bus designs apparently have higher levels of some components of operating expenses, such as fuel consumption and maintenance, in part because they provide higher seating capacities and new amenities such as air conditioning or the capability to accommodate handicapped passengers. When the measure of output used to define unit operating expenditures is not adjusted to reflect such capacity or quality improvements, newer vehicles are thus likely to exhibit higher unit operating expenditures. Because their presence thus reduces the average age of vehicle fleets, newer fleets may exhibit higher rather than lower operating expenditures per vehicle-hour or vehicle-mile.

Characteristics of Service Provided

Two characteristics of bus transit service are included in the model: first, the degree of peaking in the daily time profile of service is tested for its previously hypothesized effects on average unit operating expenses. Peaking is measured by the ratio of the maximum number of buses in service during weekday morning or evening service to the number typically in service during the midday period. While the most direct effect of this measure is likely to be on vehicle requirements and capital costs, peaking should also affect operating expenditures since operator and other labor requirements are also determined largely by the maximum number of vehicles in service.

This occurs because each bus in morning and evening peak service utilizes at least one full driver work shift, as well as because the number of maintenance and supervisory workers is closely related to the peak vehicle requirement.

The second service characteristic is whether buses operate in conjunction with rail rapid transit service in the urban area. This variable, which takes a "yes-no" value, is included to control for the effect of rail transit service on the structure of bus routes and its consequences for bus operating costs. Ideally, the presence of a central city-oriented rail system allows buses to operate primarily on local and feeder routes, thus improving operating speeds and vehicle utilization. Because their feeder function is supplemented by walking, taxis, and private autos, limiting buses to local and suburban service may also reduce the degree of peaking required to meet hourly variation in demand, although this should be partly captured by directly entering the peaking measure in the model. Both of these effects offer the potential for lower-cost operation of buses in conjunction with rail transit service.

Unfortunately, this effect may be compromised by the higher cost structures characterizing extremely large, multi-mode urban transit systems. These arise partly because of their high rates of labor compensation, although this effect should be largely captured by explicitly including the wage rate variable. Nevertheless, there are apparently other sources of higher costs in large bus-rail systems, stemming from geographic and institutional characteristics of the older, densely-populated, and often heavily congested urban areas where they operate. These include the heavily politicized environment in which transit operations must often be managed, severe labor relations problems that can compromise the productivity of transit employees, or more tangible factors still not captured in the model, such as the generally deteriorated quality of surface street rights-of-way on which buses operate. Unfortunately, the net effect of all of these factors operating simultaneously is difficult to anticipate.

Constraints on the Utilization of Labor

The model also attempts to directly measure the effects of constraints on the utilization of operator labor imposed by labor agreement provisions. Although several important work rules govern the assignment of operators, many of which have potentially significant effects on labor costs, information was obtainable for only two. The first is the time elapsed from initially reporting to work after which a driver must be paid at a specified premium rate; under such an arrangement, he is paid at this higher rate for the difference between the total duration of his work shift and this threshold.[3] The premium is generally computed by paying the driver for more than one hour for each hour he actually works beyond the threshold, most commonly at the rate of 1.5 straight time equivalent pay hours per hour of such "spread penalty time."

For example, a driver working a twelve hour split shift under a labor agreement requiring a spread penalty time after ten hours would be paid for 1.5 hours for each of the last two hours worked. The length of time between the beginning of morning peak service and the end of the evening peak, together with the number of extra vehicles used to provide peak service, largely determines the number of split driver shifts. Given these parameters, a shorter spread penalty time increases the number of hours for which drivers must be paid to provide the level of service scheduled. By doing so, it raises total wage payments and thus operating expenditures for providing a given schedule of transit service.

The second labor agreement provision incorporated in the model is the maximum duration permitted for operator shifts, measured from the initial reporting hour to the time when the driver's scheduled work shift actually ends. This rule restricts the overall length of time permitted for operator shifts that are scheduled to include an unpaid break between driving assignments, in order to cover both morning and evening peak periods. The most common such provision is that driver shifts may not exceed thirteen hours in total time elapsed between check-in and finish of work.[4]

Again, interaction among the length of time between the start of morning peak service and the resumption of base service at the end of the evening peak, the number of vehicles added to provide peak service, and this "maximum spread time" is critical. As this limitation is shortened so that it approaches or equals the time encompassed by morning and evening peaks, the number of driver shifts necessary to provide a scheduled level of service can increase sharply. This raises total driver wage payments for peak period service, as well as average operating expenditures per unit of service supplied.

Effects of Guaranteed Subsidies

Finally, this analysis attempts to test the effects of guaranteed availability of government assistance on transit operating expenditures. It does so by examining the association of operating costs with the fraction of each system's operating budget derived from state and local tax sources that are specifically dedicated to finance transit assistance. (Separate effects of state and local assistance from dedicated tax sources were tested for, but were found not to differ significantly.) While it is also tempting to introduce some measure of federal operating assistance payments, the dominant role of population and population density in the Section 5 distribution formula makes it nearly impossible to separate any effect of operating assistance from those of the population and density variables themselves.

The potential for confusing the direction of causality between federal subsidies and unit cost levels introduced by including such a measure would also be difficult to avoid without a considerably more complex model, more complete and reliable data, and perhaps more complicated statistical techniques than those used here. The guaranteed, specifically earmarked nature of assistance funded from dedicated local and state tax sources makes the anticipated direction of their potential effects on transit expenditures much clearer than is the case with federal assistance. Although it certainly seems reasonable to hypothesize a similar effect of federal subsidies, federal payments under fixed formulas are not reported separately from discretionary assistance, so that reliable tests of the effect of dedicated federal subsidies cannot readily be performed.[5]

STATISTICAL ESTIMATION RESULTS

The parameters of the model were estimated using data for 74 bus transit systems with fiscal years ending during 1980. Both operating expenditures per vehicle-hour and per vehicle-mile are tested as dependent variables, with somewhat better results obtained using the vehicle-hour measure of unit expenses. Tables 4.1 and 4.2 present estimates of the models' parameters, their standard errors (the usual measure of the precision with which individual parameters can be estimated), and measures of how well slightly different versions of the model explain unit cost variation among individual systems. Overall, the models are only moderately successful in accounting for variation in expenditure levels, and the effects of some factors hypothesized to have an important influence on cost variation cannot be reliably detected. Nevertheless, the results do provide some useful insights into the structure of transit operating expenditures and their recent escalation.

The estimated effects of prices for operating inputs are mixed, although driver wage rates consistently display an important effect on unit operating expenditures. In fact, the coefficient values in Table 4.1 suggest that a one dollar increase in the hourly driver wage raises total expenses per vehicle-hour by 2.4 to 3.0 times that amount. This result probably reflects several of the previously hypothesized effects: first, higher driver wage rates apparently are associated with higher compensation rates for other transit system employees, the effect of which is subsumed in the estimated

Table 4.1

Regressions of Operating Expenditure per Vehicle-Hour for 74 Bus Transit Systems in 1980

Variable	Regression Coefficient (Standard Error) in: Model 1	Model 2	Model 3	Model 4
Operator Wage Rate (dollars)	2.999 (0.594)	2.705 (0.645)	2.574 (0.653)	2.428 (0.659)
Fuel Price/Gallon (dollars)	3.436 (5.149)	3.880 (5.149)	2.637 (5.249)	2.156 (5.350)
Average Fleet Age (years)	-0.1414 (0.2601)	-0.1224 (0.2599)	-0.0472 (0.2674)	-0.0436 (0.2610)
Ratio of Peak to Base Buses in Service	3.084 (1.174)	3.036 (1.172)	2.783 (1.190)	2.744 (1.170)
Nondriver Employees per Peak Bus	1.926 (0.758)	1.808 (0.763)	1.720 (0.765)	1.775 (0.754)
Rail Transit Dummy (1=yes)		2.065 (1.788)		2.336 (1.771)
% of Operating Budget from Dedicated Taxes			0.0567 (0.0350)	0.0617 (0.0349)
Spread Premium Time:				
8:01-9:00 hours	7.002 (2.885)	6.459 (2.887)	5.735 (2.906)	5.468 (2.840)
9:01-10:00 hours	2.389 (2.447)	2.557 (2.440)	2.498 (2.431)	2.192 (2.401)
10:01-11:00 hours	0.082 (2.127)	0.132 (2.119)	0.010 (2.113)	0.305 (2.079)
11:01-12:00 hours	0.143 (2.223)	0.463 (2.083)	0.549 (2.076)	0.571 (2.042)

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Table 4.1

Regression of Operating Expenditure per Vehicle-Hour for 74 All-Bus Transit Systems in 1980 (cont'd.)

Maximum Spread Time:				
10:01-11:00 hours	4.721	4.676	4.414	4.447
	(2.229)	(2.217)	(2.213)	(2.153)
11:01-12:00 hours	3.690	3.211	3.573	3.884
	(1.918)	(1.944)	(1.954)	(1.934)
12:01-13:00 hours	2.989	2.546	2.765	2.813
	(1.561)	(1.599)	(1.600)	(1.569)
13:01-14:00 hours	1.979	2.323	2.410	2.401
	(1.471)	(1.482)	(1.477)	(1.449)
Adjusted R^2	0.573	0.583	0.592	0.601
Standard Error of Estimate[a]	4.261	4.213	4.167	4.121

[a]Around a mean of $25.14.

Table 4.2

Regressions of Operating Expenditure per Vehicle-Mile for 74 Bus Transit Systems in 1980

	Regression Coefficient (Standard Error) in:			
Variable	Model 1	Model 2	Model 3	Model 4
Operator Wage Rate (dollars)	0.1977 (0.0629)	0.1182 (0.0638)	0.1377 (0.0637)	0.1386 (0.0658)
Fuel Price/Gallon (dollars)	0.1195 (0.5449)	0.3198 (0.5094)	0.5048 (0.5119)	0.5203 (0.5347)
Average Fleet Age (years)	0.0133 (0.0276)	0.0290 (0.0257)	0.0072 (0.0261)	0.0126 (0.0261)
Ratio of Peak to Base Buses in Service	0.2387 (0.1243)	0.2255 (0.1160)	0.2631 (0.1160)	0.2470 (0.1169)
Nondriver Employees per Peak Bus	0.2198 (0.0803)	0.1877 (0.0755)	0.2007 (0.0747)	0.1902 (0.0752)
Rail Transit Dummy (1 = yes)		0.5602 (0.1769)		0.5403 (0.1770)
% of Operating Budget from Dedicated Taxes			0.0038 (0.0031)	0.0042 (0.0034)
Spread Premium Time:				
8:01-9:00 hours	0.6105 (0.3228)	0.4634 (0.3825)	0.5712 (0.3759)	0.5364 (0.3836)
9:01-10:00 hours	0.1882 (0.2647)	0.2339 (0.2403)	0.2426 (0.2346)	0.2607 (0.2399)
10:01-11:00 hours	0.0143 (0.2310)	0.0280 (0.2086)	0.0492 (0.2036)	0.0153 (0.2077)
11:01-12:00 hours	0.0454 (0.2269)	0.0854 (0.2050)	0.0726 (0.1999)	0.0775 (0.2040)

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Table 4.2

Regressions of Operating Expenditures per Vehicle-Mile for 74 Bus Transit Systems in 1980 (cont'd.)

Maximum Spread Time:				
10:01-11:00 hours	0.6491	0.6479	0.6518	0.6496
	(0.4481)	(0.4176)	(0.4110)	(0.4165)
11:01-12:00 hours	0.5873	0.5286	0.5748	0.5791
	(0.3088)	(0.2913)	(0.2880)	(0.2932)
12:01-13:00 hours	0.2991	0.3500	0.3173	0.3303
	(0.2711)	(0.2572)	(0.2535)	(0.2568)
13:01-14:00 hours	0.2666	0.2598	0.2468	0.2540
	(0.2615)	(0.2456)	(0.2416)	(0.2448)
Adjusted R^2	0.512	0.583	0.604	0.593
Standard Error of Estimate[a]	0.359	0.332	0.325	0.328

[a]Around a mean of $1.98.

coefficient of the driver wage rate on operating expenses. Another part of the estimated coefficient probably represents differences in fringe benefit payments, the hourly equivalent of which varies among transit systems in rough proportion to wage rates themselves.[6] Finally, minimum pay guarantees and non-working time allowances included in driver shifts often require well over one driver pay hour per hour of service actually provided, an effect that is partially subsumed in the coefficient attached to the base wage rate.

While the coefficient on fuel costs shows the expected positive sign and implies an effect on operating expenses of reasonable magnitude, it is consistently smaller than its standard error, so that it is impossible to reliably isolate the size of the actual effect. This may occur because of the limited amount of variation in fuel costs among individual transit systems; although the absolute range of prices is fairly wide, those paid by most transit operators cluster tightly around the mean value in the sample. As a consequence, firms facing closely comparable fuel prices may have overall unit operating expenses that vary considerably, leading to a wide range of possible values for the fuel price coefficient. The pattern of coefficient estimates among the four specifications also suggests that collinearity between fuel prices and the measure of dedicated state and local tax support may be partly responsible for this result. Structurally, this could arise if states that exempt transit operators from fuel taxes also earmark specific revenue sources for transit operating assistance, although no information is easily available to test this explanation.

The average age of vehicle fleets does not appear to have a strong association with expenditures per unit of service, despite its considerable variation within the sample. Apparently variations in annual vehicle utilization and maintenance policies, together with higher operating costs of some newer vehicle models, offset the anticipated escalation of operating and maintenance expenses with vehicle age. Unfortunately, available measures of the age structure of vehicle fleets are not sufficiently detailed to detect how much of this result is due to the recent introduction of new bus designs with higher operating costs.

Of the two service characteristics anticipated to affect operating expenses, the degree of peaking in service appears to exert a more pronounced effect. Its estimated coefficient suggests that higher ratios of peak to midday vehicles in service are associated with considerably higher unit operating expenses. For example, the estimates reported in Tables 4.1 and 4.2 suggest that a transit system with twice as many vehicles in peak service as during midday hours (approximately the sample average) will have unit operating costs 11-13% above those of an otherwise identical system with equal numbers of vehicles in peak and base service. If there is any surprise in this finding, it is that the estimated effect of peaking is not considerably larger than this. On the other hand, much of its anticipated effect stemmed from the expected interaction with work rules that prevent or raise the cost of assigning individual drivers to both daily peaks. By explicitly including these variables in the model, the effect of this interaction is probably removed from the estimated coefficient on the peaking measure itself.

The estimates reported in Tables 4.1 and 4.2 also suggest that bus operating costs increase where they are operated in conjunction with rapid rail transit service, although there is considerable uncertainty about the exact magnitude of this cost premium. The range of coefficient estimates suggests that unit costs for buses operated in conjunction with rail service average at least 8%, but perhaps as much as 28% higher than for comparable bus-only systems. Thus even after accounting for the higher wage rates, different peaking characteristics, and often more restrictive work rules that prevail in large urban areas where bus and rapid rail transit operate together, bus operating expenses there can be considerably higher than in comparable all-bus transit systems.

Among the most interesting estimates are those for the two work rules tested, the length of shifts after which premium pay rates apply, and the maximum permissible duration of driver shifts. The variables describing these provisions are coded to allow varying effects of progressive changes in their restrictiveness; for example, each successive hour by which the maximum shift length changes is allowed to affect unit operating expenses by a different dollar amount. Although the resulting estimates of the cost implications of variation in the restrictiveness of these two provisions are subject to considerable uncertainty, as indicated by the large standard errors attached to the coefficient estimates, some interesting inferences can still be drawn from the general pattern.

First, the effect of varying shift lengths beyond which premium pay rates are required does not appear to be pronounced so long as this provision remains at relatively unrestrictive levels. Thus spread penalty times longer than ten hours do not increase estimated costs significanlty over situations where no restriction is specified. However, when labor agreements specify premium pay rates for shifts exceeding nine to ten hours (as for approximately one-quarter of the systems sampled) costs can increase as much as 10%, although considerable uncertainty still surrounds these estimates. The coefficient estimates also suggest that spread penalty thresholds in the 8-9 hour range can inflate operating costs as much as 25-30%, but the small number of transit systems operating under such provisions makes this estimate somewhat uncertain.

In contrast, transit systems without maximum shift restrictions apparently do experience lower costs than where even very long maximum spread times apply: the reported estimates suggest that maximum shift lenghts of 13-14 hours can raise unit costs approximately 8-10%. Interestingly, the estimated cost penalty typically imposed by the maximum spread rule does not increase significantly beyond this level when shifts longer than 12-13 hours are prohibited. Maximum shift lengths less than twelve hours in duration, however, do appear to raise unit operating expenditures further. According to the estimates reported in Tables 4.1 and 4.2, maximum shift lengths in the 10-11 hour range can raise expenditures per vehicle-hour and mile to levels as much as 15-25% higher than where no restriction applies.

Tables 4.1 and 4.2 also provide some evidence that government operating assistance for transit is partially absorbed by escalation in unit operating expenses. Specifically, the coefficient estimate for the dedicated subsidy variable suggests that 20-25% of an increase in operating assistance financed by dedicated tax sources is absorbed by higher unit costs, even after accounting for any indirect effect such "guaranteed" subsidies may have by raising labor compensation rates. With the fraction of transit operating assistance financed from earmarked local tax sources rising rapidly, particularly in a few large metropolitan areas having extensive transit systems, this is a significant finding by itself. In addition, it may also have important implications about the inflationary effects of other forms of transit operating assistance, including approximately $1 billion per year distributed under the federal Section 5 Operating Assistance Program without regard to the operating characteristics of systems receiving subsidies.

INFERENCES ABOUT THE CAUSES OF RISING UNIT OPERATING EXPENDITURES

Although these estimates are based on a cross-sectional analysis of transit system financial variables and operating characteristics for a single recent year, they provide some useful evidence about the causes of rapid escalation in operating expenses over time. Of course, any such inferences need to be drawn cautiously, and it is probably not possible to develop exact estimates of the contributions of individual variables to cost growth. Nevertheless, it should be possible to infer some sense of the relative importance of various structural causes of unit cost escalation.

Table 4.3 presents estimates of recent changes in the values of some factors found to be significantly associated with variation in unit expenditure levels. As it also indicates, recent changes in most of these variables would have contributed to rapidly increasing unit

Table 4.3

Changes in Variables Affecting Transit Operating

Expenditures Between 1970 and 1980[a]

Variable	1970 Value	1980 Value	% Change
Operating Expenditures:			
Per Vehicle-Hour	$7.97	$25.14	215%
Per Vehicle-Mile	$0.71	$1.98	179%
Operator Wage Rate	$3.99[b]	$8.18	105%
Fuel Price per Gallon	$0.11	$0.74	57%
Ratio of Peak to Base Buses in Service	2.02	1.94	-4%
Nondriver Employees per Peak Bus	1.67	2.66	59%
% of Operating Budget from Dedicated State and Local Taxes	0%	9.4%	--
Median Spread Premium Time	--	10.5 hours	--
Median Maximum Spread Time	--	12.8 hours	--

[a]Average or median values for 74 bus transit systems reporting financial and operating data to APTA in both 1970 and 1980.

[b]Average for bus transit systems in large U.S. cities.

Sources: American Public Transit Association, 1970 Transit Operating Report, 1980 Operating Statistics Report, and 1980 Expense Recovery Ratios Report; and U.S. Bureau of Labor Statistics, "Union Wages and Hours: Local Transit Operating Employees," 1970.

cost levels in urban transit operations. Most important, the basic hourly wage rate paid to bus operators more than doubled over the ten years encompassed by the table, from slightly below $4.00 in 1970 to well over $8.00 for the 74 transit systems included in the preceding analysis.[7] If the estimated effect of wage rates on operating cost variation is consistent over time, their growth could have accounted for nearly 60% of the actual escalation in inflation-adjusted unit operating expenditures over this period, an estimate that is consistent with those presented in Chapter 2. While rising costs of living in urban areas absorbed much of this increase in wage rates, transit employees probably also experienced other income gains, including increases in fringe benefits and in the number of paid hours that are not matched by hours actually worked.

Costs for motor fuel also exhibited rapid growth over the decade, increasing from about 11 cents per gallon in 1970 to more than 95 cents per gallon by 1980.[8] While this analysis could not reliably identify a pronounced effect of fuel price differences among transit firms once they had reached this much higher level, it is almost certain that increases of this magnitude were responsible for some of the rapid growth over time in operating expenses. Disregarding their high standard errors, the coefficient values reported in Tables 4.1 and 4.2 suggest that rising diesel fuel expenses could have accounted for another 20% of the increase in unit operating costs for bus transit service from 1970 to 1980, even after adjusting for the effects of inflation.

For the sample of bus transit systems used in the preceding analysis, there was also a slight reduction in the degree of peaking during the decade, as Table 4.3 indicates. In conjunction with the previously estimated effect of peaking on unit operating expenses, this change would have slightly reduced operating costs. However, this development may have resulted partly from increased restrictiveness of labor provision agreements governing the assignment of drivers to work shifts: several transit systems reported imposing new provisions requiring premium pay for split shifts or specifying maximum shift durations between 1976 and 1980, while some systems tightened existing restrictions at the same time.[9] By requiring transit operators to purchase more excess labor hours to maintain a given schedule of peak service, more restrictive work rules may have actually reduced the cost of expanding off-peak service. If operators consequently reduced the number of vehicles in peak service that were taken out of service during the midday, as would have been expected, one result would be the observed decline in the peaking measure used here. Although this response would minimize the effect of more restrictive work rules on average unit costs, total operating expenditures for providing a given schedule of peak service would still have risen as a result.

Finally, the estimated effects of earmarked operating assistance on transit costs suggest that continuing growth in the level of government subsidies also contributed to cost escalation. Rapid increases in the availability of assistance, combined with its distribution according to fixed formulas or earmarking of tax sources, seriously weakened the incentives for operating efficiency and other forms of cost control faced by transit managers. Well over half of the aggregate operating budget for public transit service in the U.S.

is now funded by government operating assistance, with revenues from earmarked state and local tax sources and federal formula grants each making up about one-third of total assistance.[10] Thus even if as little as 20-25% of these dedicated forms of assistance, as estimated previously, has been defrayed in higher unit operating expenditures, the growing availability of operating subsidies themselves may itself have been a major cause of escalating costs for providing transit service.

IMPLICATIONS OF THE ANALYSIS

The analysis presented in this chapter suggests that variations in unit operating expenses among transit systems are partly the result of prices paid for labor and other operating inputs, contractual provisions or management practices affecting labor productivity, and certain characteristics of the service they supply. It also provides some evidence that government operating assistance weakens transit managers' incentives for cost control sufficiently to allow part of it to be absorbed by higher unit operating expenses. Although precise estimates of the contributions of various underlying causes of escalation in transit costs are difficult to construct, developments in the national economy and the changing urban environments in which transit systems operate are certainly partly responsible. These include factors such as rising fuel prices, rapid escalation in the cost of living, and peaking in transit demand.

Nevertheless, the most important sources of cost escalation, including explosive wage and fringe benefit increases and unnecessarily protective labor agreement provisions hampering the productive use of labor, are more directly subject to management control. Others, principally the distribution of operating assistance without regard for its effects on managerial incentives, are the product of well-intentioned but conceptually errant government policies. Regardless of whether they should have been avoidable in the first place, their contributions to cost escalation must be more fully appreciated and carefully anticipated if the recent growth in transit operating budgets is to be reduced to acceptable rates in the future.

FOOTNOTES TO CHAPTER 4

1. See American Public Transit Association, Labor Information Review, 1976-77 edition, Volume 1, Table 15, p. I-E-01, Table 16, p. I-E-03, and Table 17, p. I-E-05.

2. John R. Meyer and Jose A. Gomez-Ibanez, Improving Mass Transportation Productivity, Report MA-11-0026, Urban Mass Transportation Administration, February 1977, Chapter 1.

3. American Public Transit Association, Labor Information Review, 1978-79 edition.

4. American Public Transit Association, Labor Information Review, 1978-79 edition; see also Kenneth M. Chomitz and Charles A. Lave, Part-Time Labor, Work Rules, and Transit Costs, Report CA-11-0018, Urban Mass Transportation Administration, January 1981, Chapter 3.

5. For previous attempts to detect the influence of federal subsidies, see Darold Barnum and James Gleason, Measuring the Influence of Subsidies on Transit Efficiency and Effectiveness, U.S. Department of Transportation, September 1979; and John Pucher, Redesigning Federal Transit Subsidies to Control Costs and to Increase the Effectiveness of the Transit Program, Report NJ-11-0011, Urban Mass Transportation Administration, pp. 24-39.

6. Timothy A. Patton, Transit Performance Indicators, Staff Study, U.S. Department of Transportation, Transportation Systems Center, April 1983, Table 3, pp. 13-14.

7. U.S. Bureau of Labor Statistics, Union Wages and Hours: Local Transit Operating Employees, 1970; and Amalgamated Transit Union, "Survey of Top Hourly Operator Wage Rates on June 1, 1980."

8. Computed from American Public Transit Association, 1970 Transit Operating Report, and "Quarterly No. I-D Diesel Fuel Price Report," Volume 5, Number 4, February 1981.

9. Kenneth M. Chomitz and Charles A. Lave, Part Time Labor, Work Rules, and Transit Costs, Report CA-11-0018, Urban Mass Transportation Administration, January 1981, Table 5-1, p. 39.

10. Urban Mass Transportation Administration, National Urban Mass Transportation Statistics, November 1982, Table 1.03.2, p. 1-8.

Chapter 5

THE CAUSES OF DECLINING TRANSIT SERVICE UTILIZATION

As Chapter 1 indicated, the extended postwar decline of nationwide transit patronage was reversed during the early 1970s. Nevertheless, it is important to distinguish between aggregate transit patronage, which is partly determined by the level of transit sevice supplied, and measures of how completely or intensively the available level of transit service is actually utilized by riders. Despite its modest growth over the decade, transit ridership failed to keep pace with the expansion in service levels; thus the number of passengers carried per vehicle-mile operated -- one measure of how intensively service is utilized -- actually fell slightly. As Chapter 2 indicated, this decline in the utilization of transit service was one source of the explosive growth in transit operating deficits during the decade. Further, without the sigificant reductions in transit fares and increases in auto operating costs that accompanied the expansion of transit services, the decline in utilization and its contribution to escalating losses would no doubt have been even more pronounced.

Tables 5.1 and 5.2 report changes in various estimates of transit service patronage and utilization during the 1970s. Table 5.1 reports estimates of total passengers and passenger-miles carried by U.S. urban bus transit systems, as well as two alternative measures of the intensity with which bus service was utilized, while Table 5.2 reports similar estimates for urban rail rapid transit in the U.S. These

Table 5.1

Trends in the Utilization of U.S. Urban Bus Transit Service[a]

Year	Originating Passengers Carried[b] (millions)	Estimated Passenger-Miles[c] Carried (millions)	Originating Passengers Boarding per Vehicle-Mile	Estimated % of Capacity-Miles[d] Occupied
1970	4,117.0	18,114.8	2.98	27.6%
1975	3,960.1	17,820.5	2.60	26.0%
1980	4,486.5	21,535.0	2.68	26.4%
% change:				
1970-75	-3.8%	-1.6%	-12.8%	-6.0%
1975-80	13.3%	20.8%	3.1%	1.6%
1970-80	9.0%	18.9%	-10.1%	-4.3%

[a]Service provided by single mode bus systems plus bus operations of combined bus-rail systems.

[b]Initial boardings only; excludes transfer passengers (corresponds to "Linked Passenger Trips").

[c]Computed from estimates of average passenger trip lengths constructed by the author from sources detailed in footnote 1, Chapter 4.

[d]Passenger-miles carried as a percent of seat-miles of service.

Sources: American Public Transit Association, Transit Operating Report, 1960, 1965, 1970, 1975, and 1980 Operating Statistics Report; U.S. Department of Transportation, National Urban Mass Trasportation Statistics, 1980; estimates of average vehicle seating capacity constructed from Institute for Defense Analysis, Economic Characteristics of the Urban Public Transportation Industry, 1972, Table 3.16, and American Public Transit Association, Transit Fact Book, 1980, p. 20.

Table 5.2

Trends in the Utilization of U.S. Urban Rail Transit Service[a]

Year	Originating Passengers Carried[b] (millions)	Estimated Passenger-Miles Carried[c] (millions)	Originating Passengers Boarding per Vehicle-Mile	Estimated % of Capacity-Miles Occupied[d]
1970	1,565.1	10,955.7	3.71	27.0%
1975	1,420.0	10,224.0	3.26	24.4%
1980	1,460.8	10,809.9	3.52	26.6%
% change:				
1970-75	-9.3%	-6.7%	-12.1%	-9.6%
1975-80	2.9%	5.7%	7.9%	9.0%
1970-80	-6.7%	-1.3%	-5.1%	-1.5%

[a]Heavy rail rapid transit service plus light rail service provided by systems operating both heavy and light rail; excludes commuter rail service.

[b]Initial boardings only; excludes transfer passengers (corresponds to "Linked Passenger Trips").

[c]Computed from estimates of average passenger trip lengths constructed by the author from sources detailed in footnote 1.

[d]Passenger-miles carried as a percent of capacity-miles of service.

Sources: American Public Transit Association, Transit Operating Report, 1960, 1965, 1970, 1975, and 1980 Operating Statistics Report; U.S. Department of Transportation, National Urban Mass Trasportation Statistics, 1980; estimates of vehicle passenger-carrying capacity constructed from data reported in B. Pushkarev and J. Zupan, Urban Rail Transit in America, 1977, Table 3.2.

tables indicate that after declining during the early part of the decade, both bus and rail transit ridership rose between 1975 and 1980, although the growth in rail ridership was very slight. Further, because of a slight increase in the estimated length of passenger trips on both modes, the number of passenger-miles carried rose somewhat more than ridership during the latter half of the decade.[1]

Nevertheless, these tables also suggest that growth in ridership fell short of the increase in transit service, so that the intensity with which service was utilized actually fell slightly. As they indicate, the number of passengers trips originating per vehicle mile of bus service fell approximately 10% over the decade, while trips carried per vehicle mile of rail transit service fell about 5%. An index of the frequency with which passengers board transit vehicles as they operate along routes, this measure suggests that each vehicle-mile of service attracted fewer originating trips by the end of the decade than in 1970. This occurred despite substantial increases in the aggregate volume of urban travel, significant transit fare reductions, and sharply rising costs for private automobile travel.

Similarly, Tables 5.1 and 5.2 report that the estimated number of passenger-miles carried per unit of passenger-carrying capacity declined slightly for both bus and rail transit during the 1970s. This measure reflects the typical fraction of transit vehicles' passenger-carrying capacities that is actually occupied by passengers. Its decline suggests that although the total volume of transit passenger travel increased over the decade, it nevertheless represented falling utilization of the level of capacity that was provided by the nation's transit operators. Even the significant increase during the decade in the number of passenger-miles traveled on buses still represented a declining fraction of the volume that could have been accommodated by the combination of larger buses and the expanding level of service supplied by bus operators.

Regardless of the specific index used to measure it, the utilization of transit service is the outcome of complex interaction between the demand for travel by public transportation in an urban area and the level, price, and other characteristics of public transit service actually supplied. Demand for transit travel depends upon the geographic distribution of jobs, population, and related activities within urban areas, as well as on certain demographic and income characteristics of urban residents that affect the importance they attach to various attributes of transportation services. Among the characteristics of transit service that affect its utilization are the extent and density of the coverage it provides, as well as the frequency and speed of service it offers. The first section of this chapter assesses the effect of declining demand for public transit travel on the utilization of transit service, while the second focuses on how changing patterns of transit service deployment may have contributed to its declining utilization.

DECLINING DEMAND FOR PUBLIC TRANSIT TRAVEL

The decline in transit utilization occurred mainly because important economic and demographic trends, most of which were visible in U.S. cities throughout the twentieth century, continued to reduce the demand for transit travel during the 1970s. In addition, these trends altered the spatial and temporal patterns of urban travel demand in ways that made high utilization of transit services more difficult for its operators to achieve. The most important of these trends was the continuing dispersion of residences, employment, and population-serving activities within U.S. metropolitan areas, which sharply reduced the number of trips for which transit could offer travel times and service levels that made it competitive with private automobile travel.

Dispersion of Population and Employment

Table 5.3 documents changes in residential and employment locations within the nation's urban areas during the first half of the 1970s, and compares them with changes that took place during the previous decade. After rising between 1960 and 1970, both employment and population in the densely developed central cities of the nation's cities, where transit demand was historically concentrated, fell during the early 1970s.[2] At the same time, the rapid growth in suburban population and employment experienced throughout the 1960s continued through the first half of the subsequent decade, as Table 5.3 reports.

Certainly some of the growth in suburban area populations documented by Table 5.3 reflected natural increases in the populaton originally residing there, annexations of populated land contiguous to expanding urban areas, and migration from surrounding rural areas. Nevertheless, much of it represented the relocation of households from central cities to their surrounding suburbs. The dominant force producing this rapid decentralization of urban population was

Table 5.3

Percent Changes in the Distribution of Population, Employment, and Travel to Work Within U.S. Metropolitan Areas[a]

		Employment Zone[b]		
Residence Zone	% Change from:	Central City	Suburban Ring	Entire SMSA
Central City	1960-70	-1.5%	38.8%	2.3%
	1970-75	-8.5%	10.7%	-5.5%
Suburban Ring	1960-70	15.3%	38.8%	29.4%
	1970-75	3.9%	15.6%	11.4%
Entire SMSA	1960-70	3.4%	37.0%	15.2%
	1970-75	-4.5%	14.7%	3.5%

[a]All U.S. Standard Metropolitan Statistical Areas.

[b]Central city, suburban ring, and SMSA boundaries for some individual areas vary among years.

Sources: U.S. Bureau of the Census, U.S. Census of Population: 1960, Report PC(1)-1D, Table 218; and Current Population Reports, Series P-23, Number 99, "The Journey to Work in the United States," 1975, Table F, p. 5.

continuing real income growth: even after adjusting for inflation, both household and per capita incomes of urban residents grew nearly as much from 1970 to 1980 as during the previous decade of sustained economic boom.[3] As has been the case for several decades, rising incomes stimulated the demand for dwelling space and other amenities provided by lower residential densities. Thus despite sharp declines in their average membership, urban households continued to use some of their rising incomes to purchase the more spacious living arrangements that were most inexpensively and readily available in the suburban areas of U.S. cities.

At the same time, the evolving technology and industrial mix of urban economic activity combined to produce the similar -- although slightly less rapid -- decentralization of employment in U.S. urban areas revealed by Table 5.3. This occurred as the introduction of new products and technological innovations in manufacturing processes continued to stimulate demand by various industries for the large areas of land that were most cheaply and readily available in suburban areas, thus fostering the relocation of some manufacturing employment into areas outside central cities. Perhaps more important, continuing evolution of the industrial mix of U.S. economic activity meant that increases in employment were concentrated in lighter manufacturing and service-producing industries. Because such industries employed more land-intensive production technologies and depended less on access to centralized transportation facilities than did traditional manufacturing activities, their increasing importance in the nation's economy also contributed to continuing decentralization in employment within urban areas.

Changing Urban Travel Patterns

Table 5.3 also illustrates that as a result of these changing distributions of population and employment, there were pronounced changes in patterns of travel to work. Perhaps most important, the gradual decline during the 1960s in the number of work trips made entirely within the central cities of urbanized areas, the traditional stronghold of transit service and patronage, accelerated sharply during the subsequent decade. While no equally reliable data are available to document changes in urban travel for purposes other than commuting to work, declining populations and the relatively slow growth in income levels of many inner city residents suggest that non-work travel within central cities probably also declined during the 1970s.

Growth in the other major market in which transit travel was widespread, radial commuting to central city jobs from suburban residences, also slowed sharply during the early 1970s, as Table 5.3 reports. Because of the accompanying dispersion of retail and other population-serving activities into suburban areas, travel from outlying residential areas to central cities for shopping, personal business, and other purposes probably also declined significantly. The combined effect of these developments in urban travel patterns was clearly to reduce travel volumes in those markets where transit service and ridership were historically concentrated.

Declining Transit Mode Shares

Nevertheless, Table 5.4 shows that commuting by public transit declined by far more than would have resulted simply from decentralization and its effects on urban travel patterns. As the table illustrates, the number of transit trips between central city residences and jobs fell by nearly a third between 1970 and 1975. Both outbound transit travel from central city residences to suburban jobs and transit commuting within suburban areas declined by similarly large percentages during the early 1970s, although these declines were not nearly as important in their absolute effects on transit ridership. Only for inbound radial travel -- that from suburban residences to central city work locations -- did transit commuting rise during the early 1970s. Further, much of this growth occurred in the few older, congested urban areas where employment remained relatively highly centralized, but levels of street and highway capacity serving their central areas were not substantially improved. On balance, the number of work trips by public transit fell by nearly one-quarter during the first five years after 1970, as Table 5.4 indicates.

The declining demand for transit travel revealed by its falling mode shares resulted largely from the previously discussed growth in urban residents' income levels, together with continued improvements in street and highway capacities that facilitated automobile travel. Rising incomes affected transit demand by increasing urban travelers' valuations of the advantages offered by auto travel, including its minimal access and waiting times, scheduling and routing flexibility, privacy, and personal comfort and safety. The rapid travel speeds it

Table 5.4

Percent Changes in the Number of Work Trips
Made by Public Transit in U.S. Urban Areas, 1970-75[a]

Residence Zone[b]	Employment Zone[b] Central City	Suburban Ring	Entire SMSA
Central City	-31.9%	-33.0%	-32.1%
Suburban Ring	4.6%	-21.5%	-4.0%
Entire SMSA	-24.7%	-26.5%	-24.9%

[a]All U.S. Standard Metropolitan Statistical Areas.

[b]Central City, Suburban Ring, and SMSA boundaries for some individual areas vary among years.

Sources: U.S. Bureau of the Census, U.S. Census of Population: 1960, Report PC(a)-ID, Table 218, and Current Population Reports, Series P-23, Number 99, "The Journey to Work in the United States," 1975, Table F, p. 5.

offered were facilitated by the substantial additions to road and highway capacity in which most urban areas continued to invest during this period. Their combined effect was reflected in the explosive growth in auto ownership in urban areas reported in Table 5.5: as it illustrates, automobiles owned per household, per capita, and per employed urban resident grew nearly as rapidly during the 1970s as during the previous decade.[4]

Changing Characteristics of Transit Travel

Even in the few travel corridors where transit demand remained relatively strong, the combination of urban decentralization, rising auto ownership, and accompanying developments made it more difficult for operators to maintain high utilization of transit service. It did so by increasing the concentration of transit demand during peak travel hours, as well as by aggravating imbalances in the spatial patterns of ridership. In conjunction with rising income and auto ownership levels, widespread relocation of retail and other population-serving activities into suburban areas probably reduced the number of non-work trips for which public transit was used. At the same time, because it less drastically reduced the number of work trips for which transit remained competitive with automobile commuting, the effect of decentralization on transit travel to work was less pronounced. Since trips to work are generally more concentrated during morning and evening travel periods than those for other purposes, the changing mix of travel purposes for which it was used increased the fraction of transit trips that took place during peak hours.[5]

Table 5.5

Changes in Household Characteristics and Automobile Ownership in U.S. Urban Areas[a]

Year	Average Household Size (persons)	Employed Persons Per Household	Average Automobiles Owned: Per Household	Per Household Member	Per Employed Household Member
1960	3.52	1.31	1.01	0.29	0.77
1970	3.18	1.29	1.23	0.39	0.95
1980	2.73	1.23	1.41	0.52	1.16
% change:					
1960-70	-9.7%	-1.5%	21.8%	34.5%	23.4%
1970-80	-14.2%	-4.7%	14.6%	33.3%	22.1%

[a]Data for all U.S. Standard Metropolitan Statistical Areas.

Sources: U.S. Bureau of the Census, Statistical Abstract of the United States, 1981, and Provisional Estimates of Social, Economic, and Housing Characteristics: SMSAs and SCSAs, 1980, report PC80-51-5.

Because transit operators expanded vehicle fleets and employment to accommodate ridership increases that were concentrated during a few hours of the day, the overall utilization of capital and labor inputs fell steadily.[6] As Chapter 4 discussed previously, this problem was aggravated by labor agreements that increasingly restricted the assignment of operators to work shifts encompassing morning and evening peaks. Peak vehicle and labor requirements were further extended because 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 urban decentralization and other developments such as the increasing number of multiple-worker households.[7] The accompanying increase in the fraction of commuting trips on many transit routes also tended to concentrate ridership in a single direction during peak travel hours, thereby complicating the problem of designing routes and schedules to maintain satisfactory utilization of drivers and vehicles, while further compounding peak vehicle and labor requirements.

INEFFECTIVE DEPLOYMENT OF TRANSIT SERVICES

Transit service utilization declined even more during the 1970s than these developments would have suggested, apparently because its operators failed to understand them fully and adapt their to service policies accordingly. Instead of carefully identifying specific routes where transit service that was sufficiently rapid and frequent to achieve acceptable utilization could be maintained at reasonable operating costs, many operators expanded service into widespread new markets. These new routes typically provided infrequent service to suburban areas with low densities of employment and population, as well as high levels of automobile ownership and street capacity. Thus they were unlikely to achieve traditional standards for passenger utilization, at least when fares were set to reflect the costs of providing them.

Table 5.6 reports changes between 1970 and 1980 in several characteristics of nationwide bus transit service that illustrate this pattern. During this time, when the number of urban travel corridors along which it could compete effectively with automobile travel probably declined significantly, the table indicates that total route miles served by urban bus transit grew by more than one-third. At the same time, total land area encompassed by U.S. cities grew by almost exactly the same percentage, as the table also indicates. In conjunction with relatively modest growth in vehicle-miles of bus transit operated, these figures suggest that several critical dimensions of transit service changed in ways that reflected operators' failure to deploy service as effectively as might have been possible.

Because route mileage increased more rapidly between 1970 and 1980 than the number of vehicle-miles operated, annual bus-miles operated per route-mile fell 13%, as Table 5.6 also reports. This measure reflects changes in the frequency of typical bus transit service, since it is an index of the average number of vehicle trips made annually over each route. In absolute terms, this reduction in the average frequency of bus service amounts to 5-6 round trips per day, although this figure no doubt represents the average of a wide

Table 5.6

Changes in Characteristics of Bus Transit Service and Areas Served, 1960-80

Year	Vehicle Miles (millions)	Bus Route Miles (thousands)	Urbanized Land Area[a] (thousand sq. miles)	Vehicle Miles per Route Mile	Route Miles per Sq. Mile of Urbanized Area	Vehicle Miles per Sq. Mile of Urbanized Area
1970	1,379.8	91.0	387.6	15,170	0.235	3,560
1975	1,526.0	--	491.0	--	--	3,110
1980	1,658.9	125.6	530.4	13,200	0.237	3,130
% change:						
1970-75	10.5%	--	26.7%	--	--	-12.6%
1975-80	8.7%	--	8.0%	--	--	0.6%
1970-80	20.2%	38.1%	36.8%	-13.0%	0.9%	-12.1%

[a]All U.S. Standard Metropolitan Statistical Areas.

Sources: American Public Transit Association, Transit Fact Book, various years; U.S. Department of Transportation, National Urban Mass Transportation Statistics, 1980; and U.S. Bureau of the Census, Statistical Abstract of the United States, 1981.

range of service changes. At the same time, Table 5.6 reports that the number of route-miles per square mile of urbanized land area within the nation's cities, an indicator of how densely the area encompassed by metropolitan development is served on average by bus routes, changed only slightly from 1970 to 1980. Finally, because increases in annual vehicle mileage failed to keep pace with growth in urbanized land area, the table indicates that the average number of vehicle-miles operated per square mile of urbanized area fell rapidly during the first half of the decade.

The decline in average service frequency probably reflects the net outcome of several different developments. One of these is the widespread extension of bus routes outside transit systems' traditional service areas, where typical service frequencies were probably much lower than those historically operated on central city routes. By itself, this would have reduced systemwide average service frequencies even if total vehicle miles operated increased enough to leave schedules on existing routes unaffected, yet many transit operators also reduced traditional service standards on central city routes in response to falling passenger loads. Declining average service frequencies in most urban areas probably reflected both of these developments, as transit operators attempted to adapt route networks to rapidly decentralizing patterns of urban development by redeploying vehicles from central city routes to suburban route extensions. Another development that may be partly reflected by this measure is the establishment of new bus transit systems in many smaller cities during this period. These newly created systems often provided service over expansive route networks at frequencies well below those offered in major urban areas, again reducing the nationwide average level of bus service frequency.

Regardless of the exact combination of these factors responsible for declining service frequency, they suggest that the flexibility offered by bus transit was used to provide more geographically widespread service, while reducing the frequency of schedules historically offered on central city routes. Some of this service cutting on traditional routes was probably a rational response to declining passenger load factors, rising costs for providing service, and the availability of larger buses. Nevertheless, because of rising incomes and the advantages of automobiles for travel in lower-density areas, redeployment of bus service into suburban areas and the establishment of transit systems in many small urban areas were probably major causes of the overall decline in utilization of bus transit service.

Although the other measures of the characteristics of transit service reported in Table 5.6 are more difficult to interpret, they provide a consistent image of the changing nature of urban transit service. Specifically, they suggest that many transit systems extended existing routes and added others in an attempt to expand transit coverage to serve new areas of residential development, employment concentration, and commercial activity. Because these newly developing areas were expanding so rapidly, however, even the accompanying increase in bus-miles operated failed to maintain the typical levels of service density and frequency that prevailed at the outset of the decade. Again, the proliferation of transit service in lower-density areas of urban development suggested by these measures was probably an important cause of the accompanying decline in transit service utilization.

INTERACTION BETWEEN DECLINING DEMAND AND CHANGING SERVICE PATTERNS

Regardless of how it is measured, the utilization of transit service fell significantly during the 1970s, as the widely heralded reversal of the historical decline in transit patronage failed to produce ridership gains that matched expansions in transit service. This occurred primarily because the basic economic and demographic forces operating in urban areas produced continuing developments in urban spatial structure and transportation demands that reduced urban residents' reliance on public transit service. It also occurred partly because transit operators expanded service into recently developed, lower-density suburbs of major cities and began service in some smaller urban areas.

In both of these settings, its relatively infrequent schedules, the higher income levels of travelers, and extensive street and highway networks made it difficult for transit to compete with travel by private automobile. At the same time, service levels may have been curtailed on routes serving the more densely developed central areas of some cities, where transit ridership was historically concentrated. Although extending transit service was widely advocated by various levels of government as an objective of their transportation, energy, and environmental policies, the declining level of utilization that resulted proved to be costly to transit operators, as well as ultimately to the taxpayers who financed their rapidly escalating deficits.

FOOTNOTES TO CHAPTER 5

1. Estimates of the average length of transit trips were constructed by the author from the following sources: bus transit trip length data for eight metropolitan areas reported in Herbert S. Levinsohn, Characteristics of Urban Transportation Demand, Wilbur Smith and Associates with DeLeuw, Cather, and Co., April 1978, Tables 3-19 and 3-21; U.S. Department of Transportation, Nationwide Personal Transportation Survey, 1969 and 1977, Report Number 8: "Home To Work Trips and Travel;" U.S. Bureau of the Census, Current Population Reports, Series P-23, Numbers 68, 72, and 105, "Selected Characteristics of Travel to Work in U.S. Metropolitan Areas," 1975, 1976, and 1977; U.S. Department of Transportation, National Urban Mass Transportation Statistics: 1980, Table 17.2; and American Public Transit Association, Transit Operating Statistics Report, 1980, p. A-25.

2. These comparisons may understate the decline in central city employment and commuting patterns, since some central city boundaries were apparently expanded outward between these dates.

3. Measured in constant dollars to adjust for inflation, the average annual income of households residing in U.S. urban areas rose 15.8% from 1960 to 1970, and another 9.3% during the following decade. Because the size of typical urban households declined throughout this period, real per capita income of urban residents rose 28.2% from 1960 to 1970 and another 27.4% from 1970 to 1980. See U.S. Bureau of the Census, Statistical Abstract of the United States, 1981, and Provisional Estimates of Social, Economic, and Housing Characteristics: SMSAs and SCSAs, 1980, Report PC80-51-5.

4. During much of the period studied, the U.S. automobile population grew approximately twice as fast as the nation's human population; see Anthony Downs, "The Automotive Population Explosion," Traffic Quarterly, July 1979 (Volume 33, Number 3), pp. 347-362. The dominant role of income growth in expanding levels of auto ownership and use is examined in John F. Kain, "The Impact of Higher Crude Oil Prices on Future Vehicle Ownership," Harvard University, John F. Kennedy School of Government, Policy Note P81-1, February 1981.

5. Nationwide data indicate that nearly two-thirds of all worktrips are made during the hours of 6-9 AM and 3-6 PM, while less than a third of all trips for other purposes are made during those same hours; see U.S. Department of Transportation, Nationwide Personal Transportation Survey, 1969, Volume 8, p. 20.

6. Although historical data on peak hour ridership are unavailable, the number of buses operated in peak hour service by a sample of 74 large U.S. bus transit systems rose 44 percent from 1970 to 1980, while the number of operators and other employees rose more than 70 percent. At the same time, their total ridership

increased less than 20 percent; in part as a result of this disparity between input and ridership growth, annual hours of utilization per bus feel 12 percent, while hours of revenue service per employee dropped 21 percent. These figures were computed from reports for individual transit systems contained in American Public Transit Association, Transit Operating Report, 1970, and 1980 Operating Statistics Report; and U.S. Department of Transportation, National Urban Mass Transportation Statistics: 1980.

7. Statistics from several urban area origin-destination surveys suggest that worktrips are on average at least 50 percent longer than those for other purposes, and perhaps as much as 100 percent longer; see Herbert S. Levinsohn, Characteristics of Urban Transportation Demand, Wilbur Smith and Associates, April 1978, Tables 3-21, C-36, C-40, and C-47.

Chapter 6

CAUSES OF DECLINING FARE REVENUE YIELDS

As reported in Chapter 2, falling fare revenue per passenger carried (or revenue "yield") by U.S. public transit systems was a prominent source of recent escalation in operating losses, accounting for more than one-quarter of the several billion dollar increase in their aggregate deficit between 1970 and 1980. Although this estimate slightly overstates the role of declining fares, it still suggests that their contribution to rising operating losses was exceeded only by that of increasing labor expenses. Thus if average fare revenue per passenger had merely kept pace with inflation over the decade (which would have required average fares almost exactly to double), aggregate transit operating losses might have been reduced by as much as $750 million during 1980.

Regardless of the exact dollar magnitude of their contribution, declining fare revenue yields were a surprisingly important source of the intensifying cost-revenue squeeze faced by public transit operators. This chapter first presents estimates of changes in passenger revenue yields during the 1970s, which reveal the critical effect of inflation in dampening the real impact of what appear superficially to be substantial fare increases. Following this, several major developments in transit operators' fare policies that contributed to the decline in revenue per passenger during this period are explored in detail.

THE DECLINE IN FARE REVENUE YIELDS

Table 6.1 reports recent changes in average farebox revenue per passenger carried by bus and rail transit systems in the U.S. Average revenue is reported in both current dollars, computed from actual transit system revenues and ridership, and adjusted to 1980 dollar equivalents to compensate for the effect of inflation. The table indicates that average fare revenue rose significantly from 1970 to 1980 when denominated in current dollars, increasing 42% over the decade for bus riders and nearly 60% for rail transit passengers. After adjusting for inflation, however, this apparent increase in fare revenue yields was entirely eliminated: expressed in constant 1980 dollars, average bus fares fell nearly 30% over the decade, while rapid rail transit fares declined about 20%, as the table indicates.

Typical transit fare increases thus failed to match the explosive growth in per-passenger operating expenses during this period, which far exceeded the rate of price inflation. One cause of this failure was deliberate stabilization of basic cash fares for transit service -- which had risen rapidly in the preceding decade -- during a period of sustained inflation, causing fares to fall in relation to prices throughout the remainder of the economy. Second, partly in resposne to government policy leadership, transit operators introduced fare discounts for various groups who together represented a sizeable fraction of total transit riders. Finally, many operators reduced or eliminated premium fares or surcharges for passenger trips that were praticularly costly for them to carry, including those covering long

Table 6.1

Changes in Average Fare Revenue Per Passenger Carried by U.S. Urban Transit Systems

Year	Average Fare Revenue in Current Dollars		Average Fare Revenue in Constant 1980 Dollars[a]	
	Bus[b]	Rail[c]	Bus[b]	Rail[c]
1970	$0.26	$0.32	$0.53	$0.62
1975	0.32	0.36	0.47	0.53
1980	0.38	0.50	0.38	0.50
% Change:				
1970-75	21.2%	13.3%	-11.3%	-15.7%
1975-80	17.2%	39.9%	-20.0%	-4.6%
1970-80	42.0%	58.5%	-29.1%	-19.6%

[a]Adjusted to 1980 dollar equivalent using changes in the implicit price deflator for the Gross National Product.

[b]Passengers carried by single mode bus systems plus bus operations of multi-mode systems.

[c]Heavy rail (subway and elevated) rapid transit plus light rail (subway and streetcar) service provided in systems operating both modes.

Sources: Computed from individual transit system reports published in American Public Transit Association, 1970 Transit Operating Report, 1980 Operating Statistics Report, and 1980 Expense Recovery Ratios Report; and Urban Mass Transportation Administration, National Urban Mass Transportation Statistics, July 1982. Supplemental data from American Public Transportation Association, 1981 Transit Fact Book.

distances, trips made during peak travel hours, and trips entailing transfers. Each of these developments contributed substantially to the rapid decline in fare revenue yields, and thus to the growth of operating losses among the nations' transit systems during the decade.

STABILIZATION OF BASIC TRANSIT FARES

Table 6.2 reports changes in basic adult cash fares charged for transit service in twenty-six large urban areas of the United States between 1974 and 1980. As it indicates, these systems together carried approximately two-thirds of the nation's transit passengers, so that their fare structures represent a substantial component of nationwide transit pricing policy. The table also suggests that transit systems in these large urban areas raised base fares significantly during this period, at least when they are measured in current dollar terms. Again however, after adjusting for inflation, a very different picture emerges: the average base fare charged in large cities where both rail and bus service are provided rose only about 6% over this period, while that charged by large bus transit systems actually fell nearly 10%.

Thus most major transit operators' fare-setting practices over this period held increases in the basic price of transit trips to or even below the rate of economy-wide price inflation.[1] Perhaps more important, because the cost of private auto travel nearly doubled over this period, transit operators substantially reduced basic fares for public transportation in relation to the cost of traveling by automobile. By doing so, operators complied with an explicitly

Table 6.2

Changes in Basic Transit Fares and Revenue Per Passenger for Transit Systems in 26 Large U.S. Urban Areas

Urban Areas	Year	% of Nationwide Transit Riders[a]	Average of Basic Adult Cash Fares[b]		Average Revenue[b] Per Passenger	
			Current $	1980 $	Current$	1980$
6 Cities with Bus and Rail Rapid Transit	1974	49%	$0.33	$0.53	$0.32	$0.52
	1980	48%	0.56	0.56	0.50	0.50
	% Change	--	69.9%	6.2%	58.5%	-4.0%
20 Cities with Bus Transit Only	1974	17%	$0.35	$0.56	$0.33	$0.49
	1980	21%	0.51	0.51	0.40	0.40
	% Change	--	45.7%	-9.0%	20.8%	-17.5%

[a]Excluding commuter rail and ferry boat riders.

[b]Passenger weighted average.

[c]Adjusted to 1980 dollars using change in the implicit price deflator for Gross National.

[d]New York, Chicago, Philadelphia, San Francisco-Oakland, Boston, and Cleveland. Washington, D.C. and Atlanta, which added rail service between 1974 and 1980, are excluded.

[e]Los Angeles, Detroit, St. Louis, Baltimore, Houston, Minneapolis-St. Paul, Dallas, Seattle, Milwaukee, Atlanta, Cincinnati, San Diego, Buffalo, Miami, Kansas City, Denver, Indianapolis, San Jose, Portland (Oregon), and Washington, D.C.

Sources: Jose A. Gomez-Ibanez, "Federal Assistance for Urban Mass Transportation," Ph.D. Dissertation, John F. Kennedy School of Government, Harvard University, 1975, Tables 6-8 and 6-9; American Public Transit Association, "Transit Fare Summary: Fare Structures in Effect on September 1, 1980," 1975 Transit Operating Report, 1980 Operating Statistics Report, and 1980 Expense Recovery Ratios Report.

declared goal of government transportation policies: to stabilize transit fares in an attempt to reduce air pollution and energy consumption in urban areas by inducing motorists to shift to transit travel.[2] Although the effectiveness of transit fare reductions in achieving these objectives was questionable, reduced fares were an important source of the widening gap between expenditures for transit service and revenues contributed by its users.

FARE DISCOUNTS FOR SPECIFIC RIDER GROUPS

Comparing the base fare increases reported in Table 6.2 with growth in actual revenue per passenger indicates that growth in average revenue per passenger failed to match even these modest increases in basic adult fares. This divergence resulted partly from changes in fare policies that reduced the fraction of riders paying full fares for their trips, including widespread introduction of selective fare reductions for specific groups of riders, and increases in the size of discounts by many systems that already offered them. Discounts were most often extended to children, senior citizens, students, and handicapped passengers, although many systems also offered substantial effective fare discounts to their regular riders by introducing weekly or monthly passes priced below the equivalent of one round-trip fare per day.

Youth, Senior Citizen, and Student Fares

Table 6.3 illustrates the magnitude and applicability of fare discounts offered by some of the nation's largest transit systems. It

Table 6.3

Size and Applicability of Discount Fares in Selected U.S. Urban Transit Systems

Urban Area and Transit Operator	Basic Fare[a]	Discount Fares Offered to:[a]			% of Systemwide Riders Eligible:[b]		
		Youth	Elderly	Students	Youth	Elderly	Students
New York (NYCTA)	$.60	--	$.30	Free	--	5.0%	7.5%
Chicago (CTA)	$.80	$.35	$.35	$.35		22.2%[e]	
Seattle (Municipality)	$.50	--[c]	$.15	Free	7.1%	11.8%	2.4%
Philadelphia (SEPTA)	$.65	--	$.30/Free[d]	$.30	--	7.0%	12.0%
Los Angeles (SCRTD)	$.65	--	$.30	$.50	--	14.7%	7.3%
St. Louis (Bi-State)	$.50	$.25	$.25	$.25	1.4%	12.9%	18.6%
Pittsburgh (Allegheney County)	$.75	$.38	--	$.75/Free[d]		20.6%[e]	

[a]Data for September 1, 1980.
[b]Data for transit systems' 1978 fiscal year.
[c]Exempted from zone and transfer change.
[d]Fare during weekday peak hours/fare at other times.
[e]Combined percent of riders eligible for reduced fares.
Sources: American Public Transit Association, 1978 Transit Operating Report, and "Transit Fare Summary: Fare Structures in Effect on September 1, 1980."

indicates that the number and size of rider groups who are eligible to receive them varies somewhat among individual transit systems, yet these groups together often represent as much as 25% of total revenue ridership. The table also indicates that these discounts offer substantial reductions -- typically 50% or more -- from the fare these riders would otherwise have been required to pay, and in many cases even allow them to travel free. To illustrate their potential effect on average revenue, a half-fare policy for which only 20% of total riders are eligible, not unusual among large transit systems, would reduce average revenue per rider by 10% even if it did not result in an increse in the fraction of passengers who were eligible for the discounted fare.

Unfortunately, data on the composition of transit ridership by fare category are too limited to detect any trend in discount fare policies, although some information is available. A 1971 study of financial conditions in the urban transit industry conducted by the U.S. Department of Transportation identified only a few systems that offered discount fares, generally to children and senior citizens.[3] Yet by 1981, a survey of nationwide fare policies conducted by the American Public Transit Association (APTA) indicated that all but 12 of 240 (or 95%) systems responding offered at least off-peak fare discounts to senior citizens. At the same time, 94 of the systems surveyed (39%) offered lower fares to children, while 177 (73%) carried student paseengers at reduced fares.[4] Thus it appears that such fare discounts did become considerably more widespread during the 1970s. By reducing the fraction of passengers required to pay full fares, their proliferation was clearly one reason why fare revenue per passenger declined so sharply during the decade.

Discount Passes for Regular Riders

Another less obvious but still important form of fare discounting that became more widespread during the 1970s was reduced effective fares for frequent transit riders. These discounts were implemented by advance sales of weekly or monthly passes, which were typically priced on the basis of one round trip per weekday of the period for which they were valid. By 1981, over 160 U.S. public transit systems -- more than two-thirds of those responding to the APTA survey of fare policies -- offered weekly or monthly passes that entitled their holders to an unlimited number of rides, either free or at a substantial discount from the basic adult fare.

Table 6.4 illustrates typical multiple-ride pass arrangements for several large urban transit systems, with their sale prices expressed as the equivalent number of one-way rides at the standard adult cash or token fare. It indicates that multiple-ride passes are commonly priced substantially below the cash fare for one round trip per weekday. Although few statistics on the frequency of pass use by their purchasers are available, those that are suggest that it probably far exceeds the number of rides at which passes are priced.[5] Since pass sales are a recent innovation among most of the large number of transit systems that now offer them, their growing popularity has apparently been another important source of declining fare revenue actually received per passenger carried.

Table 6.4

Transit Pass Characteristics for Selected Urban Transit Systems in 1981

Urban Areas	Period	Sale Price	Modes Valid For	Equivalent Number of One-Way Rides At Basic Adult Fare[a]
Atlanta (MARTA)	Weekly	$4.00	bus, rapid transit	8
	Monthly	17.00	bus, rapid transit	34
Boston (MBTA)	Monthly	9.00	bus	36
	Monthly	18.00	rapid transit	36
Chicago (CTA)	Monthly	35.00	bus, rapid transit	44
Cleveland (GCRTA)	Weekly	4.00	bus, rapid transit	10
Los Angeles	Monthly	26.00	bus	40
Philadelphia (SEPTA)	Weekly	8.25	bus, streetcar, rapid transit	12
San Diego (SDTC)	Monthly	27.00	bus	45

[a]Pass price divided by basic adult cash fare.

Source: American Public Transit Association, "Transit Fare Summary: Fare STructures in Effect on February 1, 1981."

Aside from their affect on transit system revenues, multiple-ride passes pose other problems: first, they are clearly most appealing to frequent riders, including urban residents who rely heavily on transit service to meet their basic transportation demands. Thus they are most likely to be purchased by paseengers on whom the resulting revenue loss is greatest, and who were demonstrably willing to pay full fares for most of their trips. Perhaps most important, their convenience and unlimited use privilege combine to make passes particularly attractive to peak-hour commuters, whose trips impose a disproportionate share of capital and operating expenses incurred by transit operators. Further, by eliminating or substantially reducing fares faced by their purchasers for additional trips, widespread pass availability also encourages considerable new travel, some of which probably takes place at times of the day or on routes where additional passengers are indeed costly to accommodate.

ELIMINATION OF FARE PREMIUMS FOR PARTICULARLY COSTLY TRIPS

Another important source of the growing gap between transit operating expenses and fare revenue during this period was the widespread elimination of higher fares for particularly costly forms of transit service. This included the reduction or elimination of fare premiums for longer trips, trips made during morning and evening rush hours, and transfers between routes or modes. Variation of fares with trip distance, commonly implemented by surcharges for crossing boundaries of geographic zones traversed by transit routes, was reduced or eliminated in many urban ares during the 1970s as transit operators reduced zone charges, simlified the structure of fare zones, or in many cases eliminated fare zones and associated charges altogether.[6] At the same time, many transit operators reduced fare penalties for riders making transfers by lowering or eliminating charges for second boardings that were part of a single trip. Finally, most of the few examples of higher fares for riders boarding during morning and evening peak hours in the U.S. were eliminated during the decade.

Fare Surcharges for Longer Trips

Table 6.5 illustrates how widespread these changes in fare structure were, again using information for transit systems in 26 of the nation's largest metropolitan areas. As the table indicates, most large bus and rail transit operators imposed zone fares as a means of charging higher prices for longer trips in 1974, yet many of them had abandoned zone fares by 1980. Because typical transit rides were becoming somewhat longer during this period, the widespread elimination of distance-based fare surcharges was a particularly important cause of the failure of average fare revenue to keep pace with escalating costs per passenger carried.

Transfer charges, which require passengers traveling on more than one route or mode during a single trip to pay an extra charge in addition to the base fare, were once another common mechanism for charging higher fares for trips that are costly to accommodate. Yet Table 6.5 shows that free transfers become much more common in the

Table 6.5

Changes in Details of Fare Structures for Transit Systems in 26 Large U.S. Urban Areas

Urban Area Group and Transit Mode	Year	Number with Zone Charges	Number with Transfer Policies: Free	Reduced	Full Fare	Number with Higher Peak Hour Fares
6 Cities with Bus and Rapid Rail Transit Service:						
Bus Service	1974	4	1	2	3	2
	1981	4	1	2	3	2
Rail Service	1974	5[a]	4	2	0	2
	1981	3[a]	4	1	1	0
Bus-to-Rail Transfer	1974	--	1	2	3	--
	1981	--	1	4	1	--
20 Cities with Bus Transit Service Only	1974	19	7	10	3	4
	1981	14	12	8	0	1

[a]Limited zone fares on some systems.

Sources: Josė A. Gomėz-Ibañez, "Federal Assistance for Urban Mass Transportation," Ph.D. Dissertation, John F. Kennedy School of Government, Harvard University, 1975, Tables 6-8 and 6-9; and American Public Transit Association, "Transit Fare Summary: Fare Structures in Effect on February 1, 1981."

nation's transit systems during the 1970s, as many eliminated transfer charges completely, while the number of operators offering discount fares for transfer boardings also increased sharply. Although this may have been a less important cause of declining average fares than eliminating distance-based fares, it nevertheless contributed to the widening gap between operating expenditures and passenger revenues.

Higher Peak Hour Fares

Peak fare surcharges are a third mechanism for charging higher fares to riders who are most costly for transit operators to carry, since vehicle fleet and labor requirements are largely determined by the level of peak hour ridership. Although the exact magnitude of fare surcharges necessary to reflect the higher costs of carrying peak hour passengers is uncertain, there is general agreement that the structure of transit costs dictates significantly higher peak fares. Yet of the 240 transit systems responding to the previously discussed 1981 survey of transit fares, only 9 reported charging higher fares for peak hour travel.[7]

Further, Table 6.5 indicates that among the nation's largest transit systems, virtually all of the few examples of premium fares for peak hour service were eliminated between 1974 and 1980. In many cases, these had been as much as double the comparable fares charged for travel at other hours. Thus major transit operators offered some of the largest fare reductions implemented during the decade to passengers whose trips were most costly for them to accommodate. Because peak hour fare surcharges were not initially widespread, this tendency probably contributed less to the failure of fares to match cost escalation than the more widespread elimination of distance surcharges. Nevertheless, for those few transit operators that once imposed higher peak hour fares, it was a particularly damaging change in fare policy because of the high cost of carrying large passenger volumes during those hours.

ASSESSING THE ROLE OF FARE POLICY

The failure of fare revenue yields to keep pace with escalating operating expenditures was a pivotal cause of rapidly rising transit operating deficits during the 1970s. Growth in transit costs outpaced revenues not only because cost escalation was surprisingly rapid, but also because operators intentionally held increses in base fares to much lower rates. At the same time, many operators also implemented widespread fare discounts for a significant proportion of their riders, while eliminating fare surcharges for trips that were most costly to carry. Although these changes in fare policies were intended to reduce the contribution of urban transportation to air pollution and energy consumption levels, as well as to improve the mobility of various social groups, the revenue losses they entailed proved extemely costly to transit operators who offered them. Because the resulting increase in operating deficits was financed by rapid expansion of government assistance, changing fare polcies effectively shifted much of the burden of explosive increases in transit expenses to local, state, and federal government budgets, and ultimately to the taxpayers who financed their continued escalation.

FOOTNOTES TO CHAPTER 6

1. At the same time, basic cash fare increases in many large metropolitan areas fell well short of escalation in consumer prices, which rose considerably faster than the economy-wide price level. From 1974 to 1980, the implicit price deflation for the Gross National Product rose 54.3%, while the Consumer Price Index for U.S. urban areas rose 67.2%. See Economic Report of the President, 1982, Table B-3, p. 236; and U.S. Department of Labor, Monthly Labor Review, March 1983, Table 18, p. 70.

2. See Urban Mass Transportation Administration, Operating Assistance for Transit: An Evaluation of the Section 5 Program, December 1979, Chapter 2, pp. 11-18, for a discussion of these objectives.

3. U.S. Department of Transportation, Feasibility of Federal Assistance for Urban Mass Transportation Operating Costs, November 1971, pp. 13-17.

4. American Public Transit Association, "Transit Fare Summary: Fare Structures in Effect on February 1, 1981."

5. The Massachusetts Bay Transportation Authority estimates that monthly passes are used for 52 one-way rides on average. See Central Transportation Planning Staff, "Environmental and Socioeconomic Impact Report of the Fare Increase on the MBTA," April 1, 1982.

6. A study of seven American cities reported that four switched from detailed zonal fare structures to either uniform or crudely graduated systems during the 1970s. Urban Mass Transportation Administration, Increasing Transit Ridership: The Experience of Seven Cities, November 1976, pp. 16-17.

7. American Public Transit Association, "Transit Fare Summary: Fare Structures in Effect on February 1, 1981."

Chapter 7

CONTROLLING TRANSIT DEFICITS

The analyses presented in preceding chapters suggest that public transit operators, urban transportation planners, and government transportation policy officials together face several important challenges. One of these is to bring the recent explosive growth of transit operating costs under control, particularly its labor cost component. Second is the need to adapt the deployment of conventional transit services to changing urban development and travel patterns, in order to improve the utilization of services that continue to be provided. Third, transit fare policies must begin to reflect more fully not only escalation in the average costs of carrying passengers and public hesitance to continue subsidizing them, but also important variation in the costs of accommodating different types of passenger trips.

Finally, government subsidy programs for transit need to be redesigned to encourage cost control, more effective service planning, and greater reliance on farebox revenues to meet operating expenses. At the same time, governments need to reassess the effectiveness of subsidies to operators of conventional mass transit in meeting the objectives of transportation, environmental, energy, and social policies. In response to these immediate and longer-term challenges, this chapter presents recommendations for actions by transit operators, local transportation planners, and policy makers in government transportation agencies.

CONTROLLING TRANSIT OPERATING EXPENDITURES

As Chapter 2 indicated previously, rising labor costs accounted for much of the escalation in unit operating expenses for transit service. In turn, a substantial component of the increase in labor expenses was attributable to rapidly rising wage rates and fringe benefit compensation received by vehicle operators and other transit employees. In order to control labor costs, transit managers and local political officials must adopt more aggressive and responsible positions in future labor negotiations, including bringing wage and salary increases into line with standards such as improvements in labor productivity or compensation for similar work in the private economy. Comparing increases in transit workers' compensation to those for other public employees or highly unionized private sector trades (such as intercity and local trucking) is highly misleading, because those groups are also insulated from the forces that determine wage rates in normal private labor markets. Perhaps the most important challenge facing transit managers is to develop a more realistic standard for determining reasonable wage and salary levels, and to adopt firmer negotiating postures in collective bargaining procedures to hold compensation increases to the rates it dictates.

Another important component of labor compensation that has escalated dramatically in recent years is fringe benefits paid to transit employees, including vacation pay, sick leave, medical insurance, and related employee benefits. The value of employer contributions for these benefits is already quite large -- by 1980 they represented nearly one-third of total employee compensation -- and, more important, has grown extremely rapidly in recent years.[1] Increasing contributions for these benefits has thus been an important, if less visible, means by which transit managers have relinquished control over transit labor costs. Bringing growth in fringe benefit compensation into closer conformity with that in other sectors of the economy is thus another important avenue for controlling transit operating expenses.

At the same time, transit operators should pay closer attention to the cost implications of the various pay premium provisions included as part of labor agreements, chiefly those for split shifts, overtime, night, and weekend work. These provisions commonly require that such work be paid at rates 50% higher than an employee's normal wage rate, with some specifying pay premiums as high as 100%. Another critical labor agreement provision, as the analysis presented in Chapter 4 illustrated, is the threshold after which overtime pay rates must be paid to drivers assigned to split shifts. Together, these spread penalty and pay premium provisions often result in effective hourly pay rates that average 150% of an employee's basic wage, and approach twice the basic hourly rate in some instances.[2] More careful attention to the cost implications of these provisions, in both the negotiation of specific labor agreement provisions and the scheduling of vehicle operator work shifts, should be another element of transit managers' efforts to control escalation in labor costs.

Another important avenue for controlling labor costs is to improve labor productivity in transit operations, which as Chapter 2 indicated has also been a major source of increasing unit operating expenditures in the urban transit industry. The most obvious way to accomplish this is to improve the productivity of vehicle operators, primarily by changing the restrictive labor agreement provisions that currently complicate teh assignment of driver work shifts and result in considerable underutilization of paid driver time. These include restrictions on the length of unpaid breaks in drivers' work shifts, the maximum overall duration of split shifts, and the fraction of driver shifts that can be split. One recent study reports that in large bus systems, these rules can require as many as 1.4 pay hours for each hour that a driver actually operates a vehicle in revenue service, although slightly lower multiples are most common.[3]

As an illustration of the potential cost savings from even slightly relaxing such restrictions, Chomitz and Lave estimate that extending the 12 hour maximum on driver work shifts that governs many transit systems' driver assignments to 13 hours could reduce total labor costs for providing a given schedule of transit service by as much as 20%. They estimate further that requiring pay premiums after 11 rather than 10 hour driver shifts could reduce labor costs another 7% in many transit systems. Similarly, permitting more widespread use of part-time drivers could bring important cost savings, since their work shifts would include considerably fewer paid hours during which they were unutilized than is currently the case for many full-time operators.[4]

Potentially important cost savings might also stem from minor modifications of current restrictions on the overall fraction of driver shifts that can be split, since this provision now requires some transit systems to employ two full driver shifts to operate a single additional vehicle during both morning and evening peak hours. Although the possible cost savings from each of these work rule changes depends on the degree of peaking in daily ridership patterns faced by individual transit systems, these estimates do suggest that significant labor cost savings could result from relatively minor modifications.

Miscellaneous other measures may also offer some potential for reducing the number of paid labor-hours required to produce a given schedule of transit service. One study reports that absenteeism in the U.S. public transit industry averages nearly 30 days per employee per year, which increases the size of the so-called extraboard, a staff of operators paid to remain ready to assume the shifts of drivers who are absent or delayed.[5] Reducing absenteeism to a more acceptable level -- private industries often average fewer than 10 days per employee per year -- could thus substantially reduce the number of extraboard drivers who must be paid to remain available to assume the shifts vacated by absent drivers. Similarly, extraboard staffing could be reduced by improvements in driver run-cutting practices that produce schedules with fewer short vehicle assignments that are difficult to combine into full work shifts to which a single driver can be assigned. Allowing regular dirvers to bid for such "unpairable trippers" is another measure that has produced significant reductions in extraboard staffing needs in some transit systems that have adopted it.[6]

Labor requirements entailed in providing transit service could also be reduced by the continued acquisition of some larger vehicles, which has historically been an important means for reducing labor input per mile of passenger-carrying capacity in many transportation industries. In particular, wider use of currenlty available double-deck and "articulated" buses, which feature seating capacities in the 60-80 passenger range, on some routes with high passenger volumes could provide important labor cost savings without necessitating unacceptable reductions in service frequencies. Of course, the potential labor cost reductions from measures that in effect substitute capital inputs for labor services in transit operations must be balanced against the higher capital costs they entail, such as those for new, larger buses.[7] Thus the potential cost savings from such measures are likely to vary considerably among specific transit systems and routes, and should be carefully assessed by transit operators before they are implemented.

RATIONALIZING TRANSIT SERVICES

A second major challenge is to make transit service planning more responsive to changing patterns of urban travel demand, in order to improve the utilization of services that continue to be provided. This will require transit operators and planners, as well as transportation policy-makers, to understand more completely the economic, demographic, and technological forces that continue to alter the spatial and temporal patterns of transit ridership. Adapting service policies to changing demands for transit travel will require much greater willingness to reduce services on which ridership is declining than planners and operators have recently demonstrated. However, this task would be eased considerably by fare levels that more realistically reflected the costs of providing lightly-used services, particularly on routes where fares have been kept low in an effort to forestall ridership losses resulting from declining demand for transit service.

On the positive side, ridership on a few types of routes might be increased by well-planned service improvements in certain markets that are now underserved. The best example is probably the provision of more high speed, express or limited-stop bus service from suburban residential areas to centers of employment and commercial activity, 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 auto travel, in terms of both door-to-door travel times and passenger comfort levels. Although trips in these corridors are likely to be longer than average and particularly concentrated during peak hours, making them costly for transit operators to carry, auto travel is often comparably expensive as well as time-consuming because of traffic congestion and high parking charges at the trip destination. Hence many travelers seem likely to use reliable, rapid service in these developing travel corridors, even at the relatively high fares that would be necessary to cover the increased costs for providing improved service levels.[8]

While express radial services are probably the best example of underdeveloped markets for transit service, continuing evolution in urban travel demands may create others. The important challenge for planners is to more fully understand the changing market for urban transportaiton, and to be more willing to cut poorly utilized services while experimenting with new ones. At the same time, it is important that transit operators <u>not</u> resort to across-the-board service cutting, since there are probably many existing routes where transit <u>can</u> continue to offer schedule frequencies that attract substantial utilization even at fares that cover a more reasonable fraction of costs than is currently the case.

The continuing failure to reorient urban transit services in response to changing demand circumstances has been motivated by understandable political and social concerns. Nevertheless, maintaining or extending transit service in markets where attractive service levels are costly to operate and often lightly ridden has been a central cause of the intensifying financial difficulties faced by transit operators. With public willingness to continue subsidizing expanding operating deficits in serious doubt, service decisions by transit planners and the local political officials to whom they are frequently responsible must become more sensitive to the changing character of transit demand if the industry is to remain a viable element in the nation's urban transportation system.

REVIEWING FARE STRUCTURES

Finally, the fare structures of most urban transit systems need serious revision if the recent explosive growth of their operating deficits is to be brought under control. The movement toward lower and more simplified fare structures during the 1970s was encouraged by nearly all government agencies involved in urban transportation planning, as well as by many rider groups and other transit advocates. Yet the analysis reported in Chapters 2 and 6 demonstrated the pivotal role these changes in fare policies played in raising transit deficits.

If the contribution of fare structures to escalating deficits is to be reversed, transit operators must first bring the overall level of fares into closer conformity with the cost of providing transit service, since the typical transit passenger now pays only about a third of the operating cost his trip imposes. Some progress in this direction has recently been made, although it has typically been precipitated by short-term financial crises faced by individual operators (such as in Chicago, New York, and Boston), rather than by more reasoned consideration of the arguments favoring higher fares.

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. In addition to implementing more sophisticated cost estimation techniques, doing so will require a renewed willingness by transit operators to impose surcharges for particularly expensive types of transit service. This challenge may be compounded because zone fares, peak fare surcharges, and higher transfer charges are likely to be even less popular politically in most cities than general fare increases. Still, their predictable unpopularity should not cause transit operators simply to resort to arbitrary, across-the-board fare increases in the name of "equity."

The most important of these selective fare charges 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 underutilized. Over the longer term, this could substantially reduce peak vehicle and driver requirements and thus the total cost at which given levels of service can be provided. Further, peak period transit ridership consists largely of work commuters, relatively few of whom are poor, while off-peak riders include many who do have low incomes. Hence higher peak hour fares would transfer to riders with greater average incomes some of the added costs they impose, while perhaps allowing the fare burden borne by lower income riders to be reduced.

Another important form of surcharge for particularly costly service that should be relied upon more heavily by transit operators is distance- based fares, whereby higher fares are charged for longer trips through the use of zone fare systems or mileage supplements to basic fare levels. The previous analysis suggested that with the length of typical transit trips apparently growing, eliminating the higher fares once commonly charged for longer trips has been another important cause of the widening gap between operating expense and fare revenue collected per passenger. Insofar as this is the case, that gap could be narrowed substantially by charging fares that varied at least crudely 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 increase 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 U.S. 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 as they transferred more of the burden of financing particularly costly forms of transit service to those who use them, distance-based fare surcharges could actually reduce the fare burden borne by lower income riders, who typically make somewhat shorter trips than higher income passengers.[9]

RECONSIDERING GOVERNMENT POLICIES

The alarming deterioration in the financial condition of the U.S. pubilc transit industry during the past decade also raises serious challenge to government policies toward urban mass transit. With accumulating evidence that growth in the availability of government operating assistance may itself be a primary cause of the escalation in costs and deficits, one of these challenges is clearly to reassess the design and operation of government subsidy programs for transit at the federal, state and local level. The analysis presented in Chapter 4 provided important evidence that the guaranteed availability of government operating assistance reduces transit managers' incentives for operational efficiency and other cost control measures, thereby contributing to escalation in expenditures per unit of service provided.

This finding clearly suggests that local and state government agencies involved in transportation finance should very carefully evaluate decisions to earmark specific tax sources for transit assistance, since those decisions often exempt operating subsidies from much of the fiscal scrutiny normally applied to periodic budget appropriations funded from general tax sources. Similarly, state and federal transit assistance programs that distribute operating subsidies according to formulae that fail to take financial or operating performance of their recipients into account need to be seriously reconsidered. The distribution formulae for these programs need to be revised to reestablish specific incentives for transit operators to reduce operating expenses per passenger (or passenger-mile) carried, as well as to cover a larger share of those expenses from farebox revenues.

Of course, those operators who are most successful in doing so will incur the lowest deficits per passenger, and will thus display the least "need" for operating assistance. Although this is an unfortunate complication, it is certainly a preferable alternative to the current subsidy distribution process, which in effect rewards transit operators in proportion to escalation in their operating expenses and the fare reductions they must make to achieve acceptable utilization of their services. Even the recent revision of the distribution formula for federal operating assistance (under the newly created Section 9 program), which will allocate subsidies among transit operators partly according to the number of vehicle-miles of service each supplies, seems unlikely to reestablish the serious incentives for controlling operating expenses that appear vital to bringing escalating transit deficits under control.

These complications illustrate some of the problems unavoidably entailed in programs that directly subsidize expenditures by suppliers of urban transportation services. Even if the distribution of operating subsidies can be rationalized to provide incentives for improved cost control and passenger-carrying productivity, the effectiveness of such incentives is likely to be limited as long as subsidies continue to be offered only for conventional mass transit service. As many transportation analysts have argued, distributing an equivalent level of subsidies among transportation <u>users</u> who could choose among a variety of travel modes -- including conventional mass transit -- could produce still more rational deployment and pricing of transit service.

Beyond these immediate challenges, it is also impotant to reexamine the role of conventional mass transit service in the nation's urban transportation system. This will require policy-makers to reassess whether expanded levels of conventional mass transit service and heavily subsidized fares can help to achieve the ambitious objectives of the nation's transportation, energy, and environmental policies without imposing intolerable burdens on government budgets and the taxpayers who finance them. Such a reassessment is vital because changes in the underlying structure of urban transit operations, together with continued evolution in urban travel demands, suggest that some of the role historically served by conventional bus and rail transit could be served more effectively and perhaps at lower cost by other modes of travel. Further, in some urban travel corridors private operators of conventional transit service may be able to provide it at more reasonable costs than those now incurred by public transit authorities.

The most important challenge for government policies toward urban transportation is not to increase, but instead to reduce reliance on heavily subsidized conventional mass transit service, by fostering the innovation and competition necessary to encourage developments such as these. The experience with a decade of massive government assistance suggests that continuing to provide escalating subsidies directly to transit operators is destined to fail to significantly expand its role in urban transportation. Worse, it is also destined to continue to discourage the innovations necessary to improve the quality and variety of urban transportation services while controlling their resource demands on the remainder of the nation's urban economy.

FOOTNOTES TO CHAPTER 7

1. American Public Transit Association, Transit Fact Book 1981, Table 18, p. 66.

2. American Public Transit Association, Labor Information Review, 1978-79 edition.

3. Timothy A. Patton, "Transit Performance Indicators," staff study, U.S. Department of Transportation, Transportation Systems Center, April 1983, Table 3, pp. 13-14.

4. Kenneth M. Chomitz and Charles A. Lave, Part-Time Labor, Work Rules, and Tansit Labor Costs, Report CA-11-0018-1, U.S. Department of Transportation, Urban Mass Transportation Administration, January 1981, Tables E-4, E-5, and E-6.

5. Peat, Marwick, Mitchell, and Company, Study of Operator Absenteeism and Workers' Compensation Trends in the Urban Mass Transportation Industry, Report UMTA-PA-06-0050-80-1, U.S. Department of Transportation, Urban Mass Transportation Administration, 1981.

6. Chomitz and Lave, Appendix C.

7. For a discussion of the question of cost savings from larger buses see Richard Albright et. al., Articulated Bus Report, Report DOT-TSC-UMTA-82-22, U.S. Department of Transportation, July 1982.

8. The limited available evidence suggests that some such services could at least cover their operating expenses, and might well do better. In New York City, for example, nine private express bus companies operate over 34 routes, carrying approximately 25,000 riders annually. Fares charged are typically $2.50 one way, revenue yields from which apparently cover slightly more than 100% of direct operating expenses for most of these operators. See Survey of Express Bus Riders in the City of New York: Final Report, Submitted to New York Metropolitan Transit Authority by Brooklyn Polytechnical College and Charles River Associates, 1976.

9. An extensive discussion of the prospective effects of distance-based fares on cost coverage and fare burdens on riders in different income classes is contained in Robert B. Cervero, Martin Wachs, Renee Berlin, and Rex J. Gephart, Efficiency and Equity Implications of Alternative Transit Fare Policies, Report DOT-CA-11-0019, U.S. Department of Transportation, Urban Mass Transportation Administration, September 1980, Chapters 5 and 7.

NOTE: This report is an analysis of the various factors contributing to the costs of urban transit. Part of its content includes policy and other recommendations based upon this researcher's perception of the issues involved. Recognizing that there may be many alternative approaches to resolving transportation problems, these positions may not necessarily reflect those of the U. S. Government. As such, no endorsement of these recommendations is either expressed or implied by the U. S. Department of Transportation.

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