

ter and other special operating revenues are practically nonexistent on commuter rail-road operations, rail rapid transit systems, and some large municipal bus operations. On the other hand, these revenues amount to approximately 9 percent of the total revenues of the nation's largest privately owned public transit system, Transport of New Jersey; about 20 percent of New Jersey's second largest operation, Inter-City Lines; and almost that much on the 10 privately owned bus systems in Nassau County. These revenues can be quite significant to a specific locality that is contemplating assistance to, or direct operation of, its public transit system. Accordingly, I believe the choice should be left to the state or local agency as to whether it will expect to include continuation of charter service and other special operating revenues in its financing plans. The local agency is in the best position to know local competitive conditions and to determine the economic nature of the operation with or without such service.

Finally, there is the question of public versus private ownership and operation of public transit services. As I noted earlier, publicly owned systems are dominant in terms of the number of transit passengers carried but not in the number of systems operated. The issue, with respect to operating subsidies, is usually not whether operating subsidies will be required but how much the amounts will be. If the subsidies are designed as a permanent program and calculated to make the private operator whole, this includes depreciation and an adequate return on his investment. It becomes a matter of subsidizing a private profit with public funds and agreement on depreciation policies. The alternative, of course, is for the public agency to acquire the property and calculate subsidy needs based on operating needs, with or without a capital replacement charge. With most of the major transit systems now under some form of public ownership, and the trend apparently continuing, I do not view this as a major issue in the debate over implementation of a program of federal operating assistance for public transportation systems.

The immediate problem is just that—implementation of a program that will get the funds where they are needed quickly.

## REFERENCES

1. Feasibility of Federal Assistance for Urban Mass Transportation Operating Costs. U.S. Department of Transportation, Nov. 1971.
2. Ronan, W. J. Statement to the Subcommittee on Housing, House Committee on Banking and Currency, Feb. 23, 1972.

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By almost any measure, the urban transit industry has been in a decline for at least the past 20 years. Employment, fleet size, and number of passengers carried have all fallen. Although gross income has remained roughly constant in the recent past, this appears to be due largely to fare increases just offset by the decrease in number of passengers. The conventional wisdom is that the industry is sick and needs substantial subsidy in order to survive.

As part of the Urban Mass Transportation Assistance Act of 1970, Congress ordered the secretary of transportation to study the "feasibility of providing Federal assistance to help defray the operating costs of mass transportation companies in urban areas." The study conducted under that mandate turned up a number of interesting facts about the industry, some of which (a) are at considerable variance with the conventional wisdom and (b) raise serious issues about the federal role in urban transit. This paper reports

on some of the findings and issues of that study.

The sections that follow discuss the conceptual issues involved in the subsidy problem, analyze the "industry deficit," describe several possible subsidy mechanisms, and evaluate those mechanisms. The final section discusses the conclusions reached in the study submitted to Congress and suggests directions for further work.

## CONCEPTUAL FRAMEWORK

The report to Congress (1, pp. 51-52) listed a number of possible objectives of an operating subsidy program. (Throughout this paper, the term "operating subsidy" refers to a subsidy specifically intended to relate to costs of transit operation. This is in distinction to the UMTA Capital Grant program, which subsidizes the capital costs of transit operation.) The objectives were

1. Mobility for urban populations,
2. Mobility for nondrivers,
3. Help for the poor,
4. Maintenance and improvement of transit services,
5. Stabilization or reduction of existing fares,
6. Stimulation of ridership,
7. Reduction of congestion,
8. Preservation and improvement of the environment,
9. Improvement of the quality of urban development,
10. Help for financially burdened cities and states,
11. Offsetting of subsidies for the automobile,
12. Reduction of the deficit, and
13. Achievement of income redistribution.

It is significant that only objectives 4, 5, 6, and 12 refer directly to the condition of transit firms and that the majority of objectives are more directly concerned with the condition of transit riders and urban areas. This reflects the opinion of those involved in the study that the deficit itself was not the problem but a symptom of a problem. For purposes of this paper, it is suggested that the objectives outlined above may be condensed into the following definition of an ideal type of subsidy: one that would assist the improvement of mobility for people in cities, without distorting economic efficiency in resource allocation either within the transportation sector or between the transportation and other sectors of the economy.

### Improving Mobility

It should not be automatically assumed that preserving existing transit service will improve mobility of people in cities any more than it should be assumed that providing more highways in urban areas will achieve the same objective. A major cause of the "crisis in transit" is the fact that urban travel demands today are substantially different from what they were several decades ago, yet the urban transit services available today are substantially the same as they were several decades ago. With a few notable exceptions, they offer people mobility and access to about the same subset of destinations today as they did just prior to World War II. Any mechanism proposed for subsidizing transit should be tested against its ability to assist in providing increased access to a variety of different destinations.

### Allocating Resources

Clearly, most if not all potential subsidy mechanisms are incapable of satisfying all the criteria of the ideal type of subsidy. For example, consider one common defense

of transit operating subsidies; Because urban transportation markets have already been distorted (at least in terms of local decision-making) by the availability of federal funds for highway construction and by implicit subsidies to all-day parking in congested areas, transit subsidies are needed in order to overcome the existing distortion in favor of highways. Accepting this argument results in advocating subsidies for both modes, which in turn is very likely to result in too many resources being devoted to transportation as contrasted with other urban needs. If the transport mode choice is "rigged," it does not follow that the only remedy is to institute an operating subsidy program for transit; many other devices are available to alter the relative prices and levels of service of the competing modes. Using an operating subsidy program may in turn rig choices in favor of transit and against other urban public goods.

In addition to the goals of mobility improvement and efficient resource allocation within cities, the study of operating subsidies highlights some other issues of general importance in the area of federal-local relations. Two of these issues are discussed below.

### Classes of Grantors

As with many other proposed federal programs, the fiscal-imbalance argument was advanced in defense of operating subsidies. In general terms, this argument states that the federal government has the broadest tax base and hence the best ability to provide the funds for programs and the local governments are best able to decide local priorities. This, in fact, is the thrust of the many revenue-sharing proposals that have surfaced during the past few years.

The fiscal plight of the cities has been the subject of many a paper and speech. It can be argued, however, that the extent of a locality's willingness to tax itself for transit improvements (or even mere maintenance of basic service) should be taken as the measure of the priority assigned to transit service by residents of that locality. It is not clear that higher levels of government are better able to judge the levels of service that a given city should be interested in having. Obviously, offering subsidies will influence the ranking of local priorities. But, if the interest does not exist a priori at the local level, should it be imposed from above? Yes, if there exists clear evidence of externalities extending well beyond the boundaries of the urban area involved. It remains to be shown that this is the case for urban transit.

If programs financed at the local level run the risk of being undernourished, programs funded by higher levels of government run the risk of being unresponsive to local needs. A subsidy from the federal level implies some set of rules to be applied uniformly across the country in determining eligibility for subsidy payments and amounts to be received. It is by no means clear that the urban transportation problem is similar in all parts of the country (2). Yet establishment of any given level of subsidy payments, taken together with local decisions about fare levels, and given existing patronage levels will determine the levels of transit service that a firm can afford to provide, just as revenues determine the amount of service that can be provided without subsidies. The very fact that various states and cities have chosen to deal with the problems of urban transit differently—or not at all—suggests that the problem is not perceived to be the same all over the country. Any federal operating subsidy program, in particular, that provides the "right" amount of aid for firms in one state is very likely to provide too much aid for some other states and not enough for the rest. Similarly, a state-level program, in a state whose cities have widely different characteristics and problems, may not be able to deal responsively with the problems of all areas within its jurisdiction.

### Classes of Recipients

Conceptually, transit operating subsidies could be given to any or all of a number of

classes of recipients. Who gets a subsidy depends on the real goals of the subsidy program and the administrative difficulties involved in distributing the subsidy. Subsidies from the federal government might be paid to the transit operating firm, to a state or local government, or to any of a number of classes of riders. Although the outcome of making payments to any of these classes is somewhat conjectural in light of the limited experience we have had with transit subsidies, it is possible to outline the most likely outcome of each type of payment.

#### Payments to Firms

Payments to firms offer the potential of the greatest degree of control over the operations of the firm, if the subsidy grantor is willing to exercise the necessary administrative control. Should it be desired, payments could be very closely keyed to deficits, operating expenses, patronage, or any other measure of the firm's activity.

This approach has several disadvantages to offset the advantage of tight control. For one thing, it would be all too easy for the subsidy grantor to eliminate any incentive for transit management to use its judgment. The tighter the control exercised is, the greater this danger is. Another problem is that offering the subsidy to the firm eliminates the possibility of looking for trade-offs between subsidies to transit, for example, and subsidies to industry or housing developers to locate where the need for transportation would be minimal. A third difficulty is the tendency of such a payment mechanism to further institutional rigidities and eliminate the possibility of innovative corporate forms of transit being attempted.

#### Payments to Other Governments

This approach has the appeal of enabling most of the administrative burden, as well as the decision-making process about what is optimal for a given area, to be brought closer to the area involved. A requirement for local matching funds could be employed to help ensure that local priorities would not be too badly distorted by the availability of federal aid. States or localities could even be encouraged to evaluate trade-offs between aid to transit and other ways of easing the transportation burden, if the grant terms were sufficiently flexible.

This approach also has its drawbacks. States could, in theory, allocate funds to various cities in ways that the cities would feel to be grossly inequitable. If the subsidy formula did not specify a limit on the aggregate amount of funds to be spent on the subsidy program, it would be impossible to predict from one year to the next what the total subsidy bill would be. If the formula did specify a limit, it would be impossible to secure an equitable distribution of funds that would meet the needs of all cities.

The requirement for a matching share may also subject the local decision-making process to further distortion. The example currently in vogue is that a city can spend a million dollars in local funds to get \$10 million worth of new highways or \$3 million worth of new transit facilities. It would be difficult to specify any level of local participation that would not influence the intermodal trade-off one way or another.

#### Payments to Users

Proponents of free enterprise have argued that the best form of subsidy is one that is not tied to any particular mode of transportation but rather enables various classes of riders to choose via the market mechanism the mode that best suits their needs. Subsidizing riders has the appeal of enabling the subsidizer to target the payments to specific groups according to their needs. For example, if aid to low-income riders were the goal, transportation stamps could be issued in a manner analogous to the present food stamp program. Or, to broaden the scope, transportation vouchers could



be issued that would enable an individual to choose transit or taxi service according to his needs and the availability of service. Ideally, this should create more competition among the modes and result in a more optimal allocation of resources.

This technique also has drawbacks. Given the current pressure for welfare reform, it seems extremely unwise to advocate yet another categorical grant program. There is also a danger of creating a black market in vouchers or stamps and some antipathy to any program involving a "means test." Nor is it clear that such a program would have the desired result in terms of rationalizing service offered by various public modes. And, of course, such a program does nothing to encourage trade-offs between transportation and location decisions.

### Administration

The discussion in the preceding section leads naturally to the final conceptual issue to be discussed: the administrative problem. The ideal type of subsidy would, of course, have no administrative cost. In the real world, however, the trade-offs between administrative cost and subsidy effectiveness must be considered for each proposed subsidy mechanism. The ranking of objectives to be achieved by a subsidy will influence administrative cost.

Consider, for example, a subsidy mechanism whose primary objective is to improve mobility for people without access to automobiles. To maximize mobility improvement, subsidy administrators ought to know the following: where people want to go; what alternative modes are now available, and at what costs; and what new alternatives might be offered, and at what costs.

Let us assume for this discussion that it has been decided to give the subsidy to a provider of transit service rather than to the potential users. If a specific target set of travel demands can be identified, there is still the problem of ensuring that the subsidized provider does in fact provide the desired service. The ultimate administrative arrangement in this circumstance is perhaps the contract-for-services approach used in several state transit subsidy plans. Whatever the merits of such a program may be at the state level, it seems highly doubtful that such an approach would be workable at the federal level. Two alternatives appear in this approach: The providers might contract directly with the federal government, or the federal government might reimburse the states for their expenditures on such a program. Neither alternative is particularly palatable. The first substitutes federal for local judgment about the level of service to be provided; in effect it puts the federal government in the local transit business. The second has the effect of dictating to the states the way they should relate to cities and transit firms. Not only do both alternatives raise all sorts of states'-rights issues, but the sheer weight of regulation necessary to administer such a program would probably stifle the very kinds of innovation that ought to be encouraged. For administrative convenience, dealing with one large firm will probably be preferred to dealing with several smaller ones. But there is no evidence to indicate that scale economies exist in urban bus transportation; indeed, there is some evidence to the contrary (3). Jitney operations, neighborhood cooperative transport services, and similar innovative experiments would likely not be encouraged under a subsidy-regulatory scheme of the kind discussed in this section.

The levels of information required to properly administer the more detailed, contract type of subsidy arrangements simply do not exist for many transit firms today. It would be extremely difficult, for example, for the typical transit firm to give an accurate estimate of the average and marginal costs of providing a vehicle-mile or a vehicle-hour of service. And if cost statistics are bad, demand statistics are totally lacking. A contract type of subsidy, optimally, should relate subsidy payments to travel demands; as of this date, no one in or out of the transit industry really knows what the demands are for existing services let alone for innovative new types of service. A well-designed, highly detailed contract type of program would incur substantial costs for base-line and ongoing data collection.

### Some Criteria

Based on this discussion of the issues, some objectives for a subsidy program can be outlined. These objectives may then be converted into criteria to use in evaluating specific subsidy mechanisms. It should be clear from the preceding discussion that the evaluation will have to be somewhat subjective; at best, an objective ranking of various proposed mechanisms may be made with respect to the various criteria. But even if this is done, a "voting paradox" situation is likely to result wherein no one mechanism emerges as a clear winner and the most positive assertion to be made is that some mechanisms are clearly dominated. A later section discusses this matter with reference to various proposed mechanisms.

The criteria to be applied to a proposed subsidy mechanism are as follows:

1. How much can it be expected to increase mobility? (Will it at least preserve existing service and fare levels?)
2. Will it distort resource allocation? How efficient is it? How equitable is it in terms of its impact on different groups of travelers in one city? In different cities? (For example, how well would the proposed mechanism do at enabling ghetto residents to travel to job sites? Is this mechanism the most efficient way of providing for that type of travel demand? Will it work equally well in, say, Philadelphia and Phoenix?)
3. Will it encourage or discourage innovation?
4. How much will it cost to administer?

This list is not intended to be exhaustive. For one thing, it pretty much ignores the political implications of various types of pass-through mechanisms that might be employed as well as the local prerogatives issue, except to the extent they impinge on innovation or other criteria. Of course, the reader is free to add his own list for use in testing the proposed mechanisms. But for economic analysis, the 4 touchstones of mobility-firm solvency, efficiency-equity, innovation, and administration are the primary evaluative criteria.

### OF TRANSIT DEFICITS

Before analyzing the impact of subsidy mechanisms, one must know the current financial state of the industry. At this point we begin to look rather sharply at the "conventional wisdom." The data in the following discussion were furnished by industry trade associations from data provided by member firms.

For purposes of analysis, it is useful to distinguish among 3 types of firms providing urban transit service. By far the largest number of such firms provides service by motor bus only; according to the American Transit Association, there are on the order of 1,150 such firms in the country. They are called bus-only firms in this paper.

Fewer than 20 transit firms provide service by rail rapid transit on separated right-of-way, surface streetcar, trackless trolley, or other modes. Those firms are concentrated in less than a dozen cities. They are referred to here as multimodal firms, even though some of them provide rail service only.

A third category of urban transit service is provided by railroad commuter operations. There are 16 such firms, omitting the Staten Island Rapid Transit Operation that was taken over from the B&O by the Metropolitan Transportation Authority in New York City. Commuter operations are confined to operations around hubs such as Boston, New York, Philadelphia, Washington, and Chicago; a small amount of service is offered in the Pittsburgh, Los Angeles, and San Francisco areas. These firms are called commuter rail operations.

The total reported deficit from urban transportation operations included in the sample used for the study was about \$276 million. In 1969, allowing for the fact that firms included in the sample carry approximately 85 percent of the passengers transported in urban transportation in the United States and assuming that nonreporting firms ex-

perienced losses proportional to the number of passengers carried (a relatively conservative assumption, as the discussion below will make apparent), it is quite plausible to assert that the 1969 "transit deficit" was on the order of \$320 million. Reported surpluses were about \$15.8 million; based on the same reasoning, they might have been as high as \$18 million for the industry as a whole.

The above figures are not very revealing by themselves. Far more interesting is the breakdown by industry sector for sample firms, as given in Table 1.

### Bus-Only Firm Deficits

Although 47 firms in the sample reported deficits in 1969, 3 of those firms accounted for more than 49 percent of the reported deficit of \$15.2 million, 9 for 75 percent of the deficit, and 20 for well over 90 percent.

Deficits were not closely correlated with city size; dividing reported deficit by SMSA population yielded figures ranging from well under 10 cents per person to well over \$3 per person among the 20 cities with the largest deficits. Largest reported deficit for a bus-only city was approximately \$3.65 million in 1969; average deficit for those cities reporting deficits was \$323,000.

The other 50 firms in the bus-only sample reported break-even or profitable operations in 1969. Total reported profits were approximately \$10.6 million; the total reported deficit was \$15.2 million. The bus-only sector of the industry was thus by no means entirely a red-ink operation as of the end of 1969, although it could hardly be regarded as thriving.

### Multimodal Firm Deficits

Of 12 multimodal firms in the sample, 8 reported deficits totaling \$166.5 million. The other 4 showed a total profit of about \$3.5 million. The New York City Transit Authority, of course, showed the biggest loss by far—just under \$100 million and well over 50 percent of the reported losses in the sample. Boston's MBTA reported a loss of about \$44 million, amounting to a little more than 25 percent of the reported deficits of multimodal firms. None of the other firms reporting experienced individual losses of more than 7.5 percent of the total.

The comparison of deficits and urban populations is even more interesting for multimodal than for bus-only operations. Of course, most of the multimodal firms are in very large cities, so the distributional implications of the reported deficits (as between large and small cities) cannot be inferred from the multimodal data in any case. Comparing deficits with SMSA populations, though, one notes that the range goes from 22 cents per person for the Philadelphia operations (combining SEPTA and DRPA) to about 40 cents for Chicago and then jumps sharply to about \$8 per person in New Orleans, \$9 per person in New York City, and an amazing \$16 per person in the Boston area. By comparison, deficits among bus operations are trivial.

### Commuter Rail Deficits

Rail information was reported by the industry association on a road-by-road basis instead of a city-by-city basis, so comparisons are difficult. Total reported deficit for 1969 was about \$95 million for 15 roads; the Penn Central alone accounted for more than a third of the losses.

Calculations for 1970, from another source and on a somewhat different basis, indicated a total deficit of approximately \$86 million for commuter rail operations in 5 urban areas: New York, Philadelphia, Chicago, Boston, and San Francisco. Not surprisingly, New York and Philadelphia account for about 85 percent of the total deficit.

The relative importance of rail facilities may be of interest. According to one

source, about 1 revenue passenger in 15 travels by rail in New York City, 1 in 9 in Chicago, 1 in 5.8 in Philadelphia, 1 in 32 in San Francisco, and 1 in 44 in Boston. For New York and Philadelphia, at any rate, it seems fairly clear that rail operating deficits are disproportionately high relative to the volume of traffic served.

### Defining the Deficit

The purpose of this paper is not to establish the plight of the transit industry, nor to assess its cost-effectiveness in terms of reported costs and numbers of passengers carried. Nor should the data presented in preceding sections be taken as definitive. Rather than dwell at length on the significance of the specific numbers presented, we turn now to a discussion of the theoretical concept of "the deficit" in an attempt to better understand just what is happening in the transit industry.

### The Deficit as Reported

The deficit figures used in the discussion above came, as noted, from industry sources. They were calculated, in all cases, by summing operating and nonoperating revenue from transportation services and by subtracting from the total thus obtained the total costs reported. This is essentially the approach used by the industry itself in assessing its condition. Unfortunately, it raises several conceptual issues of major consequence, which are discussed below.

### Depreciation

The deficit figures used in the discussion include the depreciation figures as reported by the individual firms to their industry associations. There are 2 problems here. The first, and most serious in terms of magnitude, is that some publicly owned firms carry no depreciation account at all, following an old tradition of governmental accounting that involves an operating budget and a capital budget but no allowance for depreciation. There is no consistency among firms in this regard; among the largest cities, New York does not calculate depreciation but almost all others do.

The second problem is that, even among those firms that do report depreciation, the uniformity that exists is more likely to reflect Internal Revenue Service guidelines than the true rate of wear and tear on assets. The underlying issue in any case is, What is the true value of capital resources used up in producing a year's supply of transit? The answer, unfortunately, is simply not obtainable from reported accounts. As a result, it is impossible to tell whether the reported deficits include the cost of maintaining the capital stock in constant condition, whether the capital stock is being worn out, or whether it is in fact being built up.

### Other Services

Although less common than in former times, and largely limited to the biggest cities, arrangements involving transit firms in payments-in-kind still exist and obscure the profit-and-loss analysis. There are nontransit services that transit firms are forced to provide to cities under the terms of a franchise, and there are transit services that cities provide to transit firms. An example of the former is snow removal by the transit firm along streets carrying transit routes; an example of the latter is the provision of purchasing services provided by a municipality to its publicly owned bus firm. In both cases, the transit operation's reported costs reflect something other than the full cost—and only the cost—of providing transit.



## Local Subsidies

Finally—and most important of all—there is the entire range of state and local subsidies provided to transit operations under a wide variety of arrangements. In many cases, these subsidies are not reported as income to the transit firm; the books are balanced after the firm computes its operating loss for the year. In other cases, some of the subsidy—such as reimbursement for discount fares—is reported as income, but there may remain a net deficit to be offset by the general treasury.

In the end, the deficit reported by the industry for its own purposes is best thought of as the shortfall between operating revenues and operating expenses, with the reported figures being somewhat distorted by differences in accounting and reporting systems. To say this is not to say that the deficit is fictional—far from it. The difference between fare-box revenues and costs is real and substantial. The price that users are willing to pay for the service is significantly less than the cost of producing the service for a large number of firms carrying by far the majority of total transit riders. In analyzing the specific subsidy mechanisms discussed below, however, one must keep in mind that a considerable portion of the shortfall is already being covered, in one way or another, by existing subsidy mechanisms.

## SOME SUGGESTED SUBSIDY MECHANISMS

The report to Congress discussed a variety of possible ways of allocating subsidy to transit firms. This section briefly describes the allocation mechanisms proposed and indicates the approximate dollar cost of each mechanism. Evaluation of the various mechanisms is the topic of the next section.

Ten mechanisms were presented in the report to Congress. For discussion purposes, They are organized into 4 groups: deficit-related subsidies, cost-related subsidies, output-related subsidies, and demand-related subsidies.

### Deficit-Related Subsidies

Perhaps the simplest subsidy, in concept and administration, is one that simply pays the difference between total costs and total revenues for transit firms incurring deficits. Such a subsidy mechanism would have cost the federal government approximately \$276 million in 1969, based on the sample discussed above. Aid would have gone to 47 bus-only firms, 8 multimodal firms, and 15 commuter railroads in the amounts of \$15, \$167, and \$94 million respectively. All reported deficits would have been offset and no windfalls created.

### Cost-Related Subsidies

A family of mechanisms related to capital costs was investigated, as was a family of mechanisms related to operating costs. Capital-cost-related mechanisms were pay total fixed costs; pay depreciation; pay interest payments on debt; and pay maintenance, garage, and equipment costs for bus firms and maintenance of way and structures for multimodal and rail properties. The outcome of these mechanisms is given in Table 2 (1).

A number of operating-cost-related mechanisms were considered during preparation of the report. Three options were presented in the final version: pay 5 percent of total costs, pay 20 percent of total costs, and pay 5 percent of variable costs (administrative, maintenance, and operating costs). The outcome of each of these mechanisms is given in Table 3 (1).

### Output-Related and Demand-Related Subsidies

Two other mechanisms discussed in the report to Congress were classed as output mechanisms—a grouping with which this writer disagrees. The mechanisms were payment of 5 cents per vehicle-mile operated and 5 cents per passenger carried. The 2 mechanisms should be conceptually separated because they have different effects: the relation between vehicle-miles operated and costs is far more direct and clear-cut than the relation between passengers carried and costs. Referring to payments on a per passenger basis as a "demand-related" mechanism, in contrast to payments per vehicle-mile as an "output-related" mechanism, may help to keep the distinction in mind. Nonetheless, the outcome of both types of mechanism is given in a single table (Table 4) primarily for typographic convenience.

### An Explanatory Note

The figures given in the tables describe the impact of the respective subsidy mechanisms on sample firms only. For each mechanism, the subsidy payments and impact could only be calculated for those firms that had provided the relevant data to their industry associations. Hence, the size of deficit and subsidy and the number of firms are not strictly comparable for all mechanisms discussed. Nevertheless, the figures are indicative of the type of results to be expected; the percentage calculations are more revealing than the absolute dollar amounts. Firms in the sample did include most of the major city transit firms and about 85 percent of total transit ridership as noted above.

### ANALYSIS OF MECHANISMS

In this section, each of the classes of subsidy mechanism described above is evaluated in terms of the 4 criteria of mobility (subsuming firm solvency), efficiency and equity (the welfare issue), innovation, and ease of administration.

### Deficit-Related Subsidies

The impact of a pay-the-deficit subsidy with regard to mobility will depend in part on whether an upper limit on funding for such a program will be imposed, and at what level. If no upper limit were imposed, firms could clearly maintain their existing levels of service; survival would no longer be at stake. However, in light of the fact that a \$275-million program in calendar 1969 would escalate to a \$475-million program in 1970, an unbounded deficit subsidy appears highly unlikely. Unfortunately, imposing an upper limit on the program might actually consign some firms to bankruptcy. How would the decision be made as to which firms should be kept in operation and which permitted to go out of business?

Deficit-related subsidies are more or less neutral with respect to welfare. To the extent that they permit firms to continue operations at their present levels, they represent a net gain to those dependent on public transportation; a similar gain is realized if the availability of subsidy forestalls fare increases. However, there are many more efficient ways of ensuring that the cost of transportation does not become an excessive burden to the young, the old, the poor, and the handicapped. For example, the payments-to-users devices discussed earlier are a class of more efficient ways to achieve the welfare goal.

Deficit subsidies are slightly positive with respect to innovation, to the extent that they do not penalize a firm attempting to offer new services. (If such services incur a loss, presumably the loss will be covered as part of the subsidy payment.) However, the program provides no positive inducement for firms to try new ways to make the

Table 1. Surplus or deficit position of firms in transit sample by sector.

Sector	Deficit		Surplus	
	Amount (dollars)	Number of Firms	Amount (dollars)	Number of Firms
Bus only	15,150,000	47	10,570,000	50
Multimodal	166,460,000	8	3,460,000	4
Commuter rail	94,816,000	15	1,799,000	1

Table 2. Effect of capital-cost-related mechanisms.

Item	Pay Total Fixed Costs or \$109.1			Pay Depreciation or \$68.8			Pay Interest on Debt or \$40.4			Pay Other* or \$150.3		
	Bus	Multi-mode	Commuter Rail	Bus	Multi-mode	Commuter Rail	Bus	Multi-mode	Commuter Rail	Bus	Multi-mode	Commuter Rail
Subsidy, dollars	35.1	57.5	16.5	26.3	29.5	13.0	9.0	28.0	3.5	46.4	80.0	23.8
Initial deficit, dollars	15.2	166.5	59.5	15.2	166.5	59.5	15.2	166.5	59.5	11.2	158.0	59.5
Deficit after subsidy, dollars	6.7	139.9	47.0	7.9	159.8	49.4	12.1	143.4	57.3	3.1	84.5	35.4
Decrease in deficit, percent	56	16	20	48	4	17	20	14	4	72	47	41
Initial surplus, dollars	10.6	3.4	1.8	10.6	3.4	1.8	10.6	3.4	1.8	7.6	—	1.8
Increase in surplus, percent	252	870	225	180	637	154	56	143	71	503	—	68
Use of subsidy, percent												
Reduce deficits	24	48	72	28	25	76	34	82	64	17	92	87
Increase surpluses	76	52	28	72	75	24	66	18	36	83	8	13
Number of firms												
In sample	97	12	15	97	12	15	97	12	15	78	8	15
Receiving subsidy	93	11	13	91	10	13	73	8	9	75	8	14
Originally with deficit	47	8	14	47	8	14	47	8	14	37	7	14
Moved out of deficit after subsidy	22	3	2	19	3	2	9	1	0	23	2	1

Note: All dollar amounts are in millions.

\*Maintenance, garage, and equipment costs for bus firms and maintenance of way and structures for multimodal and rail properties.

Table 3. Effect of operating-cost-related mechanisms.

Item	Pay 5 Percent of Total Cost or \$88.0			Pay 20 Percent of Total Cost or \$354.6			Pay 5 Percent of Variable Cost or \$82.1		
	Bus	Multi-mode	Commuter Rail	Bus	Multi-mode	Commuter Rail	Bus	Multi-mode	Commuter Rail
Subsidy, dollars	20.9	50.6	17.4	87.2	197.9	69.5	20.3	46.0	15.8
Initial deficit, dollars	15.2	166.5	94.8	17.7	158.1	94.8	17.7	166.5	94.8
Deficit after subsidy, dollars	8.4	131.4	77.7	11.6	31.5	32.2	10.8	135.2	80.7
Decrease in deficit, percent	45	21	18	91	71	66	39	20	15
Initial surplus, dollars	10.6	3.4	1.8	14.7	—	1.8	14.9	3.4	1.8
Increase in surplus, percent	134	450	53	483	—	214	89	381	38
Use of subsidy, percent									
Reduce deficits	32	69	69	18	64	85	34	71	92
Increase surpluses	68	31	11	82	36	15	66	29	8
Number of firms									
In sample	97	12	16	100	9	16	103	12	16
Receiving subsidy	97	12	16	100	9	16	103	12	16
Originally with deficit	47	8	15	49	7	15	50	8	15
Moved out of deficit by subsidy	19	3	1	37	3	3	21	3	1

Note: All dollar amounts are in millions.

Table 4. Effect of output-related and demand-related mechanisms.

Item	Pay 5 Cents per Vehicle-Mile or \$75.0			Pay 5 Cents per Passenger or \$235.3		
	Bus	Multi-modal	Commuter Rail*	Bus	Multi-modal	Commuter Rail
Subsidy, dollars	24.5	40.5		80.9	140.9	12.5
Initial deficit, dollars	15.2	166.5		14.5	163.7	91.8
Deficit after subsidy, dollars	7.4	138.6		2.6	52.4	81.3
Decrease in deficit, percent	51	17		82	68	12
Initial surplus, dollars	10.6	1.1		10.2	0.2	1.8
Increase in surplus, percent	159	1,184		674	15,800	125
Use of subsidy, percent						
Reduce deficits	32	69		15	80	82
Increase surpluses	68	31		85	20	18
Number of firms						
In sample	96	11		92	9	16
Receiving subsidy	96	11		92	9	16
Originally with deficit	47	8		44	7	15
Moved out of deficit after subsidy	21	3		31	2	1

Note: All dollar amounts are in millions.

\*Not available.

service responsive to current travel patterns.

A deficit-related subsidy could be the easiest of all to administer. Unfortunately, the lighter the administrative hand is, the greater the potential for abuse in the program will be. Management would lose most if not all existing incentives to control costs if full deficits were underwritten by subsidy. But the alternative to this outcome requires regulation and audit of allowable costs, fare and wage levels, and so on; administrative simplicity is thereby eliminated.

In summary, deficit-related subsidies give one the choice between administrative simplicity and a bottomless pit or detailed administration and the possibility of some business failures, with the responsibility for the latter outcome resting primarily on the subsidy provider.

### Capital-Cost-Related Subsidies

If judged by results for the sample properties, a capital-cost-related subsidy would provide no guarantee of the firm's ability to maintain existing service. Even paying full fixed costs would offset deficits for less than half those properties that incurred deficits in 1969. Furthermore, about 75 percent of the \$35 million subsidy paid to bus-only firms by this formula would become windfall profits for firms not previously operating at a loss; about half the \$57.5 million paid to multimode firms under this formula would likewise become windfall profits.

Capital-based subsidies can no more guarantee to hold fares constant than they can guarantee to keep firms in business. Furthermore, there is reason to believe that the impact of such subsidies would vary wildly among cities, according to the capital structure of the transit firms in their respective communities. Higher subsidy payments would very likely be received by heavily leveraged firms than by firms operating on equity capital only. If nothing else, a capital-based subsidy might lead to a drastic revision in techniques of transit financing.

For reasons mentioned in the preceding paragraph, the welfare implications of a capital-based subsidy are very uncertain; they would depend almost entirely on previous financing practice of specific transit firms. To the extent that windfall profits induced firms receiving them to lower fares, there would presumably be a net welfare gain to the transit disadvantaged. But fare reductions are by no means certain, nor would they be achievable by all firms. And, as with deficit subsidies, there are more efficient ways to achieve the welfare goal.

Would capital-based subsidies induce service innovations? Again, the historical capital structure of the individual firms plays a large part in answering that question, but so does the nature of the mode involved. Rail and multimodal systems, which traditionally have the higher debt-equity ratio—if only because they are more capital-intensive—are also inherently inflexible. It is difficult to envision meaningful service innovation on such systems regardless of the source of income to the firm. Even bus firms receiving windfalls from such a subsidy, however, would find nothing inherent in the mechanism itself to induce them to innovate. This is particularly unfortunate since most of the subsidy paid under such a formula would go to currently profitable firms.

As with a deficit-based subsidy, administrative cost could be kept very low. But the trade-off is similar: Low administrative cost here would be achieved at the sacrifice of any control technique that might be used to stimulate service innovations.

The strategy of paying maintenance, garage, and equipment costs for bus-only firms and maintenance-of-way and structures costs for multimode and commuter rail systems deserves somewhat closer attention, although the general remarks above still apply. This strategy is classed with the capital-cost strategies since it deals with the capacity of the physical plant rather than the amount of output actually produced. There is, of course, some managerial discretion in the amounts spent on maintenance for a given level of traffic; if nothing else, it might be argued that a policy of subsidizing maintenance expenditures should increase safety of operations.



Data given in Table 2 show some other interesting effects of a maintenance subsidy. For multimode and rail properties, this mechanism is far more efficient than any of the other capital mechanisms investigated and is at least as efficient as any of the operating-cost mechanisms discussed below in terms of its ability to deliver subsidy that will reduce deficits rather than create windfalls. Unfortunately, the maintenance mechanism is somewhat less effective in its ability to move those firms from deficit to break-even or profitable operation; as we will see below, the operating-cost-related mechanisms are somewhat better in this regard. (Obviously, caution must be used in interpreting these figures both because of the relatively small sample size and because the subsidy payments are estimated on the basis of past expenditures, which in turn may reflect attempted economies in maintenance.)

### Operating-Cost-Related Subsidies

Table 3 gives details on the effects of 2 operating-cost-related subsidy mechanisms: payment based on variable cost and payment based on (2 levels of) total cost. The basic difficulty with operating-cost-related subsidies is twofold. For bus-only firms, any level of subsidy that moves a significant number of firms out of the red also results in substantial windfalls to profitable firms and very high overall program costs. For multimode and rail firms, the capital-cost strategies appear to be at least as effective, although, again, the figures must be interpreted with caution.

In general, the operating-cost-related subsidies share the strengths and weaknesses of the capital-cost-related subsidies, particularly with respect to mobility and welfare. Operating-cost subsidies may have an advantage with respect to innovation to the extent that service improvements depend more on noncapital than on capital outlays. But again, although operating-cost subsidies might make it more feasible for firms to innovate, they still fall short of providing a positive incentive to do so.

Administrative problems could increase with operating-cost subsidies, primarily because the greater number of operating-cost categories (as compared with capital-cost categories) may provide greater scope for creative bookkeeping and hence greater need for administrative surveillance.

### Output-Related Subsidies

Although it is conceptually possible to devise highly sophisticated output-based subsidy mechanisms, with differential payments for service at various hours of the day, for example, existing data do not permit the estimation of the impact of any but the most elementary output-based mechanism. The example given in Table 4 is of this sort: a simple payment of 5 cents per vehicle-mile.

First, note that the impact of such a mechanism on bus-only firms will be essentially similar to the impact of an operating-cost subsidy because of the very high proportion of total cost per vehicle-mile constituting operating costs. Hence, the comments about operating-cost mechanisms apply with respect to effectiveness in overcoming deficits and inefficiency in avoiding windfalls. With respect to the 4 criteria, an output subsidy is likely to have the following results.

The ability to permit maintenance of existing service and fare levels would depend, of course, on the size of subsidy program and the initial position of the firm. Although a subsidy level high enough to offset all deficits in firms could be established, any level even approaching full offset of all the firms' deficits would have to be many times the amount needed merely to pay the deficits under a deficit-based mechanism. A program funded at that high a level is virtually inconceivable.

Any likely level of subsidy, as with cost-based mechanisms, will have such widely varied impacts on various firms as to make any general prediction about maintenance of service or fares impossible. The reasoning is identical to that applied to the cost-based mechanisms.

Output-based mechanisms can have serious welfare implications. One cannot predict whether firms being reimbursed for operating additional mileage would choose to accumulate that mileage in ghettos or in wealthy suburbs. However, the easiest way to run up additional bus mileage is on express runs between the central city and suburbia, not on local runs in congested areas. For rail operations, additional vehicle-miles are most easily built up by running rush-hour-length trains all day long whether occupied or not.

Some of the output-based mechanisms, in their more sophisticated versions, could provide a significant incentive to innovate by paying more for "new" mileage such as that required to try out a new line or a demand-actuated service, for instance. Caution would have to be used in creating differential payments for different types of service. A mechanism designed to encourage off-peak operation might result in diversion of service from peak periods, thereby increasing congestion; one that paid more for peak service might leave a city without any off-peak service (in an extreme case). In favor of output-based mechanisms, it must be noted that vehicle-miles are surely a better indication of service provided than costs and other input measures.

Output-based mechanisms are administratively simple and require only such readily available and verifiable statistics as mileage operated. Even a subsidy that differentiated between peak and off-peak miles would require little more than an occasional audit of schedules and route mileages.

### Demand-Based Subsidies

Subsidies based on demand, in their simplest formulation, reward firms on the basis of passengers carried. This class of subsidy can, of course, be structured by time of day or section of city; in a more sophisticated version, subsidies could be based in part on increases in the numbers of passengers carried.

Analysis of the more sophisticated versions of demand-based subsidies is a highly speculative venture at this point because statistics on passengers carried are virtually unavailable in the industry, except in the aggregate by firm. However, even an analysis of a relatively simple mechanism—pay 5 cents per revenue passenger carried—brings out some interesting facts.

This mechanism would provide a windfall to already profitable bus-only firms of about \$69 million (for firms in our sample)—an increase of about 675 percent in profits of profitable firms. At the same time, 82 percent of the dollar deficit in bus-only firms would be eliminated, and 70 percent of deficit firms would be moved to at least a break-even point. Total cost of this mechanism for bus-only firms would have been about \$81 million in 1969.

At the same time, a total subsidy of \$140 million paid to multimode firms on the same basis would only eliminate 68 percent of the total dollar deficit in multimode firms.

How does such a subsidy meet our objectives? Since the total amount of subsidy paid is very substantial, assuming that the subsidy will be sufficient to prevent any firms from going out of business seems reasonable. It follows that this mechanism does a good job of enabling firms to maintain existing service levels, although at a very high cost—well above that for deficit-based subsidy.

Would a subsidy of 5 cents per passenger enable firms to maintain existing fares? It would. In fact, quite likely such a subsidy would cause some firms to reduce fares. However, there is a danger of feedback inherent in such an approach: To the extent that transit riding is price elastic, fare reductions will encourage more riding, which will result in higher levels of subsidy payment. One estimate put the feedback effect at an increase of 22 percent in riding (and hence in payment levels) for bus firms in 1969. Although increases in riding are to be encouraged (to the extent that they do not result in disproportionate increases in cost), this type of reaction makes it extremely difficult to predict the ultimate level of subsidy payments. And this fact, in turn, raises administrative problems that will be discussed below.



The welfare results of a demand-based subsidy of the type described are likely to be neutral at best and counterproductive at worst. To the extent that firms view lower income individuals as captive riders, they may concentrate efforts at increasing ridership (and hence subsidy payments) on middle- and high-income individuals. As with the output-based subsidies, demand-based formulas might become another subsidy to the middle and upper classes.

A subsidy based on existing demand does nothing to encourage innovation. Quite the contrary, it rewards firms with a relatively predictable income for doing things exactly as they have in the past. Although a formula that bases part of the payment on increases in ridership might encourage some innovation, predicting the form that innovation would take is difficult. Furthermore, such a formula would penalize the highly congested, multimode cities rather severely because rail systems cannot make their service more attractive by operating to different destinations off-line.

Administrative cost of a demand-based subsidy could be quite low or extremely high, depending on the nature of the formula adopted and the degree of accuracy in passenger statistics sought. Many firms, since the advent of exact-fare plans, have no accurate passenger statistics, but rather estimate numbers of passengers carried for the system as a whole on the basis of total revenue divided by some factor representing average fare paid. Line-by-line and hour-by-hour counts are impossible to secure (except by manual tabulation by drivers—a notoriously unreliable method) because fare-box vaults are only pulled at the end of the day, by which time the vehicle may have operated on many different routes. Hence, a subsidy that depended on extremely accurate passenger counts would have to include in its administrative cost the expense of developing and implementing an accurate passenger registration system for all firms.

## CONCLUSIONS

The concept that transit deficits are symptomatic of the problem and not the problem was discussed. None of the mechanisms discussed and investigated shows any promise of solving the fundamental problems of transit; at best, they may ensure continuance of service and provide a little risk capital that can be used to experiment with new types of service. But taking risks, even with some additional funds available, will require more imagination than transit operators have traditionally exhibited.

Furthermore, although there is mounting evidence that fundamental changes in transit operations are necessary, not enough is known about the responsiveness of demand to various changes in transit operations that might be attempted. As a result, it would be extremely unwise to place stringent conditions (which might turn out to be the wrong ones) on firms receiving subsidies or to make subsidy contingent on the firm submitting some plan—any plan—for service improvements. Moreover, transit operating conditions, demands, and needs are quite different among different cities because of size, location, and economic base, among other things. To attempt to prescribe any federal operating support program without taking account of these differences would lead to further distortions in local decision-making and resource allocation. It is also apparent that the deficits are concentrated in the major cities having multimode or major rail operations and that the type of service-improvement formula that might restore a bus-only firm to profitability in a short while represents a set of options that will probably not even be feasible for a rail operation.

The report to Congress recognized the pitfalls of federal operating subsidies discussed above and did not advocate a program of subsidies. It did promise further study of the problem and recommended that serious consideration be given to another type of program. It also urged enactment of the President's special revenue-sharing proposal.

If the basic goal of a subsidy program is not only preservation of transit firms but improvements in the quality of transit service, it seems logical to use federal funds to help fill the gaps in our knowledge of factors affecting the demand for transit. As a result, the report described some service innovation programs that might be funded as experiments designed to determine the types of service improvements that would gain

greatest public acceptance as well as the incentive mechanisms that would be needed to induce firms to attempt those improvements. This author heartily concurs with the thrust of those recommendations and hopes that they have not been forgotten in the ongoing political debate about transit operating subsidies.

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