

1973

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Citation of this paper:

Frankena, Mark. "Income Distributional Effects of Urban Transit Subsidies." Department of Economics Research Reports, 7311. London, ON: Department of Economics, University of Western Ontario (1973).

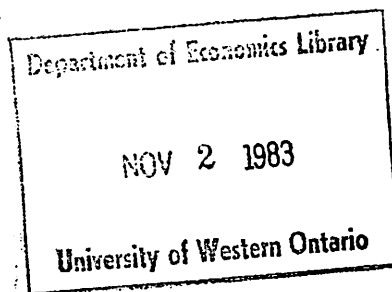
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Research Report 7311

INCOME DISTRIBUTIONAL EFFECTS OF
URBAN TRANSIT SUBSIDIES

by

Mark Frankena



May, 1973

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URBAN TRANSIT SUBSIDIES

Mark Frankena *

I. Introduction

Subsidization of urban public transportation by municipal and, to a lesser extent, provincial governments has become a standard practice in Canada.¹ During the 1960's and early 1970's, public transit systems in a large number of urban areas received subsidies of 10 to 30 percent of their costs, and special services such as suburban commuter railways and dial-a-bus systems received subsidies on the order of 50 percent of their costs.² For Canada as a whole, subsidies in the early 1970's probably averaged about 20 percent of the costs of urban public transit, and total costs of transit were on the order of \$350 million per year.³

Moreover, the average rate of subsidy for urban transit has increased in recent years. The increase in subsidization has been used (i) to prevent fares from increasing as rapidly as the cost of transit operations per vehicle mile; (ii) to maintain and extend service at times and on routes of declining or low demand; (iii) to support elimination of higher fares on longer rides; (iv) to support fare reductions for elderly people; and (v) to compensate for the loss of off-peak riders for whom fares exceed marginal cost.

At the popular level, public transit subsidies are proposed primarily as a means of reducing traffic congestion. In the scholarly literature transit subsidies are commonly suggested as a method of increasing the efficiency of resource allocation on the grounds (i) that private

automobile trips are priced below their marginal social cost; (ii) that marginal cost is below average cost for urban public transit because of increasing returns to scale; (iii) that there is an option demand for public transit on the part of non-users; (iv) that knowledge gained from research and demonstration projects is a public good; and (v) that there are external benefits associated with the particular form of urban development promoted by the existence of high-quality, low-cost public transit. Subsidies have also been proposed as a means of increasing the well-being of low-income and elderly people.⁴

II. Objectives and Scope of Study

The purpose of this paper is to determine the redistribution of income among income classes resulting from urban transit subsidies in Canada. In order to determine the "net" redistribution resulting from subsidization of public transit, we investigate not only the incidence of the subsidies themselves but also the incidence of the methods by which the subsidies are financed.

There are several reasons for studying the income distributional effects of a government policy such as subsidization of urban public transit. First, since transit subsidies are sometimes proposed as transfers-in-kind to increase the well-being of low-income people, it would be useful to know how various forms of subsidy do in fact redistribute income. Second, if there is no provision for offsetting perverse redistributional effects, or if compensation involves a deadweight loss, income distributional effects as well as efficiency considerations are relevant in evaluation of subsidies. Third, for those interested in class structure and the nature of the state, it is important to investigate

class biases in government policies.

This study is concerned only with the average change in income at each income level. Changes in incomes of individual families and of population subgroups at each income level deviate substantially from the average at that level. Although this variance is not of immediate concern here, it is a reason for rejecting use of subsidies as a means of redistributing income unless the subsidies are based directly on the incomes of the recipients.

A complete analysis of distributional effects would require evaluation of the incidence of secondary benefits, such as the reduction in traffic congestion resulting from diversion of travellers from private automobiles to public transit.⁵ It would also require consideration of shifting and capitalization, including the implications of changes in wage rates and property values caused by transit subsidies. Such secondary benefits and problems of shifting and capitalization on the benefit side have not been investigated in this study. Most of the complications arising out of effects of transit subsidies on the allocation of resources, including transit ridership and the location of economic activity, are ignored. However, much of the data used here on the incidence of taxes is drawn from studies which do allow for shifting of tax burdens.

Subject to these important qualifications, it is found that several but not all forms of subsidization and methods of financing increase inequality of incomes in Canada. Of special concern is the fact that several recent changes in transit policies which have required increased subsidization, such as abolition of two-zone fares and increases in route and vehicle mileages in low-density neighbourhoods, have had perverse effects on the size distribution of income. However, it is found that to

the extent that increased subsidization has prevented uniform fare increases, it has reduced inequality.

We turn first to a brief analysis of the incidence of the revenue sources used to finance transit subsidies and then to a more detailed investigation of the incidence of the subsidies and net incidence.

III. Incidence of Financing

Losses on urban transit operations, or subsidies to cover these losses, have been financed from four major sources: (1) general municipal revenues; (2) general provincial revenues; (3) profits earned on other routes or modes operated by the same transit authority; and (4) profits earned on public utilities such as electricity. The following analysis indicates that sources (1), (3), and (4) are all regressive methods of raising revenue while source (2) is approximately proportional.⁶

(1) General Municipal Revenues

General municipal revenues, excluding conditional grants, are derived primarily from municipal taxes, particularly property taxes, and to a much lesser extent from unconditional provincial grants. In 1969, property taxes alone accounted for 70 percent of municipal revenue excluding conditional grants in Canada.⁷

Table 1 presents data derived from studies by Gillespie and Maslove on the incidence of all municipal taxes combined and of property taxes alone in Canada.⁸ These data, and similar data in three other studies,⁹ reveal that all municipal taxes combined and property taxes alone are very regressive, especially over the lower part of the income range. Because of the limited role of unconditional grants (8 percent of municipal revenues

excluding conditional grants in 1969),¹⁰ the incidence of general municipal revenues would be similar to that of all municipal taxes combined.

(2) General Provincial Revenues

General provincial revenues are derived primarily from a combination of progressive and regressive taxes and to a lesser extent from unconditional federal grants, which in turn are financed by a variety of taxes. Data on the incidence of all provincial taxes combined are presented in Table 1. On average, the incidence of provincial taxes appears to be approximately proportional except near the bottom of the income scale, where the incidence is regressive. Since unconditional transfers from the federal government to the provinces amounted to only 11 percent of general provincial revenues excluding conditional transfers in 1970-71,¹¹ the incidence of general provincial revenues would be approximately proportional, or at most slightly progressive over the middle and upper income levels where the incidence of federal taxes is progressive.

(3) Profits on Other Public Transit

Profits earned on other public transit routes or modes are a very regressive source of financing. Transit systems commonly earn a profit on interurban and inner-city bus services while other modes and routes operate at a loss. For example, Hamilton and Toronto have used profits earned on interurban, charter, and parcels bus services to subsidize intraurban transit.

Average expenditure on interurban bus transportation in Canada in 1969 was roughly the same at all family income levels. As a percentage of income, expenditures on interurban bus transportation declined from 0.20 percent in the income range \$3,000 - \$3,999 to 0.04 percent in the income range

\$12,000 - \$14,999.¹² Thus, on average the incidence of monopoly profits on interurban bus services is regressive.

Similarly, because of differences in the residential location patterns of different income groups, on average low-income people presumably spend a higher percentage of their incomes on inner-city bus trips with both origin and destination near the center of the city than do high-income people.

(4) Profits on Public Utilities

Edmonton and Vancouver have in the past subsidized public transit from profits on public utilities such as electricity. This is a very regressive source of financing because the income-elasticity of demand for such utilities is substantially less than unity. Average family expenditure on water, power and fuel in 1969 declined from 5.9 percent of income at an annual income level of \$3,000 - \$3,999 to 2.2 percent at an income level of \$12,000 - \$14,999.¹³

One can conclude that the incidence of the financing of losses on urban transit operations by municipal governments in case (1), transit commissions in case (3), and public utility systems in case (4) is regressive while the incidence of financing by provincial governments in case (2) is roughly proportional.

IV. Incidence of Transit Subsidies and Net Incidence

Because of substantial variations both in subsidy rates and in income distributions of users among urban public transit routes and modes, it is not possible to calculate the incidence of existing transit subsidies from aggregative census data, which give average expenditure on all types of

urban public transit combined at each income level. Instead, one must identify the categories of urban public transit which receive subsidies and determine the incidence of subsidies for each. The major categories of urban transit which receive substantial subsidies in Canada are:

(1) suburban commuter railways; (2) dial-a-bus systems; (3) bus routes into outlying, low-density residential neighbourhoods; (4) rail rapid transit; and (5) travel by elderly people and children.

For transit categories (1), (2), and (3), each of which provides CBD-oriented transportation services to suburban commuters, it is found that the incidence of subsidies is commonly regressive, i.e., on average the subsidy received as a percentage of income increases with income. This pattern results from the tendency of average income to increase with distance of residence from the city center, particularly among people employed near the center, and to be higher in low-density residential areas.¹⁴

We now turn to an investigation of the incidence of each of the five subsidy categories listed above.

(1) Suburban Commuter Railways

Toronto's suburban commuter rail service, the GO Transit, has operated along Lake Ontario since 1967. In 1971 the Ontario government paid subsidies of \$4.3 million or 53 percent of the system's total costs for the year. The average annual subsidy for a GO Transit commuter who made 250 round-trips per year was \$400.

To determine the incidence of the GO Transit subsidy, one should compare the income distribution of riders with the income distribution of Ontario residents. Table 2 presents data on the income distribution of male

GO Transit riders and of male individuals in Ontario in 1967.¹⁵ The median income of male riders was \$8690 per year, compared to a median income for male individuals in Ontario of \$5562. Over 80 percent of male riders had incomes greater than the median for male individuals in Ontario. These findings are confirmed by N. D. Lea, a transportation consultant who regularly commuted on the GO Transit. He stated that he observed that "most of the people on this transit system are of the higher income group. There seem to be very few low income people who are benefiting from this very high subsidy."¹⁶

Assuming conservatively, for lack of data, that the average length and hence subsidy per trip was the same for riders at all income levels,¹⁷ the incidence of the subsidy as a percentage of income can be inferred from the average number of trips per dollar of income at each income level. It will be seen from the index of number of trips per dollar of income presented in Table 2 that the incidence of the GO Transit subsidy was strongly regressive: on average higher-income males in Ontario took more trips per dollar of income and hence received a larger subsidy per dollar of income than did lower-income males.

Since the GO Transit subsidy was financed from general provincial revenues, the incidence of which was approximately proportional, the net incidence of the subsidy and taxes together was regressive: on average, income was transferred from lower-income to higher-income people in Ontario.

(2) Dial-a-Bus Systems

Since 1970, dial-a-bus systems have been introduced in or scheduled for low-density residential neighbourhoods in Regina and several urban

areas in Ontario, including Bay Ridges, Kingston, Stratford, Bramalea, Ottawa, and North York. In spite of higher fares for dial-a-bus than for conventional bus service, fare revenues in Ontario have covered only about half of operating costs and none of initial capital costs. According to preliminary estimates, the annual loss for the dial-a-bus system scheduled to open in North York in 1973 will be between \$200 and \$400 for a daily commuter.¹⁸ In Ontario, subsidies have been paid primarily by the provincial government. In Regina they have been paid by the municipal government.

The dial-a-bus systems in Bay Ridges and North York have been designed to serve primarily as suburban feeders for two fixed-route CBD-oriented line-haul commuter systems, Toronto's GO Transit railway and Yonge Street subway extension, respectively. As in the case of GO Transit itself, one would expect the net incidence of the subsidy for the dial-a-bus service in Bay Ridges and its financing to be regressive. In North York, about half the residential areas to be served by dial-a-bus had average wage and salary levels for males in 1961 near the average for the Toronto metropolitan area while half had average wage and salary levels for males between 35 and 110 percent above the average.¹⁹

Similarly, the Regina dial-a-bus service, which was introduced in the higher-income subdivisions in the southern part of the city in an attempt to increase CBD-oriented public transit ridership from outlying low-density residential areas, recovered only 60 percent of operating costs and none of initial capital costs from the fare box in 1972.²⁰ Thirty-two percent of riders in 1972 were from families with annual incomes over \$12,000. While only about 20 percent of families in Regina had incomes over \$12,000, this group of families received about 40 percent of the total

income in Regina.²¹ Consequently, dividing the population into only two groups at a family income of \$12,000, one can conclude that the subsidy was mildly progressive: the subsidy was lower as a percentage of income for families with incomes over \$12,000 than for families with incomes of \$12,000 and under. On the same basis, the net incidence of the subsidy and its financing from general municipal revenues appears to be mildly progressive when the population is divided into two groups. While families with incomes over \$12,000 would receive 32 percent of the benefits from the subsidy, they would pay more than 32 percent of the municipal taxes used to finance the subsidy.²² Of course, the subsidy could still be regressive within the income range below \$12,000.

(3) Bus Routes into Outlying, Low-Density Residential Neighbourhoods

When a uniform fare is charged for all public transit trips in an urban area (excluding special services such as suburban commuter railways and dial-a-bus systems) regardless of route and distance travelled, longer trips and trips into lower-density residential areas are subsidized at a rate higher than the average for all transit trips in the urban area. Because average income typically increases with distance of residence from the city center and is higher in low-density residential areas, on average the subsidy per trip is positively correlated with income.²³ Consequently, for a fixed total amount of transit subsidies financed from sources outside the transit system, a uniform fare is typically regressive compared to a system in which fares are proportional to average trip costs.²⁴

Moreover, if the uniform fare is set so that the transit system as a whole breaks even, inner-city services earn profits which are used to cover losses on longer routes into low-density suburbs. The incidence of

such cross-subsidization is regressive compared to a system in which each service covers its own costs from the fare box.

As an example, it was reported that in Regina:

...much of the total subsidy required [by the public transit system] was incurred to provide bus service to the newer subdivisions in all of the outlying areas of the city, including the higher-income subdivisions in the southern half of the city. Some of these outlying bus routes recovered as little as twenty percent of their "out-of-pocket" costs from the fare box. As zone fares are not charged in Regina, this meant that the older, higher density areas were subsidizing transit service for the newer areas.²⁵

In the southern part of Regina, fixed-route bus service required subsidies as high as \$1.00 per passenger trip, or \$500 per year for a regular commuter.²⁶

Similarly, in London it was reported in 1966 that, although the public transit system as a whole operated at a profit, "the system continues to operate at a heavy loss in the outlying areas."²⁷ All eight routes which operated at a loss provided service to outlying areas where average income of residents was above the London average; four of the routes ran to areas with average wage and salary incomes for males between 25 and 60 percent above the London average in 1961.²⁸ Since these losses were covered by profits made on routes through more densely populated areas, including the inner-city, income was redistributed from lower-income to higher-income riders.

In view of the regressivity of a uniform fare compared to a system of fares dependent on distance travelled, it is significant that recently there has been a trend toward uniform fare systems in Canada. Since 1964, London, Montreal, Ottawa, Halifax, and Toronto have all abandoned two-zone transit fare structures, which charged additional fares on longer trips, in favour of uniform fares. Elimination of the additional fare of \$.15 per trip provided an income transfer of \$75 per year to suburban residents who commute daily by transit to central Toronto. Because of the relation between residential location and income, it appears likely that the incidence of the increase in subsidization required to eliminate two-zone fares is regressive.

(4) Rail Rapid Transit

The Toronto subway system has been heavily subsidized by the metropolitan and provincial governments. Until 1949, Toronto's public transit system was self-financing. The first subway line (Yonge Street) was constructed during 1949-54 without government subsidy but with \$24 million of the initial capital expenditure financed from a reserve fund accumulated during World War II from profits earned on other transit modes.²⁹ However, when the next two subway lines (University and Bloor-Danforth with extensions) were constructed in 1959-68, the metropolitan government paid 74 percent of capital costs, and in 1964 it extended a similar subsidy to the portion of the debt on the first line which remained outstanding. In 1967 the metropolitan government agreed to pay 80 percent of the capital costs of an extension of the first line (from Eglinton to Sheppard); and in 1969 it agreed to pay the entire capital cost of a further extension of the first line (from Sheppard to Finch).

After 1964 the metropolitan government, in turn, received provincial government grants covering part of its subsidies of capital costs for subway lines. By 1971 the province was paying 50 percent of capital costs of new lines and extensions.

As a result, by 1971 the municipal and provincial governments had paid or agreed to pay subsidies of \$354 million, or 73 percent of total capital expenditures on the Toronto subway system during 1949-75. In addition, in 1973 the provincial government agreed to pay 75 percent of the \$155 million capital cost of the proposed Spadina subway line. As of 1969, shares of capital costs of the Toronto subway for the period 1962 to 1974 were: metropolitan government, 64 percent; provincial government, 13 percent; transit system, 23 percent.

Further, beginning in 1968 the metropolitan government exempted the rapid transit system from municipal property taxes, which amounted to \$1 million in 1968. Even after these grants and tax exemptions, operating expenses for the Toronto public transit system as a whole exceeded operating revenues by \$6.2 million in 1972. This loss was subsidized on a 50-50 basis by the metropolitan and provincial governments.³⁰

In order to determine the incidence of subsidies for rail rapid transit in Toronto, or in metropolitan Montreal where the governments of the municipalities served are paying the entire \$214 million initial capital cost of the subway system, it is important to understand how subway trips are priced in these two metropolitan areas. In each case, the subway is integrated into a comprehensive public transit system operated by a single authority; a uniform fare is applied to all transit trips (other than suburban commuter railways and dial-a-bus systems) regardless of mode, route, and length; and transfers are free. When a transit system is operated under

such a pricing system, a subsidy for one segment, such as the subway, is identical to a subsidy for the entire system.³¹ Taking the uniform fare policy as given, a subsidy which is nominally for either the subway or the entire transit system makes possible a lower uniform fare on the entire integrated system than would otherwise be required. The incidence, which is found to be progressive, of such a fare reduction for Canada as a whole is discussed below under "Incidence of a Uniform Reduction in All Urban Transit Fares". Because of lack of data on the incomes of riders on the Toronto and Montreal public transit systems, it has not been possible to determine whether the incidence of a uniform fare reduction in these two particular urban areas would be different than in the nation as a whole.

(5) Travel by Elderly People and Children

Another subsidy policy which affects the distribution of income, in this case deliberately, is the system of reduced transit fares in effect for special population groups. Children and students travel at reduced fares in virtually all Canadian cities. Reduced fares for elderly people have been introduced in several cities, including Hamilton, Kingston, London, Ottawa, Regina, and Toronto. In 1972, the Toronto metropolitan government paid \$2.8 million to its transit commission to compensate for revenue lost as a result of half-fare concessions for people aged 65 and over.

The average expenditure on transit by elderly people per dollar of family or per capita income declines sharply as family income increases, especially over the lowest third of the income distribution. Consequently, on average the incidence of a transit fare reduction for elderly people is

progressive. This is explained primarily by (i) the relatively high incidence of low incomes among the elderly, or the relatively high incidence of elderly people in families with low incomes, and (ii) the fact that the income-elasticity of expenditure on urban public transit is less than unity. In 1969, the average urban family with an annual income under \$3,000 contained 1.48 people, including 0.75 people 65 years of age and over, while the average family with an annual income of \$15,000 or more contained 4.14 people, including 0.14 people 65 years of age and over.³²

In fact, detailed calculations lead to the conclusion that the incidence of a transit fare reduction for elderly people is sufficiently progressive that, even if the subsidies were financed by a property tax, the net incidence of the program would still be progressive.

By contrast, the incidence of a fare reduction for children and students is regressive over the low end of the income distribution and progressive over the high end; as a percentage of income, the rate of subsidy is relatively high at income levels between \$4,000 and \$9,000 per year and relatively low at lower and higher income levels. The regressivity at the low end is explained by the low incidence of children among families at the bottom of the income distribution. In 1969, the average urban family with an annual income below \$3,000 contained 1.48 people, including 0.18 people under 16 years of age, while the average family with an income of \$15,000 or more contained 4.14 people, including 1.24 people under 16.³³ The progressivity at the high end is explained by the fact that average number of children and average expenditure on transit increase proportionately less than income as income increases toward the upper end of the distribution; average number of children even declines near the top.

Reduced fares for children and students have often been financed internally by transit commissions, e.g., in London prior to 1972 losses on

children and students were financed from profits earned from regular-fare passengers on inner-city travel. Since financing either by this method or from municipal tax revenues is regressive, the net incidence of reduced fares for children and students financed from either of these sources would be sharply regressive at the low end of the income distribution.

V. Incidence of a Uniform Reduction in All Urban Transit Fares

The conclusion that a number of existing subsidies of urban public transit have a regressive net incidence does not, of course, imply that all subsidies or increases in subsidization are regressive. As a counter-example, we can evaluate the incidence in 1969 of a hypothetical 20 percent reduction in all urban transit fares in Canada, with the \$47 million annual revenue loss (assuming no change in the number of riders) financed by one of the following methods: (i) a proportional tax on money income; (ii) provincial taxes with the same incidence as those calculated by Maslove for Canada in 1969 (see Table 1); or (iii) municipal taxes with the same incidence as those calculated by Maslove for Canada in 1969 (see Table 1).

The resulting calculations are presented in Table 3. The incidence of the 20 percent reduction in fares is progressive, because the income elasticity of expenditure on urban public transit by urban residents, although positive, is substantially less than unity.

If the fare reduction were financed by a proportional income tax on a base with the same percentage distribution of incomes, the net incidence of the increased subsidy would therefore be progressive. The same would be true if the subsidy were financed by provincial taxes, since the incidence of the latter is approximately proportional. If the fare reduction were financed by municipal taxes, part of the progressivity of the increased subsidy would

be offset by the regressivity of municipal taxes, particularly at low income levels. In the latter case, the net effect of the program on average would be to transfer income from families with annual incomes under \$3,000 and from families with annual incomes above the average, especially \$15,000 and over, to families with annual incomes between \$3,000 and \$9,000, especially between \$3,000 and \$6,000.

VI. Conclusions

(1) Summary of Findings

The results of this study are summarized briefly in Table 4. The findings concerning the incidence of the four methods of financing are listed in the first row. The findings concerning the incidence of the main forms of subsidy are listed in the first column. Findings concerning net incidence are listed in the rest of the table. There are a large number of blank cells in the table because only a few combinations of subsidies and methods of financing were considered.

The principal finding of this study is that several but not all existing subsidies and methods of financing them are regressive. Of course, since urban transit subsidies are a minor item in government expenditures, the redistribution of income resulting from these subsidies is small. Nevertheless, one immediate implication is that the evidence does not support the popular impression that in general subsidization of urban public transit contributes to the well-being of low-income groups.

It is important at this point to recall that this study has ignored a number of distributional effects of transit subsidies, such as those related to the reduction in highway congestion, as well as the possibility of shifting and capitalization of subsidies.

(2) Implications of Net Regressivity

Even though one may favour reduction in the inequality of incomes as an objective of government policy, it does not follow that one should reject use of regressive urban transit subsidies. First, gains from increased efficiency of resource allocation might outweigh losses from increased inequality of incomes. Second, rather than forego use of transit subsidies in cases where they would increase the efficiency of resource allocation, one could increase the progressivity of revenue sources used to finance the subsidies. Third, the regressivity of transit subsidies could be offset by other government tax and expenditure programs. In fact, if compensating income transfers were made and did not involve deadweight losses, one could ignore income distribution effects in evaluating transit subsidies.

(3) Transit Subsidies Aimed at Low-Income Groups

If, for some reason, it was decided to use urban transit subsidies as a transfer-in-kind program to improve the well-being of low-income groups, net progressivity would not be a sufficient justification for accepting a particular program. In view of the deadweight losses involved in any practical tax-subsidy scheme and the horizontal inequity involved in redistributing income from people who do not use public transit to transit riders, one would prefer a scheme in which a high percentage of the benefits went to low-income families. This consideration suggests three changes from present practices: (i) eligibility for or rate of subsidy could be tied directly to family income; (ii) subsidies could be applied to existing services used heavily by low-income people; or (iii) financially unprofitable new services catering to low-income riders could be established and subsidized. In the last case, however, it might prove more efficient to subsidize use of private automobiles or taxis rather than use of public transit.

(4) Investment Policy and Income Distribution

It should be kept in mind that questions of income distribution arise in connection with investment as well as pricing policies. Because of indivisibilities in transportation investments, the government may at times be required to choose between alternative projects. For example, it is possible that either an expressway or a rail rapid transit line, but not both, might be justified in a given corridor. Even if the projects were unsubsidized, certain people would benefit, or receive a consumer surplus, from the investment. Because automobile ownership is positively correlated with income,³⁴ and because the share of trips which is made by private automobile rather than public transit is positively correlated with automobile ownership and income,³⁵ it is entirely possible that investment in rail rapid transit would lead to a more progressive distribution of benefits than would investment in an expressway.

(5) Further Research

This study suggests three questions for further research: (i) What is the incidence of benefits from transit subsidies resulting from reductions in highway congestion? (ii) What shares of transit subsidies are shifted via changes in wage rates of commuters or are capitalized in property values?³⁶ (iii) What are the magnitudes of the efficiency gains resulting from existing or optimal urban transit subsidies?³⁷

Table 1
Municipal and Provincial Taxes as a Percentage
of Money Income

Family Income	Municipal Taxes			Provincial Taxes	
	Property Taxes Only		All Taxes	All Taxes	
	Canada, 1961 (Gillespie)	Canada, 1969 (Maslove)	Canada, 1969 (Maslove)	Canada, 1969 (Maslove)	Ontario, 1969 (Maslove)
Under \$2,000	10.58	12.65	13.78	18.10	21.66
\$ 2,000-2,999	6.03	8.14	8.87	12.92	15.12
\$ 3,000-3,999	5.33	6.97	7.63	13.50	14.22
\$ 4,000-4,999	4.87	6.17	6.81	14.36	15.55
\$ 5,000-6,999	4.35				
\$ 5,000- 5,999		5.29	5.90	14.74	15.00
\$ 6,000- 6,999		4.98	5.56	14.98	16.06
\$ 7,000-9,999	4.16				
\$ 7,000- 7,999		4.84	5.41	14.39	14.41
\$ 8,000- 8,999		4.89	5.46	14.77	14.84
\$ 9,000- 9,999		4.74	5.27	14.49	13.96
\$10,000 and over	4.48				
\$10,000-10,999		4.63	5.15	14.60	14.62
\$11,000-11,999		4.41	4.93	14.48	13.57
\$12,000-14,999		4.16	4.64	14.35	13.67
\$15,000 and over		4.38	4.76	16.56	15.78
TOTAL	4.92	5.00	5.53	15.01	14.88

SOURCES: Gillespie [1966, Tables A4 and A5]. Includes provincial property taxes, which are relatively minor.
Maslove [1973, Tables 2.3, 2.6, B.1, and B.4].

Table 2
 Percentage Distributions of Income and Incidence of
 GO Transit Subsidy, 1967

Individual Income	Percentage Distributions of Income		Index of Number of Trips per Dollar of Income ^b
	Male GO Transit Riders ^a	Male Indivi- duals in Ontario	
Under \$3500	5.5	26.7	0.53
\$3500 - 4999	8.3	15.1	0.58
\$5000 - 5999	5.7	14.4	0.32
\$6000 - 6999	12.0	13.7	0.61
\$7000 - 7999	12.8	9.2	0.83
\$8000 and over	55.5	20.7	1.00
<u>Median Income</u>	\$8690	\$5562	

Notes: a) The percentage distribution of income of male riders is calculated excluding the 25.2 percent of male riders who did not report their income or were not employed.

b) The index gives the ratio of the number of trips per dollar of income in each income class to the number of trips per dollar of income for the \$8000 and over class. For each income class the index was calculated as follows: (i) divide the percentage of male GO Transit riders by the percentage of male individuals in Ontario; (ii) divide the result by the average income of the class, taken as \$1750 for the under \$3500 class, \$12,000 for the \$8000 and over class, and the mid-point of the income interval for the other classes; (iii) divide the result for each income class by the result for the \$8000 and over class.

Sources: Recon Research Consultants [1968, pp. 56-57 and Table T-T24] and Dominion Bureau of Statistics [1970, Tables 2, 34].

Table 3

Incidence of 20 Percent Reduction in Urban Transit Fares in 1969

Family Income	Rate of Subsidy	Rate of Tax		(Percent of Income) Net Rate of Subsidy by Method of Financing		
		Proportional Income Tax	Provincial Taxes	Proportional Income Tax	Provincial Taxes	Municipal Taxes
Under \$3,000	.182	.095	.095	.087	.087	-.005
\$3,000 - 3,999	.160	.095	.085	.065	.075	.029
\$4,000 - 4,999	.140	.095	.091	.045	.049	.023
\$5,000 - 5,999	.140	.095	.093	.045	.047	.039
\$6,000 - 6,999	.096	.095	.095	.001	.001	.000
\$7,000 - 7,999	.105	.095	.091	.010	.014	.012
\$8,000 - 8,999	.096	.095	.093	.001	.003	.002
\$9,000 - 9,999	.087	.095	.092	-.008	-.005	-.004
\$10,000 - 11,999	.081	.095	.092	-.014	-.011	-.006
\$12,000 - 14,999	.084	.095	.091	-.011	-.007	.004
\$15,000 and over	.064	.095	.105	-.031	-.041	-.018

Sources: Statistics Canada [1972a, Table 27] and [1973, Table 60, Item 820] and Table 1.

TABLE 4

Summary of Findings on Incidence of Subsidies
and Methods of Financing

Method of Financing Form of Subsidy	Proportional Income Tax (hypothetical)	General Municipal Revenues	General Provincial Revenues	Profits on Other Public Transit	Profits on Public Utilities
Uniform Proportion of Average Cost (hypothetical)	-	Regressive	Proportional ^d	Regressive	Regressive
Commuter Railways (IV.1) ^a	Regressive	-	Regressive	-	-
Dial-a-Bus (IV.2)	Both Regressive and Progressive	Progressive ^b (Regina)	Regressive (Bay Ridges)	-	-
Uniform Fare ^c (IV.3)	Regressive	-	-	-	-
Reduced Fares for Elderly (IV.5)	Progressive	Progressive	-	-	-
Reduced Fares for Children (IV.5)	Regressive at low income; Progressive at high income	-	-	Regressive	-
Uniform Percentage Fare Reduction (IV.4; V)	Progressive	Progressive ^d	Progressive	-	-

Notes: a: Number in parentheses refers to section of paper in which the form of subsidy in question is discussed.
b: Population divided into only two income groups, at income level of \$12,000 per year.
c: Rather than fare proportional to average cost.
d: Except at very bottom of income distribution, where it is regressive.

Footnotes

*Department of Economics, University of Western Ontario. I am grateful to Kul Bhatia, Gordon Davies, Larry Poon, and Robert Woodward for comments on a draft of this paper.

¹The terms "public transportation" and "transit" are used interchangeably to refer to motor buses, trolley buses, streetcars, subways, and commuter railways. Taxis and private automobiles are not included.

There is no program of federal subsidies for urban public transit, and the only ad hoc federal subsidies given have been relatively minor. In the mid-1960's, there was a federal subsidy for construction of subways in Montreal and Toronto under the Municipal Works Assistance Program; this amounted to \$6 million or about 3 percent of initial capital costs in the case of the Montreal subway. In 1970, the federal government made a grant of \$0.4 million to Halifax through DREE for construction of bus bays and shelters.

²The governments of the following urban areas, among others, gave substantial subsidies to their public transit systems during the 1960's and early 1970's: Brantford, Calgary, Edmonton, Halifax, Hamilton (beginning 1972), Kingston, London (beginning 1972), Montreal (beginning 1966), Oshawa, Ottawa (beginning 1969), Regina, St. Catharines, Saskatoon, Sault Ste. Marie, Thunder Bay, Toronto, and Winnipeg.

Public transit systems in Vancouver, Victoria, and Winnipeg are subsidized by their provincial governments. The Alberta government exempts transit systems from the motor fuel tax and has passed legislation authorizing grants for rapid transit systems. Since 1964 the Ontario

government has subsidized construction of the Toronto subway, and since 1971 the Ontario government has paid half the operating losses of all urban transit systems in the province.

We do not consider the possibility that public transit operating on urban streets may be subsidized to the extent that user charges such as motor fuel taxes do not cover an appropriate share of the costs of the street system.

³These figures are very rough estimates based on incomplete data. Quantitatively the largest subsidies were on the capital costs of the Toronto and Montreal subway systems; the two systems in effect used about \$500 million of capital without being charged for interest or depreciation. The estimate of the average subsidy does not include cross-subsidization among trips on different public modes, on different routes, or of different lengths.

⁴For further discussion of justifications for urban transit subsidies, see Meyer et al. [1965, pp. 341-53], Domencich and Kraft [1970], Straszheim [1969], Sherman [1972], and Tyson [1972].

⁵One could consider the incidence of benefits for several groups of trip-takers: (i) people who would use public transit with or without the subsidy; (ii) people who would travel by public transit rather than private automobile or other modes as a result of the subsidy; (iii) people who would travel by private automobile with or without the subsidy; and (iv) people who would travel by public transit or private automobile as a result of the subsidy rather than not travel. The present study considers only the incidence of benefits to group (i). Since one of the major

reasons for transit subsidies is to increase the efficiency of resource allocation by reducing traffic congestion, it would be desirable to determine the magnitude and incidence of benefits to group (iii).

⁶In this study, the incidence of a tax or other revenue source is regressive if the average tax burden as a percentage of income declines as income increases. The incidence of a subsidy is regressive if the average subsidy received as a percentage of income increases as income increases. The net incidence of a subsidy program is regressive if the average subsidy received minus the average tax burden, both calculated as percentages of income, increases as income increases.

⁷Canadian Tax Foundation [1971, p. 51].

⁸The present study uses the term "family" to apply to both families and unattached individuals and takes the family as the economic unit for income purposes. Income is measured by money income.

⁹Clayton [1967], Johnson [1969], and Ministry of Treasury, Economics and Intergovernmental Affairs [1972].

¹⁰Canadian Tax Foundation [1971, p. 51].

¹¹Canadian Tax Foundation [1971, p. 36].

¹²Statistics Canada [1973, Table 60, Item 831].

¹³Statistics Canada [1973, Table 60, Items 100-107].

¹⁴These relationships between distance from the center, density, and income in Toronto are being studied by Gordon W. Davies.

¹⁵ Unlike the rest of the income distributions used in this study, these distributions are for individual rather than family income.

¹⁶ Lea [1969, p. 636].

¹⁷ Since average income probably increases with length of trip, this assumption presumably leads to an underestimate of the regressivity of the subsidy.

¹⁸ The Globe and Mail, Toronto, 30 March 1973, p. 5.

¹⁹ Dominion Bureau of Statistics, Catalogue 95-530 [1963, Table 3]. Inferences about incidence based on average incomes in residential areas depend on the assumption that transit riders are not unrepresentative of the residents in their neighbourhoods. Unfortunately, few data on the incomes of riders are available.

²⁰ Regina Telebus Study [1972a, pp. 1,4] and [1972b, p. 4]. The dial-a-bus services were in 1961 census tract 8, where average wage and salary income for males and females in 1961 were 46 and 11 percent, respectively, above the city average. Dominion Bureau of Statistics, Catalogue 95-533 [1963, Table 3].

²¹ Regina Transit System [1972]. In 1971, 12.3 percent of families in Saskatchewan had incomes of \$12,000 and over. Statistics Canada [1972b, Table 1]. Based on differences between the total and metropolitan distributions in the prairie provinces in 1969, one would estimate that 17.8 percent of families in metropolitan Saskatchewan had incomes of \$12,000 and over in 1971. Statistics Canada [1972a, Table 1]. Allowing for changes between 1971 and 1972 and differences between Regina and metropolitan

Saskatchewan, one could estimate that about 20 percent of families in Regina had incomes of \$12,000 and over in 1972. One typically finds that the top 20 percent of families by income receive about 40 percent of the total.

²²Using the municipal tax rates for Canada as a whole in 1969 (see Table 1) and the national income distribution in 1969, one would estimate that families with incomes over \$12,000 would pay 36.5 percent of municipal taxes. The share would be higher in 1972.

²³See footnote 19.

²⁴However, since low-income people take more trips per dollar of income, they may still receive a higher rate of subsidy per dollar of income under a uniform fare system than do high-income people.

²⁵Regina Telebus Study [1972a, p. 14].

²⁶Regina Telebus Study [1972b, p. 2].

²⁷London Transportation Commission [1967, p. 4].

²⁸Dominion Bureau of Statistics, Catalogue 95-526 [1963].

²⁹Thus, part of the costs of the subway system were subsidized by people who rode other public transit modes in earlier periods.

³⁰Toronto Transit Commission [1971] and [1972].

³¹In the case of Montreal, the subsidy given for the subway system is reported to be greater than the loss incurred in operating the subway; some of the subsidy is used to offset losses on the bus system. On the other hand, the transit system presumably earns a profit on short subway trips.

³² Statistics Canada [1973, Table 13].

³³ Statistics Canada [1973, Table 13].

³⁴ In 1967, 68 percent of families in eleven major Canadian urban areas owned at least one automobile, but among families with annual incomes under \$2,500, only 7 percent owned a car; between \$3,000 and \$3,500, 36 percent; between \$4,000 and \$4,500, 54 percent. Dominion Bureau of Statistics [1971, Table 2]. In addition, the share of families with more than one car increases with income.

³⁵ In Edmonton in 1961, the share of CBD-oriented work trips which was made by public transit was inversely related to average automobile ownership and income in the residential neighbourhood. Edmonton District Planning Commission [1963, p. 41]. In 1969, on average urban families with annual incomes of \$15,000 or more spent about ten times as much as families with incomes under \$3,000 to operate automobiles, compared to four and a half times as much on urban public transit. Statistics Canada [1973, Table 60, Items 760-777, 820].

³⁶ The problem of capitalization in property values is considered by Ridker and Henning [1967] and Edel [1971] in the case of air pollution and by Oates [1969] in the case of property taxes and expenditures on public education. Only Edel considers distributive implications, and none considers urban transit subsidies.

³⁷ For some careful empirical work related to this problem, see Mohring [1972].

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