12-1983

Economic Effects of Tri-Met's Operating and Capital Expenditures FY 1983 on the Portland Metropolitan Economy

James G. Strathman
Portland State University

Rishinath L. Rao
Portland State University

ECONOMIC EFFECT OF TRI-MET'S OPERATING AND CAPITAL EXPENDITURES FY 1983 ON THE PORTLAND METROPOLITAN ECONOMY

Prepared for

Tri-County Metropolitan Transportation District
of Oregon (Tri-Met)

December, 1983

James G. Strathman
Rishinath L. Rao

Center for Urban Studies
Portland State University

ECONOMIC EFFECTS OF TRI-MET'S OPERATING AND CAPITAL EXPENDITURES FY 1983 ON THE PORTLAND METROPOLITAN ECONOMY

A summary of the transit-related benefits and an assessment of the economic effects of Tri-Met's operating and capital expenditures was performed. The economic effects of the agency's expenditures were derived using a 24-sector input-output model of the four county Portland SMSA economy. Input-output analysis is frequently used for the purpose of impact assessment because it provides exceptionally detailed estimates of interindustry activity, employment and income that result from agency/project related expenditures.[1] The primary data and background information needed to perform this analysis were provided by the Tri-Met Transit Planning and Development Office.

The major findings of this study include:

- Nearly 67 percent ($66 million) of the agency expenditures for FY 1983 were made within the metropolitan area.

- Direct local expenditures of $66 million generated a total of $108 million in direct, indirect and induced metropolitan production.

- Approximately 4,360 person-years of direct, indirect and induced employment were generated by Tri-Met

expenditures.

BACKGROUND

The Tri-County Metropolitan Transportation District of Oregon (Tri-Met) is the mass transit operating agency for the Portland metropolitan area. It is the largest transit district in Oregon and the fifth largest public U.S. transit agency on the West Coast. Its operation covers an area of approximately 1,000 square miles and serves a population of a little over 1 million.

Tri-Met's primary objectives as a mass transit agency are to provide efficient, safe and reliable transportation to area residents. In short, it seeks to offer a viable alternative to the automobile.

In working toward its objectives, Tri-Met has benefited the Portland metropolitan area in the following areas:

- Revitalization of the downtown area;
- Deferred highway costs;
- Increased mobility and reduced congestion;
- Mobility for the transit dependent.

Apart from the above benefits, Tri-Met also generates a secondary string of impacts through its operating and capital expenditures in the Portland economy. The purpose of this analysis is to

estimate the magnitude of these secondary impacts.

AGENCY AND OPERATING CHARACTERISTICS[2]

Tri-Met currently employs approximately 1,800 personnel as follows:

1,100 bus operators;
280 mechanics;
270 operations and non-operations support personnel;
150 managers.

It has 573 standard diesel buses and 87 articulated diesel buses.

Tri-Met operates 24 hours a day, seven days a week. During peak hours, most buses operate at five to fifteen minute intervals and during non-peak hours at twenty to thirty minute intervals. A few buses continue operating during the early hours of the morning to provide "owl service" on selected routes. Of the 71 bus routes operated, 53 travel to downtown Portland while the other 18 serve as crosstown or feeder routes.

Additional services provided by Tri-Met include:

- Carpool classified;
- Carpool Parking Program;
- Vanpooling;
- Buspool;

- Park and Ride;
- Transportation Consulting Service;
- Special Needs Transportation Service;
- Charter Service.

TRANSIT USE

In the Portland region at the present time, about 4 percent of all trips are made by transit, 96 percent by car or other modes. During commuting rush hours 48 percent of downtown employees take the bus.

Twenty four percent of the people in the three county area ride the bus at least twice a month. During peak hours, 32 percent of all trips to and from the downtown area are made by transit, including recreation, shopping and appointments. In all, Tri-Met carried approximately 36 million passengers during FY 1983.

FINANCES

Besides revenue from the farebox, Tri-Met's major sources of income include federal grants and a payroll tax of 0.6 percent levied on businesses in the Tri-Met District. Businesses with employees pay the tax on their gross payroll; self-employed individuals pay the tax on their net earnings.

In FY 1983, 24.8 percent of Tri-Met's revenues came directly from

the fare box; 53.1 percent from the employer payroll tax; and the remaining 22.1 percent from federal grants, working capital and advertising income. Federal funds are provided by the U.S. Department of Transportation. Federal dollars from the Urban Mass Transportation Administration (UMTA) pay 80 percent of the cost for capital items such as buses, equipment, and construction of bus shelters, garages, transit centers, etc. In addition, the federal government provides monies through varying formulas for transportation planning, special projects and operations. The agency's operating budget, excluding capital receipts and expenditures for FY 1983 was:[3]

Operating Revenue

	Amount Budgeted	Percent
Payroll Tax	$38.76	53.1
Fares	18.10	24.8
Federal Grant	7.67	10.5
Working Capital	2.19	3.0
Other	6.28	8.6
Totals	$73 million	100.0

Operating Expenditures

	Amount Budgeted	Percent
Operations (maintenance, drivers, etc.)	$56.94	78.0
Administrative and General	16.06	22.0
	$73.0	100.0

Capital Expenditures: (excluding Light Rail) $23 million

ECONOMIC IMPACT OF TRI-MET'S OPERATING AND CAPITAL EXPENDITURES

This analysis contributes to Tri-Met's Economic Benefits Study, undertaken by the agency's Transit Planning Department. The Economic Benefits Study is intended to identify the primary benefits and secondary gains to the Portland metropolitan area attributable to Tri-Met's transit operations.

Primary benefits from Tri-Met's operations have been identified as follows:[4]

Downtown Growth and Transit: Tri-Met has been an important factor in enabling and encouraging the expansion of office and retail activity in the downtown area. Since Tri-Met's creation in 1969, employment in downtown Portland has grown from 56,000 to over 84,000--an increase of nearly 30,000 jobs. At the same time, traffic entering downtown has remained constant at 1971-72 levels. This difference in downtown growth has been attributed to transit, public redevelopment programs and the growth of the regional economy.

Almost 50 percent of the people who work and shop in the downtown ride the bus.

A considerable saving in terms of deferred costs for

parking and expanding highway and street capacities into the downtown is attributed to Tri-Met.

Deferred Highway Costs: For every dollar spent on Tri-Met since its inception, over one dollar in freeway construction costs have been deferred.

Mobility/Congestion: 21,000 automobiles have been taken off the highway system entering the downtown area; this has been attributed to transit.

Without transit many of the region's major arterials and roadways would suffer from serious congestion in the peak hours, resulting in delays and dangerous conditions. Additional lanes would be required on Hawthorne, Barbur, Powell, McLoughlin and Sunset and Interstate Boulevards to remedy this problem. Tri-Met carries the equivalent of a new lane of traffic on each of the above streets in and out of the downtown in the peak hour.

Mobility for the Transit Dependent: Property tax savings, i.e., savings in transportation costs of school districts, can be attributed to Tri-Met providing service to the transit dependent in the community, namely, schools.

Having highlighted the primary benefits to the community from Tri-Met's service, the intent of this analysis is to measure the secondary economic effects (direct, indirect and induced impacts on the Portland economy) attributable to Tri-Met's operating and capital expenditures in the metropolitan area. An area input-output model is used to measure these impacts.

THE IMPACT OF TRI-MET'S OPERATING AND CAPITAL EXPENDITURES

An input-output model functions as a demand-driven interindustry accounting system, providing very disaggregated production, employment and income projections resulting from an initiating direct economic change. In this analysis the direct stimulus is defined to be Tri-Met's annual operating and capital expenditures (FY 1983 operating and capital expenditures, excluding Light Rail expenditures.)

In satisfying the direct demands for goods and services required for Tri-Met's operations, local producers must purchase additional inputs to produce their own products. The producers of these inputs, in turn, place similar demands on their suppliers. These secondary rounds of interindustry activity provide an added stimulus to the local economy, called indirect activity.

In addition to the secondary rounds of economic activity associated with the direct demands, an induced change in local production related to household spending may be estimated. This

effect is attributable to the increase in consumption by a labor force employed to produce the goods and services needed to satisfy the direct and indirect requirements.

The magnitude of combined direct, indirect and induced effects is highly influenced by the interindustry structure of the local economy in the sense that not all demands are met by local producers. Metropolitan economies are typically characterized by large volumes of imports and exports. To the extent that agency-related demands are met by imported goods and services, a portion of the economic effect "leaks" out of the area to other regions. With regard to Tri-Met's operation these leakages may take several forms. First, a portion of the direct demands associated with the agency will be satisfied by producers in other regions--diesel buses and gasoline, for example. In addition, imports may be required to satisfy some of the indirect economic activity. Finally, induced output may be reduced by the fact that not everyone in the metropolitan labor force resides in and consumes the products of the four county region. The input-output model accounts for the indirect and induced leakages endogenously. Direct leakages have been dealt with in a manner that is outlined below.

The approach used in assessing the economic effects of direct expenditures in an input-output model is to allocate an expenditure to the appropriate supplying sector in the 24-sector model. In the case of Tri-Met's operating and capital

expenditures this would mean that the $100 million budgeted expenditures be broken down into itemized purchases of products that are consumed in the operation of the agency. Thus, transit operations are defined by the purchases of labor, consulting services, transportation equipment, fuel and lubricants, etc. In doing this, we allow for the identification of expenditures for goods and services that have been produced outside the region. These expenditures represent direct leakages.

The Transit Planning and Development Department of Tri-Met provided data consistent with the disaggregated format of the model. This data is contained in Table 1. The first column in Table 1 gives the total budgeted expenditures by item of purchase. These expenditures sum to $100 million. The second column lists those purchases that are known to have been satisfied by producers outside the region (i.e., the direct leakages). A total of $33 million--33 percent of the total agency budget--was identified as direct leakages. These expenditures are primarily for diesel buses and support equipment, gasoline and fringe benefits. The third column gives the expenditures for locally produced materials and services and labor. Of the total local expenditure of $66 million, the labor component represents $44 million--66 percent, and materials and services are $22 million--34 percent. As one would expect, these figures portray the labor-intensiveness of mass transit.

To determine the effects of the local expenditures on the

TABLE 1

TRI-MET OPERATING AND CAPITAL EXPENDITURES - FY '83
(in millions)

Item	Budget Amount	Content Description	Expenditures	
			Non-Local	Local
Labor	43.660	-	-	43.660
Fringe Benefits	9.107	FICA	2.979	-
		Pension	-	1.322
		Disability	-	.323
		Medical Insurance	-	2.682
		Dental Insurance	-	.700
		Life Insurance	-	.094
		Unemployment Ins.	.068	-
		Workers Compensation	.772	-
		Uniforms	.132	.035
Professional & technical serv.	2.545	-	1.018	1.527
Other services	1.404	-	.281	1.123
Fuel & Lubricants	6.057	-	6.057	-
Tires & Tubes	.858	-	.768	.090
Other Materials	4.784	-	3.906	-
Supplies		Office Supplies	-	.325
		Printing & Pub.	-	.357
		Cleaning Supplies	-	.174
		Hand Tools	-	.022
Utilities	.918	Electric Private	-	.476
		Natural gas	-	.067
		Garbage	-	.067
		Water	-	.026
		Sewer	-	.069
		Telephone	-	.213
Special Transp.	1.851	-	-	1.851
Misc. Expenses	.830	-	.722	-
		Education & Training	-	.035
		Postal	-	.048
		Rental & Leasing	-	.025
Interest Expenses	3.340	-	-	3.340
Capital Expend.	23.583	Buses & support equipment	15.993	-
		West Side Garage	-	7.231
		Pioneer Square	-	.213
		Sunset T.C.		.025
		Building Improvement	-	.106
		Misc. Construction	-	.015
Total Allocated Expenditures	98.937		32.696	66.241
Unallocated Expenditures	1.131*			
Total Budgeted Expenditures	100.068			

Source: Tri-Met Fiscal Year '83 Expenditures (excluding Light Rail) data obtained from Tri-Met Transit Planning and Development Department.

* This expenditure represents the sum of the personnel and property liability payments made by Tri-Met. Since the agency is self-insured it makes these payments directly to individuals and therefore they could not be allocated to any sector within the model. Had the agency contracted with an insurance carrier to provide this service, this expenditure would be allocated to the Finance, Insurance & Real Estate sector.

metropolitan economy the data in Table 1 were allocated to their originating sectors in the input-output model. Table 2 provides the resulting direct expenditures across the model's 24 sectors. In the first column the payment for local labor of $44 million was distributed among the 24 sectors using the model's endogenous household consumption function. Note that only a portion of this total amount is actually converted into the direct consumption of goods and services by household. Federal, state and local taxes are deducted from the gross payments to labor, leaving $33 million for direct consumption. In the second column the full amount attributable to local material and service purchases--$22 million--is allocated across the 24 sectors. The third column gives the combined total direct local purchases--$55 million consumed directly by the labor force and the agency itself in locally provided goods and services. The combined demands are largely concentrated in 4 sectors--Construction, Wholesale and Retail Trade,[5] Finance, Insurance and Real Estate and Services account for 78 percent of the total direct demand.

The direct, indirect and induced production generated by the labor force and agency-related materials and service expenditures is given in Table 3. The figures in this Table represent the production attributable to the combined labor and materials and services direct demands. Total regional production attributable to Tri-Met expenditures is estimated to be $108 million. As with direct demands this total is largely concentrated in a few sectors, with those noted previously and Transportation,

TABLE 2

DIRECT LOCAL EXPENDITURES ASSOCIATED WITH TRI-MET
OPERATING AND CAPITAL EXPENDITURES - FY '83

	Labor	Materials & Services	Total Final Demand
Agr., For. & Fish	283,790		283,790
Mining	0	0	0
Construction	0	7,590,000	7,590,000
Food & Kindred Prod.	2,453,692	0	2,453,692
Text. & App.	440,966	0	440,966
Wood Products	270,692	0	270,692
Pulp & Paper	266,326	356,990	623,316
Chemical Product	467,162	174,305	641,467
Rubber & Leather	56,758	0	56,758
Stone, Clay & Glass	26,196	0	26,196
Prim. & Fab. Metal	78,588	0	78,588
Machinery	30,562	0	30,562
Electrical Equip. & Instr.	266,326	0	266,326
Trans. Equipment	611,240	0	611,240
Misc. Mfg.	126,614	0	126,614
TCU	1,846,818	2,197,880	4,044,698
Electrical Services	694,194	476,000	1,170,194
Wholesale/Retail Trade	7,321,782	381,775	7,703,557
FIRE	7,941,754	5,779,000	13,720,754
Services	8,670,876	5,482,295	14,153,171
Govt. Enterprises	462,796	142,825	605,621
Electrical Utilities			
• Federal	30,562	0	30,562
• State & Local	100,418	0	100,418
Scrap	87,320	0	87,320
Total Direct Disposable	32,535,432	22,581,070	55,116,502
Total Direct	43,660,000	22,581,070	66,241,070

TABLE 3

DIRECT, INDIRECT AND INDUCED EFFECTS OF TRI-MET PURCHASES ON THE PORTLAND SMSA ECONOMY

	Combined Total of Labor + Materials & Services
Agr., For., & Fish	1,454,952
Mining	45,045
Contract Construction	9,672,944
Food & Kindred Products	5,161,953
Textiles & Apparels	849,990
Wood Product	1,812,398
Pulp & Paper	2,494,640
Chemical Product	2,149,409
Rubber & Leather	303,264
Stone, Clay & Glass	676,586
Prim. & Fab. Metal	2,015,343
Machinery	361,936
Elect. Equip . & Inst.	986,741
Transportation Equip.	1,396,719
Miscellaneous Mfg.	266,466
TCU	9,012,850
Electrical Services	2,571,053
Wholesale/Retail Trade	14,774,465
FIRE	24,618,190
Services	25,141,495
Govt. Enterprises	1,446,205
Electrical Utilities	
• Federal	85,491
• State & Local	270,145
Scrap	213,804
Total Regional Production*	107,782,084

*Estimates of regional production include wage and salary payments to employees residing within the Portland SMSA totaling $32,060,091.

Communications, and Utilities accounting for 77 percent of the total local output.

Table 4 provides the indirect and induced employment generated in each sector. Of the total 2,487 person-years estimated the five sectors noted earlier account for 85 percent. When combined with the direct employment of 1,871 person-years[6] a total of 4,358 person-years was determined.

A breakdown of the generated indirect and induced employment by occupation is given in Table 5. Larger than normal concentrations are found among Professional/Technical, Managers, Clerical and Service Workers, reflecting the relative emphasis of the expenditures on services over manufactured products. Production, income and employment multipliers associated with the expenditures are given in Table 6. A multiplier is typically defined as follows:

$$\text{Multiplier} = \frac{\text{Direct + Indirect + Induced Change}}{\text{Direct Change}}$$

With respect to the regional product multiplier the direct change may be defined in a number of ways. As indicated in Table 6 alternative definitions of what values constitute direct change lead to different product multipliers. The first multiplier (1.07) defines direct change as the agency's total budgeted

TABLE 4

INDIRECT & INDUCED EMPLOYMENT, BY SECTOR,
ASSOCIATED WITH TRI-MET OPERATING & CAPITAL EXPENDITURES
(in person-years)

	Combined Total of Labor + Materials & Services
Agr., For., & Fish	26.99
Mining	1.03
Contract Construction	177.16
Food & Kindred Products	45.52
Textile & Apparel	25.15
Wood Product	26.61
Pulp & Paper	36.96
Chemical Product	14.78
Rubber & Leather	7.70
Stone, Clay & Glass	12.37
Prim. & Fab Metal	29.04
Machinery	7.46
Elect. Equip. & Inst.	25.43
Transportation Equip.	18.72
Miscellaneous Mft.	7.07
TCU	169.10
Electrical Services	19.45
Wholesale/Retail Trade	492.48
FIRE	262.73
Services	1017.87
Govt. Enterprises	61.54
Electrical Utilities	
• Federal	0.81
• State & Local	1.97
Scrap	0
Combined Total	2487.94
Total Direct (Tri-Met employees)*	1871.00
Total Direct, Indirect & Induced	4358.94

*1983-1984 Tri-Met Budget - Appendix A - Personnel Lists

TABLE 5

OCCUPATIONAL DISTRIBUTION OF INDIRECT
& INDUCED EMPLOYMENT EFFECTS

Occupational Category	Combined Total of Labor + Materials & Services
Professional/Technical	440.44
Managers	281.22
Sales Workers	173.83
Clerical Workers	491.40
Craft & Kindred	293.57
Operatives	268.61
Service Workers	399.14
Laborers	118.16
Farmers/Farm Workers	21.57
Totals	2487.94

TABLE 6

MULTIPLIERS ASSOCIATED WITH TRI-MET'S
OPERATING AND CAPITAL EXPENDITURES

Regional Production:	
• Total Budgeted Expenditures	1.07
• Direct Local Outlays	1.63
• Direct Local Disposable Outlays	1.96
Regional Income:	1.734
Regional Employment:	2.32

expenditures ($100 million). The interpretation of this multiplier is as follows: for every dollar budgeted for Tri-Met's operations, regional production will expand by 1.07 dollars. The definition of direct change for the subsequent product multipliers are:

- "Direct Local Outlays" - direct change equals the gross wages and salaries paid to the agency labor force plus local material and service purchases ($66 million).

- "Direct Local Disposable Outlays" - direct change equals the value of goods and services directly consumed by the agency labor force plus local material and service purchases ($55 million).

The regional multipliers are relatively large.[7] This is attributable to smaller direct leakages of material and service expenditures and the labor-intensiveness of mass transit. A relatively high employment multiplier is recovered because persons directly employed in the agency (Tri-Met) are well paid in comparison with indirect and induced employees, and because additional employment is generated by Tri-Met's material and service purchases.

MODEL DOCUMENTATION

The model employed in the analysis is a 24 sector input-output

system covering the four county Portland SMSA. The interindustry transactions component is based on the IMPLAN model developed by the U.S. Forest Service.[8] The IMPLAN system is derived from the 1977 national input-output model developed by the U.S. Department of Commerce.

An endogenous household sector was constructed using established closure practices, with data provided by the 1980 Census and other U.S. Department of Commerce publications. The occupational component of the model was derived from industry-occupational data contained in Bureau of Labor Statistics publications.

ACKNOWLEDGEMENT

The analysis was performed by James G. Strathman, Assistant Professor in PSU's School of Urban and Public Affairs, and Rishinath L. Rao, Graduate Research Assistant in the Center for Urban Studies. David Auxier, Manager, Accounting Department, provided more detailed information on expenditure patterns. G.B. Arrington, Project Development Planner, provided material on the agency's direct benefits and made a number of helpful suggestions regarding the organization of the analysis. The authors gratefully acknowledge their efforts.

FOOTNOTES

1. For examples of the application of input-output analysis to impact assessment see:

   Isard, W. and R. Kuenne, "The Impact of Steel Upon the Greater New York-Philadelphia Industrial Region," The Review of Economics and Statistics, Vol. 35 (1953), pp. 289-301.

   Isard, W., T. Reiner, R. Van Zele, J. Strathman, Regional Economic Impacts of Nuclear Power Plants, University of Pennsylvania, Energy Policy Project, prepared for Brookhaven National Laboratory, Report No. BNL50562, August, 1976.

   Miller, R.E., "The Impact of the Aluminum Industry on the Pacific Northwest: A Regional Input-Output Analysis," The Review of Economics and Statistics, Vol. 39 (1957) pp. 200-209.

   Stieker, G. and J. Strathman, "Regional Economic Impact From Construction of a Nuclear Electric Generating Plant," Regional Science Research Institute, RSRI Discussion Paper No. 91, December, 1976.

2. Fact Sheet, January 31, 1983, Tri-Met, Portland, Oregon.

3. General Manager's Report for Fiscal Year 1983, Tri-Met, Portland, Oregon.

4. Arrington, G.B., Transit Planning and Development Inter-Office Memorandum, July 26, August 19, August 23, 1983, Tri-Met, Portland, Oregon.

5. The expenditures described in this study are defined in terms of producer prices. Within the input-output system this means that the value of demand by sector represents only that portion of the final sales price received by each sector. Following this convention, the figures for the wholesale/retail trade sector do not represent the value of sales. Rather, the levels of activity measured in this sector represent trade margins equal to the value of sales minus the cost of the items purchased for resale. The cost of the item to this sector is then allocated to the original producer. This procedure has no effect on the value of the total economic activity.

6. 1983-1984 Tri-Met Budget.

7. By the term "relative" we mean two things. First, the Portland SMSA has been identified as the eleventh most diversified metropolitan economy in the U.S. Thus, fewer "leakages" would be expected here in comparison with other metropolitan areas. Secondly, if we view the alternative to these expenditures to be outlays for alternative modes of transportation we would also expect greater direct leakages. This is because expenditures for alternative modes would be more capital and energy-intensive (i.e., vehicles and fuel), both of which are heavily imported into the region.

8. See Alward, G.S. and C.J. Palmer, "IMPLAN: An Input-Output Analysis System for Forest Service Planning" (mimeo) U.S. Forest Service.