GUNNISON COUNTY INTERINDUSTRY SPENDING AND EMPLOYMENT ATTRIBUTED TO FISHING AT BLUE MESA RESERVOIR

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EXECUTIVE SUMMARY

An economic input-output model is generated from the USDA IMPLAN system and used to study the role of fishing at Blue Mesa reservoir in the Gunnison county economy. The current contribution of spending by non-resident fishing is estimated to be $5.25 million in added sales revenue and 170 jobs. A weighted least squares statistical travel cost demand model is estimated using a sample of 200 on-site personal interviews. The demand function is used to measure the effect of changes in expected fish catch and travel cost on visit rate. Schedules of visit rates for different expected fish catch and travel cost are created. The input-output model and statistical demand equation are combined to calculate schedules of local employment and interindustry sales associated with various levels of expected fish catch and travel cost to visit Blue Mesa reservoir.

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GUNNISON COUNTY INTERINDUSTRY SPENDING AND EMPLOYMENT ATTRIBUTED TO FISHING AT BLUE MESA RESERVOIR

INTRODUCTION

The purpose of this report is to describe the economic impacts in Gunnison county, Colorado, of fishing at Blue Mesa Reservoir. The impacts are estimated using IMPLAN, a new county-level input-output (I/O) data base available from the Forest Service, USDA.[1] The IMPLAN I/O data are processed in a user-friendly microcomputer program (McKean and Johnston, 1985). This report briefly reviews the method, and shows how it can be used in conjunction with a statistical demand model for fishing at Blue Mesa reservoir to describe and impacts of fishing at the reservoir on the Gunnison county economy.[2]

Personal income in Gunnison county's economy is dominated by the government, services, retail trade and extraction sectors. Extreme instability of the extraction and related construction sectors has occurred in the last decade. For example, personal earnings in Gunnison county mining rose from $9,384,000 in 1978 to a peak of $19,121,000 in 1981 and then fell sharply in 1983 to $8,787,000. Table 1 shows that government, restaurants and lodging, amusement services, and retail trade are the largest employers in the county.

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[1] The IMPLAN system generates interindustry spending flows for a county or group of counties from secondary data rather than from survey data. If adequate funding is available, a survey-based analysis should be more accurate. A number of survey-based input-output studies have been conducted by researchers at Colorado State University. See the references at the end of the report for a partial listing of some recent studies. The relatively low cost of Implan data make I/O analysis practical when funding is limited.

[2] A changing environment exists for both rural and urban economies within the state of Colorado. The effects of outside influences, including U.S. business conditions, the national farm program, world farm produce markets, and world energy markets on both rural and urban economies in Colorado can be severe. The I/O technique can describe, with considerable detail, these local impacts that are created by national and world events. I/O can be used to calculate the cumulative effects on each sector of the economy as industries expand or decline. The impacts of entry by new industries can also be projected through the inclusion of phantom sectors (McKean and Winger, 1987).

TABLE 1 EMPLOYMENT BY SECTOR, 1982 [1] [2]
(full time equivalent workers)

1	AGRICULTUR	112.0
2	COAL MINES	414.8
3	OTHER MINE	122.2
4	NEW CONSTR	302.4
5	MAINT CNST	88.5
6	MFG/TRN/UT	308.1
7	WHOLESALE	64.8
8	REC RETAIL	52.5
9	OTHER RETL	536.6
10	FIN/INSUR	112.8
11	REAL EST	169.5
12	LODGING	274.4
13	RESTAURANT	921.6
14	HEALTH SER	86.2
15	EDUCATION	136.8
16	AMUSEMENTS	300.4
17	OTHER SER	233.1
18	CLUBS	122.5
19	GOVT ENTS	947.0
	TOTAL	5,307

1/ Source: IMPLAN, Forest Service, USDA.

2/ More detailed employment data are shown in Appendix II.

The employment mix indicates a strong influence of tourism on the counties economy.

Uses of the I/O Technique

The I/O modeling technique traces spending flows within an economy, such as Gunnison county, in order to measure the direct, indirect, and induced effects of changes in sales to final demand. The method assumes that growth or decline of the economy is due to changes in sales to final demand (ignoring growth created by increased productivity). Examples of final demand change include: growth or decline of exports of goods and services by firms in the region; spending in Gunnison county by tourists, fishermen, hunters, or other non-resident travelers; retirement income or other receipts[3] from outside the county by residents of Gunnison county; new investment and sales made to the federal government or other sources outside the county. The relative importance of exports as a driving force for the Gunnison county economy is shown in table 2. Coal and other extraction were the largest source of export earnings (in 1982). Other important sources of export earnings occurred in the manufacturing/transportation/utilities, households, restaurant, amusements and lodging sectors.[4]

In this study, the accounting focus is on the county rather than state or national impacts. The presence of a resource in the county--fishing recreation at Blue Mesa Reservoir--creates tourist spending in the county. A survey of fishermen at the reservoir was conducted to estimate their direct

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[3] For example, in Gunnison county about 4% of farm income is from federal government payments (agriculture is not a very large part of the Gunnison county economy). In some Colorado counties however, federal government payments as a percent of farm income rises above 100%. (Miller, Gray and Trock)

[4] Complete detailed industry dollar transactions-among-sectors and percentage distributions of sales and purchases for the Gunnison county economy are shown in appendices IV, V, and VI.

TABLE 2 EXPORTS AND TOTAL SALES BY SECTOR IN GUNNISON COUNTY, COLORADO, 1982[3]

	DMSTC EXP[1]	FOR EXPORT[2]	TOTAL SALES	EXPORTS/SALES
1 AGRICULTUR	$ 8,936,800.	$ 142,600.	$ 11,258,900.	.81
2 COAL MINES	32,087,800.	7,724,500.	45,973,500.	.87
3 OTHER MINE	6,127,700.	2,771,700.	10,412,200.	.85
4 NEW CONSTR	13,488,300.	100.	29,409,000.	.46
5 MAINT CNST	1,256,800.	1,100.	3,447,900.	.36
6 MFG/TRN/UT	15,015,800.	1,118,800.	27,516,100.	.59
7 WHOLESALE	0.	137,600.	157,400.	.87
8 REC RETAIL	0.	0.	1,148,400.	0.00
9 OTHER RETL	3,440,000.	3,900.	12,477,300.	.28
10 FIN/INSUR	6,490,300.	17,200.	18,742,100.	.35
11 REAL EST	3,644,700.	286,600.	13,001,700.	.30
12 LODGING	3,431,200.	4,800.	4,407,600.	.78
13 RESTAURANT	6,611,000.	10,100.	13,066,400.	.51
14 HEALTH SER	913,100.	0.	3,841,600.	.24
15 EDUCATION	3,373,500.	0.	4,133,000.	.82
16 AMUSEMENTS	6,316,300.	56,900.	8,182,700.	.78
17 OTHER SER	1,576,800.	90,600.	9,139,900.	.18
18 CLUBS	611,600.	9,900.	1,542,200.	.40
19 GOVT ENTS	1,052,600.	34,400.	19,090,100.	.06
20 HOUSEHOLDS	6,919,500.	0.	84,814,000.	.08
TOTALS	121,293,800.	12,410,800.	489,616,400.	

1/ Sales delivered within the U.S.
2/ Sales delivered outside the U.S.
3/ Source: IMPLAN, Forest Service, USDA

spending (Johnson and Walsh, 1987). An I/O model for the county is used to estimate the indirect and induced impacts of the spending by non-residents attracted to the county by the presence of fishing opportunities at the reservoir. Thus, the total economic impacts on the county are estimated as the sum of the direct, indirect, and induced spending (and related employment).

The IMPLAN Input-Output Data

In the past, data necessary to construct regional I/O tables were expensive to obtain. Affordable data to implement the I/O model are now available from the Rocky Mountain Forest and Range Experiment Station, Forest Service, USDA located in Fort Collins, Colorado. These county data are estimated from the national I/O model rather than based upon personal interview survey as in the conventional I/O study.

The 1977 Bureau of Economic Analysis I/O data for the United States have been updated to 1982 by Engineering-Economics Associates under contract to the Forest Service, USDA. The IMPLAN I/O data are available only to government agencies and universities through the USDA IMPLAN computerized data retrieval and I/O model synthesizer program. The USDA IMPLAN computer system can be operated via a series of user job submissions to create data sets corresponding to any county or combination of counties in the United States.[5]

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[5] In order to access IMPLAN, a user account must be set up to fund the time required on the U.S.D.A. Univac computer located at the Craddock Building in Fort Collins. The Implan system can be used in combination with the IMS I/O Analysis computer program to generate, retrieve, store and analyze I/O data for any county or combination of counties in the U.S. The data for each county consist of a matrix equivalent in size to a 528 x 528 table containing as many as 278,784 observations on transactions among industries. Additional matrices are retrieved containing imports, exports and employment by the 528 industries.

Once the data have been transmitted by telephone from the USDA Univac to a microcomputer, they can be stored on hard disk or Bernoulli Box storage devices. A user-friendly program has been developed to allow aggregation of the 528 industries down to 110 or fewer sectors which are organized in a data file compatible to the IMS I/O Analysis program. At this point, the I/O data are available for economic analysis and forecasting.

CHAPTER 2

ECONOMIC IMPACTS ON GUNNISON COUNTY FROM FISHING AT BLUE MESA RESERVOIR

The effects of spending by fishermen at Blue Mesa reservoir on the Gunnison county economy can be estimated using the results of the onsite survey expanded to represent annual visits. These data are reported in Economic Benefits and Costs of Fish Stocking at Blue Mesa Reservoir (Johnson and Walsh, 1987). The estimated spending by non-residents of Gunnison county are shown in table 3. Since most visitors are from outside the county and non-resident visitors spend more per visit than resident visitors, non-residents of Gunnison county account for over 99 percent of the spending by fishermen at Blue Mesa reservoir. Entry of the data from table 3 into the IMS interindustry modeling program allows estimation of detailed impacts of the fishermen spending on Gunnison county as shown in tables 4 through 9.[6] Table 3 shows that some $2.62 million dollars are spent directly by non-resident fishermen annually at Blue Mesa reservoir.

Table 4 shows sector by sector spending impacts which total to some $5.25 million dollars for the Gunnison county economy. Household income, retail sales, lodging and restaurants are the primary recipients of direct, indirect and induced spending from fishing at Blue Mesa reservoir. Table 5 shows that the indirect effects of fishermen spending create employment in 14 out of 19 sectors of the Gunnison county economy. However, the indirect effects only account for some 32 jobs while direct fishermen spending creates about 140 jobs. The small indirect effects reflect the undeveloped nature of the Gunnison county economy which must depend on imports for large portions of

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[6] The input-output forecasting technique is described briefly in Appendix I.

household and retail inputs (see rows 24 and 25 of appendix table VI, Direct Input Requirements). Table 8 shows the significant nature of Blue Mesa fishermen spending on recreational retail, lodging and other retail sectors of the Gunnison county economy. Table 9 distributes the added spending created by fishing at Blue Mesa reservoir within the transactions-among-sectors table so that a detailed picture of the spending patterns created throughout the economy is demonstrated.

TABLE 3 GUNNISON COUNTY ADDED SALES TO FINAL DEMANDS RESULTING FROM FISHING VISITS TO BLUE MESA RESERVOIR[1] [2]

(DOLLARS)

1	AGRICULTUR	0.
2	COAL MINES	0.
3	OTHER MINE	0.
4	NEW CONSTR	0.
5	MAINT CNST	0.
6	MFG/TRN/UT	0.
7	WHOLESALE	0.
8	REC RETAIL	221,322.
9	OTHER RETL	931,530.
10	FIN/INSUR	0.
11	REAL EST	0.
12	LODGING	853,717.
13	RESTAURANT	371,212.
14	HEALTH SER	76,398.
15	EDUCATION	0.
16	AMUSEMENTS	0.
17	OTHER SER	76,398.
18	CLUBS	0.
19	GOVT ENTS	93,424.
20	HOUSEHOLDS	0.
21	IND BUS TX	0.
22	PROFITS	0.
23	PROP INC	0.
24	COMP IMPS	0.
25	N-C IMPS	0.
	TOTAL	2,624,001.

1/ Export sales to nonresidents visiting Blue Mesa reservoir for the purpose of fishing.

2/ Source: On-site Survey of non-resident fishers at Blue Mesa Reservoir.

TABLE 4 DIRECT, INDIRECT, AND INDUCED INDUSTRY SALES CREATED BY FISHERS AT BLUE MESA RESERVOIR

		(DOLLARS)
1	AGRICULTUR	1,437.
2	COAL MINES	723.
3	OTHER MINE	476.
4	NEW CONSTR	0.
5	MAINT CNST	20,435.
6	MFG/TRN/UT	236,239.
7	WHOLESALE	227.
8	REC RETAIL	238,483.
9	OTHER RETL	1,057,919.
10	FIN/INSUR	199,973.
11	REAL EST	197,797.
12	LODGING	869,837.
13	RESTAURANT	484,028.
14	HEALTH SER	123,993.
15	EDUCATION	10,822.
16	AMUSEMENTS	22,222.
17	OTHER SER	246,618.
18	CLUBS	15,894.
19	GOVT ENTS	142,555.
20	HOUSEHOLDS	1,380,662.
	TOTAL	5,250,340.

TABLE 5

EMPLOYMENT CREATED BY DIRECT SPENDING FOR FISHING AT BLUE MESA RESERVOIR (Full Time Equivalent Workers)		
1	AGRICULTUR	0.0
2	COAL MINES	0.0
3	OTHER MINE	0.0
4	NEW CONSTR	0.0
5	MAINT CNST	0.0
6	MFG/TRN/UT	0.0
7	WHOLESALE	0.0
8	REC RETAIL	10.1
9	OTHER RETL	40.0
10	FIN/INSUR	0.0
11	REAL EST	0.0
12	LODGING	53.1
13	RESTAURANT	26.1
14	HEALTH SER	1.7
15	EDUCATION	0.0
16	AMUSEMENTS	0.0
17	OTHER SER	1.9
18	CLUBS	0.0
19	GOVT ENTS	4.6
	TOTAL	137.8

EMPLOYMENT CREATED INDIRECTLY BY FISHERMEN AT BLUE MESA RESERVOIR (Full Time Equivalent Workers)		
1	AGRICULTUR	0.0
2	COAL MINES	0.0
3	OTHER MINE	0.0
4	NEW CONSTR	0.0
5	MAINT CNST	0.5
6	MFG/TRN/UT	2.6
7	WHOLESALE	0.0
8	REC RETAIL	0.7
9	OTHER RETL	5.4
10	FIN/INSUR	1.2
11	REAL EST	2.5
12	LODGING	1.0
13	RESTAURANT	7.9
14	HEALTH SER	1.0
15	EDUCATION	0.3
16	AMUSEMENTS	0.8
17	OTHER SER	4.3
18	CLUBS	1.2
19	GOVT ENTS	2.4
	TOTAL	32.5

TABLE 6 TOTAL EMPLOYMENT CHANGE CREATED
BY FISHING AT BLUE MESA RESERVOIR

(Full Time Equivalent Workers)

1	AGRICULTUR	0.0
2	COAL MINES	0.0
3	OTHER MINE	0.0
4	NEW CONSTR	0.0
5	MAINT CNST	0.5
6	MFG/TRN/UT	2.6
7	WHOLESALE	0.0
8	REC RETAIL	10.9
9	OTHER RETL	45.4
10	FIN/INSUR	1.2
11	REAL EST	2.5
12	LODGING	54.1
13	RESTAURANT	34.1
14	HEALTH SER	2.7
15	EDUCATION	0.3
16	AMUSEMENTS	0.8
17	OTHER SER	6.2
18	CLUBS	1.2
19	GOVT ENTS	7.0
	TOTAL	170.3

TABLE 7 SUMMARY OF CHANGE IN EMPLOYMENT CREATED
BY FISHING AT BLUE MESA RESERVOIR

RESOURCE	----DIRECT----	---INDIRECT---	----TOTAL----
EMPLOYMENT	137.8	32.5	170.3

TABLE 8 PERCENT CHANGE IN GUNNISON COUNTY EMPLOYMENT AND TOTAL SALES CREATED BY FISHING AT BLUE MESA RESERVOIR

		(PERCENT)
1	AGRICULTUR	0.0128
2	COAL MINES	0.0016
3	OTHER MINE	0.0046
4	NEW CONSTR	0.0000
5	MAINT CNST	0.5927
6	MFG/TRN/UT	0.8585
7	WHOLESALE	0.1442
8	REC RETAIL	20.7666
9	OTHER RETL	8.4787
10	FIN/INSUR	1.0670
11	REAL EST	1.5213
12	LODGING	19.7349
13	RESTAURANT	3.7044
14	HEALTH SER	3.2276
15	EDUCATION	0.2618
16	AMUSEMENTS	0.2716
17	OTHER SER	2.6983
18	CLUBS	1.0306
19	GOVT ENTS	0.7467
20	HOUSEHOLDS	1.6279

TABLE 9 DISTRIBUTION OF ADDED TRANSACTIONS CREATED BY FISHING AT BLUE MESA RESERVOIR AMONG SECTORS (Dollars)
(Purchases by sectors listed at the top from sectors listed at the left)

	1 AGRICULTUR	2 COAL MINES	3 OTHER MINE	4 NEW CONSTR	5 MAINT CNST	6 MFG/TRN/UT	7 WHOLESALE
1 AGRICULTUR	267.	0.	0.	0.	0.	7.	0.
2 COAL MINES	0.	95.	0.	0.	0.	9.	0.
3 OTHER MINE	0.	0.	67.	0.	1.	408.	0.
4 NEW CONSTR	0.	0.	0.	0.	0.	0.	0.
5 MAINT CNST	2.	1.	1.	0.	4.	255.	0.
6 MFG/TRN/UT	17.	6.	8.	0.	338.	24062.	11.
7 WHOLESALE	0.	0.	0.	0.	2.	9.	0.
8 REC RETAIL	0.	1.	0.	0.	4.	55.	0.
9 OTHER RETL	3.	1.	0.	0.	1089.	178.	0.
10 FIN/INSUR	31.	4.	2.	0.	125.	1334.	2.
11 REAL EST	44.	12.	7.	0.	39.	2426.	3.
12 LODGING	1.	1.	0.	0.	16.	355.	1.
13 RESTAURANT	0.	1.	1.	0.	15.	3675.	7.
14 HEALTH SER	17.	0.	0.	0.	0.	0.	0.
15 EDUCATION	0.	0.	0.	0.	0.	69.	0.
16 AMUSEMENTS	0.	0.	0.	0.	0.	3754.	1.
17 OTHER SER	10.	11.	5.	0.	155.	4416.	9.
18 CLUBS	0.	0.	0.	0.	1.	115.	0.
19 GOVT ENTS	3.	2.	2.	0.	28.	1246.	1.
20 HOUSEHOLDS	84.	229.	179.	-1.	7355.	60506.	94.
21 IND BUS TX	29.	30.	53.	0.	322.	6006.	28.
22 PROFITS	58.	2.	-37.	0.	410.	533.	4.
23 PROP INC	24.	100.	22.	0.	282.	21377.	25.
24 COMP IMPS	573.	217.	153.	-3.	9755.	89362.	37.
25 N-C IMPS	274.	8.	12.	0.	494.	16083.	3.
TOTALS	1437.	723.	476.	-5.	20435.	236239.	227.

TABLE 9 DISTRIBUTION OF ADDED TRANSACTIONS CREATED BY FISHING AT BLUE MESA RESERVOIR AMONG SECTORS (Dollars)
(Purchases by sectors listed at the top from sectors listed at the left)

	8 REC RETAIL	9 OTHER RETL	10 FIN/INSUR	11 REAL EST	12 LODGING	13 RESTAURANT	14 HEALTH SER
1 AGRICULTUR	0.	0.	0.	0.	276.	37.	0.
2 COAL MINES	0.	0.	0.	6.	0.	0.	0.
3 OTHER MINE	0.	0.	0.	0.	0.	0.	0.
4 NEW CONSTR	0.	0.	0.	0.	0.	0.	0.
5 MAINT CNST	208.	890.	7880.	4969.	4598.	419.	87.
6 MFG/TRN/UT	12315.	54781.	2294.	3815.	46949.	14680.	2618.
7 WHOLESALE	0.	8.	0.	0.	20.	59.	3.
8 REC RETAIL	42.	161.	3.	79.	79.	26.	10.
9 OTHER RETL	270.	1212.	201.	123.	1164.	289.	48.
10 FIN/INSUR	1827.	8148.	6200.	2019.	13992.	3267.	855.
11 REAL EST	9428.	41792.	5222.	12091.	39430.	11784.	5878.
12 LODGING	332.	1450.	126.	103.	651.	156.	261.
13 RESTAURANT	1163.	5181.	795.	987.	9394.	1045.	1091.
14 HEALTH SER	0.	0.	32.	0.	0.	0.	4735.
15 EDUCATION	0.	0.	3.	2.	0.	0.	19.
16 AMUSEMENTS	145.	636.	15.	26.	276.	81.	3.
17 OTHER SER	6936.	30702.	5847.	2110.	48943.	9728.	4428.
18 CLUBS	42.	246.	30.	49.	967.	215.	113.
19 GOVT ENTS	1495.	6698.	1169.	720.	14959.	1963.	852.
20 HOUSEHOLDS	110894.	491784.	21472.	9971.	250772.	140336.	51032.
21 IND BUS TX	35552.	157696.	28718.	26050.	30352.	19718.	403.
22 PROFITS	7621.	33762.	-1706.	-2627.	-21689.	10569.	11142.
23 PROP INC	18877.	83719.	102199.	123858.	113693.	26171.	6662.
24 COMP IMPS	29489.	130785.	17079.	12571.	292393.	143756.	27325.
25 N-C IMPS	1848.	8267.	2395.	876.	22616.	99729.	6426.
TOTALS	238483.	1057919.	199973.	197797.	869837.	484028.	123993.

TABLE 9 DISTRIBUTION OF ADDED TRANSACTIONS CREATED BY FISHING AT BLUE MESA RESERVOIR AMONG SECTORS (Dollars)
(Purchases by sectors listed at the top from sectors listed at the left)

	15 EDUCATION	16 AMUSEMENTS	17 OTHER SER	18 CLUBS	19 GOVT ENTS	20 HOUSEHOLDS	21 FED NON-MI
1 AGRICULTUR	3.	54.	0.	1.	1.	775.	0.
2 COAL MINES	6.	0.	0.	0.	489.	117.	0.
3 OTHER MINE	0.	0.	0.	0.	0.	0.	0.
4 NEW CONSTR	0.	0.	0.	0.	0.	0.	0.
5 MAINT CNST	46.	65.	132.	110.	770.	0.	0.
6 MFG/TRN/UT	524.	738.	9228.	976.	1891.	60990.	0.
7 WHOLESALE	0.	1.	3.	0.	0.	122.	0.
8 REC RETAIL	1.	2.	1060.	3.	13.	15619.	0.
9 OTHER RETL	7.	8.	353.	8.	56.	121382.	0.
10 FIN/INSUR	36.	168.	1252.	51.	32.	160627.	0.
11 REAL EST	778.	532.	6754.	826.	184.	60539.	0.
12 LODGING	6.	80.	1759.	294.	19.	10511.	0.
13 RESTAURANT	117.	322.	3805.	552.	174.	84490.	0.
14 HEALTH SER	2.	48.	0.	0.	2.	42758.	0.
15 EDUCATION	2.	0.	54.	0.	5.	10666.	0.
16 AMUSEMENTS	43.	905.	24.	18.	5.	16288.	0.
17 OTHER SER	387.	588.	8000.	536.	301.	47107.	0.
18 CLUBS	10.	26.	254.	6.	4.	13821.	0.
19 GOVT ENTS	86.	93.	1770.	255.	387.	17400.	0.
20 HOUSEHOLDS	6382.	7611.	88322.	7458.	126183.	0.	0.
21 IND BUS TX	3.	1152.	3238.	4.	0.	0.	0.
22 PROFITS	3.	118.	28386.	0.	1.	0.	0.
23 PROP INC	-3.	3954.	36866.	28.	2041.	0.	0.
24 COMP IMPS	2136.	5074.	47889.	4373.	9664.	717450.	0.
25 N-C IMPS	244.	682.	7469.	397.	332.	0.	0.
TOTALS	10822.	22222.	246618.	15894.	142555.	1380662.	0.

TABLE 9 DISTRIBUTION OF ADDED TRANSACTIONS CREATED BY FISHING AT BLUE MESA RESERVOIR AMONG SECTORS (Dollars)
(Purchases by sectors listed at the top from sectors listed at the left)

	22 FED MIL	23 FED CCC	24 ST/LOC N-E	25 ST/LOC ED	26 INVENTORY	27 CAPTL FORM	28 DMSTC EXP
1 AGRICULTUR	0.	0.	0.	0.	0.	0.	0.
2 COAL MINES	0.	0.	0.	0.	0.	0.	0.
3 OTHER MINE	0.	0.	0.	0.	0.	0.	0.
4 NEW CONSTR	0.	0.	0.	0.	0.	0.	0.
5 MAINT CNST	0.	0.	0.	0.	0.	0.	0.
6 MFG/TRN/UT	0.	0.	0.	0.	0.	0.	0.
7 WHOLESALE	0.	0.	0.	0.	0.	0.	0.
8 REC RETAIL	0.	0.	0.	0.	0.	0.	221322.
9 OTHER RETL	0.	0.	0.	0.	0.	0.	931530.
10 FIN/INSUR	0.	0.	0.	0.	0.	0.	0.
11 REAL EST	0.	0.	0.	0.	0.	0.	0.
12 LODGING	0.	0.	0.	0.	0.	0.	853717.
13 RESTAURANT	0.	0.	0.	0.	0.	0.	371212.
14 HEALTH SER	0.	0.	0.	0.	0.	0.	76398.
15 EDUCATION	0.	0.	0.	0.	0.	0.	0.
16 AMUSEMENTS	0.	0.	0.	0.	0.	0.	0.
17 OTHER SER	0.	0.	0.	0.	0.	0.	76398.
18 CLUBS	0.	0.	0.	0.	0.	0.	0.
19 GOVT ENTS	0.	0.	0.	0.	0.	0.	93424.
20 HOUSEHOLDS	0.	0.	0.	0.	0.	0.	0.
21 IND BUS TX	0.	0.	0.	0.	0.	0.	0.
22 PROFITS	0.	0.	0.	0.	0.	0.	0.
23 PROP INC	0.	0.	0.	0.	0.	0.	0.
24 COMP IMPS	0.	0.	0.	0.	0.	0.	0.
25 N-C IMPS	0.	0.	0.	0.	0.	0.	0.
TOTALS	0.	0.	0.	0.	0.	0.	2624001.

TABLE 9 DISTRIBUTION OF ADDED TRANSACTIONS CREATED BY FISHING AT BLUE MESA RESERVOIR AMONG SECTORS (Dollars)
(Purchases by sectors listed at the top from sectors listed at the left)

	29 FOR EXPORT	TOTALS	TOTAL FD
1 AGRICULTUR	0.	1421.	0.
2 COAL MINES	0.	722.	0.
3 OTHER MINE	0.	475.	0.
4 NEW CONSTR	0.	0.	0.
5 MAINT CNST	0.	20436.	0.
6 MFG/TRN/UT	0.	236241.	0.
7 WHOLESALE	0.	227.	0.
8 REC RETAIL	0.	238481.	221322.
9 OTHER RETL	0.	1057923.	931530.
10 FIN/INSUR	0.	199973.	0.
11 REAL EST	0.	197769.	0.
12 LODGING	0.	869841.	853717.
13 RESTAURANT	0.	484026.	371212.
14 HEALTH SER	0.	123992.	76398.
15 EDUCATION	0.	10821.	0.
16 AMUSEMENTS	0.	22222.	0.
17 OTHER SER	0.	246617.	76398.
18 CLUBS	0.	15897.	0.
19 GOVT ENTS	0.	142555.	93424.
20 HOUSEHOLDS	0.	1380663.	0.
21 IND BUS TX	0.	309356.	0.
22 PROFITS	0.	66551.	0.
23 PROP INC	0.	539897.	0.
24 COMP IMPS	0.	1540077.	0.
25 N-C IMPS	0.	168155.	0.
TOTALS	0.		

CHAPTER 3

PROJECTED ECONOMIC IMPACTS ON GUNNISON COUNTY OF CHANGES IN TRAVEL COST AND EXPECTED FISH CATCH

As described in appendix I, the economy is assumed to be driven by changes in sales by local producers final demand. For the purposes of this study, the relevant final demand change is the variation in the number of visits to Blue Mesa reservoir by persons from outside Gunnison county. Sales made to non-residents who are attracted to Gunnison county for fishing at Blue Mesa reservoir are county exports created by the Blue Mesa reservoir fishing resource. Projections of expected annual visits per visitor group conditional upon the travel cost of a visit and/or the expected fish catch are shown in Chapter 5 in tables 15 and 16. Estimates of the total spending and jobs in Gunnison county due to exports created by Blue Mesa reservoir fishing are shown in tables 10 and 11 respectively. One can use a proportional change in visit rate to calculate changes in exports which drive the input-output model i.e. if the visit rate falls by X% then dollars of fishing-related export sales also fall by X%.

TABLE 10 PROJECTED SALES AND EMPLOYMENT CREATED BY BLUE MESA FISHING AS TRAVEL COST IS INCREASED IN 5% INCREMENTS

AVERAGE COST OF TRIP	SALES REVENUES	EMPLOYMENT
$ 544.87	$ 5,252,226.00	170.36
572.11	5,068,408.00	164.40
599.36	4,899,133.00	158.91
626.60	4,742,669.00	153.83
653.84	4,597,553.00	149.13
681.09	4,462,533.00	144.75
708.33	4,336,546.00	140.66
735.57	4,218,673.00	136.84
762.82	4,108,121.00	133.25
790.06	4,004,195.00	129.88
817.31	3,906,290.00	126.70
844.55	3,813,874.00	123.71
871.79	3,726,474.00	120.87
899.04	3,643,678.00	118.19
926.28	3,565,113.00	115.64
953.52	3,490,446.00	113.22
980.77	3,419,382.00	110.91
1,008.01	3,351,652.00	108.71
1,035.25	3,287,015.00	106.62
1,062.50	3,225,260.00	104.61
1,089.74	3,166,183.00	102.70
1,116.98	3,109,606.00	100.86
1,144.23	3,055,371.00	99.10
1,171.47	3,003,323.00	97.42
1,198.71	2,953,327.00	95.79
1,225.96	2,905,261.00	94.23
1,253.20	2,859,008.00	92.73
1,280.44	2,814,462.00	91.29
1,307.69	2,771,527.00	89.90
1,334.93	2,730,111.00	88.55
1,362.17	2,690,133.00	87.26
1,389.42	2,651,514.00	86.00
1,416.66	2,614,186.00	84.79
1,443.90	2,578,076.00	83.62
1,471.15	2,543,129.00	82.49
1,498.39	2,509,281.00	81.39
1,525.64	2,476,484.00	80.33
1,552.88	2,444,683.00	79.30
1,580.12	2,413,835.00	78.29
1,607.37	23,83,893.00	77.32
1,634.61	2,354,816.00	76.38

TABLE 10 PROJECTED SALES AND EMPLOYMENT CREATED BY BLUE MESA FISHING AS TRAVEL COST IS DECREASED IN 5% INCREMENTS

AVERAGE COST OF TRIP	SALES REVENUES	EMPLOYMENT
$ 544.87	$ 5,252,226.00	170.36
517.63	5,452,674.00	176.86
490.38	5,672,247.00	183.98
463.14	5,913,995.00	191.83
435.90	6,181,670.00	200.51
408.65	6,479,953.00	210.18
381.41	6,814,765.00	221.04
354.17	7,193,687.00	233.33
326.92	7,626,660.00	247.38
299.68	8,126,940.00	263.60
272.43	8,712,668.00	282.60
245.19	9,409,421.00	305.20
217.95	10,254,480.00	332.61
190.70	11,304,690.00	366.68
163.46	12,651,510.00	410.36
136.22	14,453,040.00	468.80
108.97	17,010,670.00	551.76
81.73	20,986,980.00	680.73
54.49	28,218,200.00	915.28
27.24	46,809,890.00	1518.32

TABLE 11 PROJECTED SALES AND EMPLOYMENT CREATED BY BLUE MESA FISHING AS EXPECTED CATCH IS INCREASED IN 5% INCREMENTS

EXPECTED CATCH	SALES REVENUES	EMPLOYMENT
6.95	$ 5,252,226.00	170.36
7.29	5,421,422.00	175.85
7.64	5,587,818.00	181.25
7.99	5,751,585.00	186.56
8.33	5,912,878.00	191.79
8.68	6,071,828.00	196.95
9.03	6,228,573.00	202.03
9.38	6,383,219.00	207.05
9.72	6,535,871.00	212.00
10.07	6,686,625.00	216.89
10.42	6,835,569.00	221.72
10.76	6,982,786.00	226.49
11.11	7,128,349.00	231.21
11.46	7,272,329.00	235.88
11.81	7,414,785.00	240.51
12.15	7,555,783.00	245.08
12.50	7,695,377.00	249.61
12.85	7,833,619.00	254.09
13.20	7,970,561.00	258.53
13.54	8,106,241.00	262.93
13.89	8,240,715.00	267.30
14.24	8,374,017.00	271.62
14.58	8,506,180.00	275.91
14.93	8,637,248.00	280.16

TABLE 11 PROJECTED SALES AND EMPLOYMENT CREATED BY BLUE MESA FISHING AS EXPECTED CATCH IS DECREASED IN 5% INCREMENTS

EXPECTED CATCH	SALES REVENUES	EMPLOYMENT
6.95	$ 5,252,226.00	170.36
6.60	5,080,043.00	164.78
6.25	4,904,654.00	159.09
5.90	4,725,819.00	153.29
5.56	4,543,259.00	147.36
5.21	4,356,655.00	141.31
4.86	4,165,643.00	135.12
4.51	3,969,785.00	128.76
4.17	3,768,576.00	122.24
3.82	3,561,399.00	115.52
3.47	3,347,512.00	108.58
3.13	3,125,985.00	101.39
2.78	2,895,647.00	93.92
2.43	2,654,974.00	86.12
2.08	2,401,903.00	77.91
1.74	2,133,538.00	69.20
1.39	1,845,544.00	59.86
1.04	1,530,854.00	49.65
0.69	1,176,258.00	38.15
0.35	749,688.30	24.32

CHAPTER 4

ANALYSIS OF THE GUNNISON COUNTY REGION

Introduction

An economic description of the Gunnison county economy is included in this report. This description of the economy hinges on two major components of the interindustry model. These components are: the transactions-among-sectors table showing spending flows among industries and agencies in Gunnison county; and the total requirements multipliers which measure the cumulative spending and employment impacts of changes in sales to final demands. These tables are discussed and interpreted in this section. Because of the size of the transactions-among-sectors table, it is presented in appendix IV.

Total requirements multipliers pertain to both economic and resource inputs. Multipliers calculated for Gunnison county show the impacts of new final demand sales on: industry sales, employment, and payroll[7]. Generalized growth multipliers (Gray, McKean, Sparling, 1979) are also presented for industry sales[8].

The Transactions-Among-Sectors Table

The first essential component of any I/O study is the tabulation of data which describe the dollar flows of commodities and merchandise from each supplying sector to each purchasing sector. These flows are typically measured over a one year time period (1982). The information is arrayed with the selling sectors listed at the left of the table and the purchasing sectors

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[7] The effects on industry sales (business multipliers) are shown in the text as are employment multipliers. Payroll multipliers can be found in the household row (row 20) of the interdependency matrix in appendix VII.

[8] See the final column (row sums) of the interdependency matrix in appendix VII. The row sums show the cumulative impact on industry sales for the industry at the row head if all sectors expand sales to final demand by one dollar.

listed across the top. The information in this table, termed the transactions-among-sectors table does two things simultaneously: it identifies the estimated dollar value of sales by sector to each of the other sectors, it identifies the purchases of inputs for processing by each sector from each of the other sectors, and it shows sales for final consumption.

In essence, the information contained in the transactions-among-sectors table represents a double-entry system of bookkeeping in which every sale is simultaneously described as a purchase. Thus, the system deliberately double counts.

Figure 1 shows the quadrants of a transactions-among-sectors table. The Major portion of the table is in quadrant 1 where all the intermediate processing sales (purchases) are displayed. Intermediate processing includes all producers, handlers, dealers and merchandisers who create products and services. When the production process is completed, these products and services are sold to sectors listed in quadrant 2 of the table. Quadrant 2 shows the purchases for final use by state and federal government, capital formation, or exports. Goods and services sold for final use are those which will not receive any further processing within Gunnison county. Thus goods sold for final use are either consumed locally or shipped out of Gunnison county. Quadrant 3 shows sectors which supply inputs in Gunnison county but do not make purchases in the county. Purchases from these sectors are termed "leakages" since the money is not returned to the Gunnison county economy. Imports are the primary sectors in Quadrant 4 but savings and taxes are other forms of leakages also included in this quadrant.[9]

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[9] See Appendix I for a more complete description of the I/O model and a mathematical formulation of the model.

Figure 1. SCHEMATIC OF AN I/O TRANSACTIONS TABLE
SHOWING THE FOUR QUADRANTS OF ACCOUNTS

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\P U R C H A S I N G   I N D U S T R I E S
S   _____________________________________________________
E  |                                     |                |
L  |                                     |                |
L  |                                     |       F        |
I  |                                     |    Q  I        |
N  |                                     |    U  N        |
G  |                                     |    A  A        |
   |                                     |    D  L        |
I  |                                     |    R           |
N  |             QUADRANT 1              |    A  D        |
D  |       INTERMEDIATE PROCESSING       |    N  E        |
U  |                                     |    T  M        |
S  | {sales among local firms and agencies |     A        |
T  |     excluding final consumption}    |    2  N        |
R  |                                     |       D        |
I  |                                     |       S        |
E  |                                     |{sales for final |
S  |                                     | consumption}   |
   |_____________________________________|________________|
   |                                     |                |
   |             QUADRANT 3              |   QUADRANT 4   |
   |           FINAL PAYMENTS            |                |
   | {imports, saving and other leakages} |               |
   |_____________________________________|________________|
```

Gunnison County Transactions-Among-Sectors

The transactions-among-sectors table for Gunnison county is found in appendix IV. A detailed description of the industry and agency sectors in the I/O model along with detailed employment estimates is shown in appendix II.

The rows and columns of the transactions-among-sectors table (shown in appendix IV) which are numbered 1-20 identify the intermediate processing sectors (sector 20, households may be excluded in some analyses). This quadrant of the transactions-among-sectors table shows purchases and sales by the local producers, services, and merchandisers in Gunnison county.

Final demands, i.e. the demands for goods and services that will not be further processed in Gunnison county are identified in columns 21-29.

Rows 21-25 contain the final payments sectors. These payments are for inputs not provided by local suppliers (imports), or for profits, savings and taxes. All final payments are leakages from local spending. Thus the entries in rows 1-20 are receipts to the sectors listed at the left of the table who are located in Gunnison county. Entries in rows 21-25 are receipts of firms located outside the county, government receipts, or withdrawals from the spending stream in the form of savings.

The distribution of total output of each sector, according to the sectors in which the output is sold, may be readily discerned by reading across the rows of the transactions-among-sectors table (appendix IV). The bill of purchases by each sector is found by reading down any column of the table. These column entries show the allocation of purchases among industries.

For example, consider sector 12, Lodging. Reading across row 12 of the transactions-among-sectors table, the sales by lodging services were distributed as follows: $9,300 to agricultural firms, $39,900 to coal mines, $10,100 to other mines, $32,600 to new construction, and so on across the row.

At the right of the table, sales by lodging to final demand such as domestic exports are shown to be $3,431,200 total sales were $4,407,600.

The distribution of purchases by the lodging services sector is shown in column 12. Purchases by lodging from agriculture are $1,400, from maintenance construction are $23,300, from mfg/trn/ut are $396,300, and so on down the column. Total spending by the lodging services sector, shown at the foot of the column, is $4,407,600 just equal to the sales. All intermediate processing sectors in the I/O model show spending equal to sales. This accounting equality is brought about by including saving and profit as items in the spending column.

Other information can be obtained directly from the transactions table. The household row (row 20) represents wages paid and self employment income. Similarly, industry payments to local and county taxes (row 21) may be obtained from the transactions-among-sectors table.

While these and other items, obtained directly from the transactions-among-sectors table, are useful as initial indicators of the relative importance of each sector in the region's economy, the important question of interdependencies is not yet addressed.

I/O Multiplier Effects

The use of demand driven I/O multipliers to identify the sectors of the economy which can provide the greatest boost to employment is well known among regional scientists. These multipliers are termed "backward-linked" or input requirement multipliers since they show the dollar amount of inputs that are directly and indirectly required, throughout the economy, for a one unit change in sales to final demand in any given industry. Typically the added sales to final demand are industry exports although government purchases and support payments might also be important in some instances.[10] [11] In contrast, a forward-linked multiplier would reveal the effect of a new input supply to attract downstream user industries. For example, the creation of a new supply of irrigation water might attract new farm producers in an arid region _if_ it had a suitable growing climate and adequate demand for farm products. Generally such forward links are much less consistent and predictable then are backward (input requirement) links and thus I/O forecasting usually measures only backward linked effects.

Conceptually, the intermediate processing sectors of the economy must always move toward a stable equilibrium where sales equal receipts in each industry. Receipts can be disturbed when final demands such as exports or government purchases from industry change. Changes in final demand set off a series of transactions as each industry responds to either direct or indirect changes in their demands. An example of direct change in demand would occur if

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[10] For example, impacts of federal defense industry operations are large in the Denver metropolitan area.

[11] A closely related multiplier construct can be used to analyze payroll, property income, profits, taxes, imports, or gross regional product. These variables all vary in fixed proportion to industry sales thus their multipliers are computed in a similar manner.

Seven I/O input requirements multipliers are of particular interest. The employment multipliers show for each industry the direct, indirect and induced change in employment, throughout the economy, per added dollar of sales to final demand (exports). The indirect business tax requirements multipliers show for each industry the direct, indirect and induced change in tax collected, throughout the economy, per added dollar of sales to final demand, The payroll requirement multipliers show for each industry, the direct, indirect and induced effect on payroll throughout the economy per added dollar of sales to final demand. The profit and property income multipliers show for each industry the direct, indirect and induced effect on profits or property income throughout the economy per added dollar of sales to final demand. The import requirement multipliers show the direct, indirect and induced spending on imports throughout the economy per added dollar of sales to final demand. Balance of trade multipliers are calculated by subtracting the import requirement multipliers from unity. Gross regional product multipliers are approximated as the sum of the payroll, indirect business tax, profit, and property income multipliers.

lodging exports increased, while an example of an indirect demand change could be the response of hotels and motels to increase output and in so doing they purchase more labor, supplies, electricity and similar inputs thus creating the indirect or "derived" demand for other sectors of the economy. When the other sectors find their demand rising they too will buy more inputs and thus the original export change causes a series of reactions and reverberations throughout the economy. These reverberations gradually die out since during each round of spending part of the spending leaks out to saving, taxes, and imports. The greater the leakage the faster the effects die out and the smaller the multiplier effect will be.[12]

Multiplier effects are usually distinguished as "type I" or "type II." Type II multipliers include households in the interdependency matrix calculations while type I multipliers exclude households. Including households in the interdependency calculations increases the size of the multipliers but it requires the assumption that households have stable spending patterns as is assumed for the production-based spending of the other intermediate processing sectors. Type II and type I business multipliers are shown in table 3. Type II and type I employment multipliers are shown in table 4.

Several other multiplier effects are revealed in the interdependency matrix shown in appendix VII. The direct, indirect, and induced effects on the receipts of a particular intermediate processing sector (row heading of the interdependency matrix) when an industry (column heading of the interdependency matrix) expands sales to final demand by one dollar are shown by the row elements. For example, elements in row 20 of the interdependency

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[12] A much more detailed description of the input-output technique is shown in appendix I.

matrix show the effects on total payroll in Gunnison county as the sector shown at the column head expands sales to final demand.

The education sector has the largest payroll multiplier of .766, 77 cents direct, indirect, and induced payments to teachers and staff are created when education sales expand by one dollar. Other labor intensive sectors such as retail trade (.60) and health services (.56) also have high payroll multipliers.

TABLE 12 BUSINESS MULTIPLIERS FOR GUNNISON COUNTY, COLORADO

TYPE II			TYPE I		
NAME	(RANK)	MULTIPLIER[1]	NAME	(RANK)	MULTIPLIER
AGRICULTUR	(18)	1.5407	AGRICULTUR	(1)	1.3566
COAL MINES	(9)	1.9411	COAL MINES	(5)	1.2262
OTHER MINE	(6)	2.0950	OTHER MINE	(4)	1.2402
NEW CONSTR	(16)	1.7214	NEW CONSTR	(17)	1.1049
MAINT CNST	(14)	1.8466	MAINT CNST	(18)	1.1044
MFG/TRN/UT	(15)	1.8022	MANUFACT	(7)	1.2128
WHOLESALE	(8)	2.0484	WHOLESALE	(10)	1.1814
REC RETAIL	(5)	2.1121	REC RETAIL	(13)	1.1683
OTHER RETL	(4)	2.1122	OTHER RETL	(12)	1.1685
FIN/INSUR	(19)	1.4557	FIN/INSUR	(11)	1.1709
REAL EST	(20)	1.3130	REAL EST	(15)	1.1579
LODGING	(12)	1.9079	LODGING	(3)	1.2427
RESTAURANT	(17)	1.6951	RESTAURANT	(16)	1.1060
HEALTH SER	(7)	2.0669	HEALTH SER	(8)	1.1981
EDUCATION	(2)	2.4167	EDUCATION	(6)	1.2216
AMUSEMENTS	(10)	1.9299	AMUSEMENTS	(9)	1.1922
OTHER SER	(11)	1.9156	OTHER SER	(14)	1.1631
CLUBS	(3)	2.2773	CLUBS	(2)	1.2659
GOVT ENTS	(1)	2.7069	GOVT ENTS	(19)	1.0355
HOUSEHOLDS	(13)	1.8633			

1/ Column sums of the interdependency matrix shown in appendix VII.

TABLE 13 EMPLOYMENT MULTIPLIERS FOR GUNNISON COUNTY, COLORADO

Direct, Indirect (and for type II and Induced) Employment in Gunnison County for each Million Dollars of Added Exports by the Sector listed.

TYPE II NAME (RANK)	TYPE II MULTIPLIER	TYPE I NAME (RANK)	TYPE I MULTIPLIER
AGRICULTUR (19)	16.3	AGRICULTUR(16)	14.4
COAL MINES (16)	19.5	COAL MINES (18)	12.0
OTHER MINE (13)	24.2	OTHER MINE (15)	15.3
NEW CONSTR (15)	19.8	NEW CONSTR (17)	13.3
MAINT CNST (11)	36.7	MAINT CNST (11)	28.9
MFG/TRN/UT (14)	22.1	MANUFACT (14)	15.9
WHOLESALE (1)	426.2[1]	WHOLESALE (1)	417.1[1]
REC RETAIL (6)	58.9	REC RETAIL (6)	49.0
OTHER RETL (7)	56.1	OTHER RETL (7)	46.3
FIN/INSUR (20)	12.6	FIN/INSUR (19)	9.6
REAL EST (18)	17.7	REAL EST (13)	16.1
LODGING (4)	74.7	LODGING (4)	67.7
RESTAURANT (3)	78.7	RESTAURANT (3)	72.6
HEALTH SER (12)	36.0	HEALTH SER (12)	26.9
EDUCATION (8)	50.3	EDUCATION (9)	37.8
AMUSEMENTS (9)	49.7	AMUSEMENTS (8)	42.0
OTHER SER (10)	37.7	OTHER SER (10)	29.9
CLUBS (2)	97.8	CLUBS (2)	87.2
GOVT ENTS (5)	67.8	GOVT ENTS (5)	50.3
HOUSEHOLDS (17)	19.4		

1/ Wholesale sales are only $157,400 so this multiplier is meaningless.

CHAPTER 5

PROJECTING EFFECTS OF CHANGES IN FISHING QUALITY, INCOME AND TRAVEL COST

The statistical forecasting equation coefficients used to project visits to Blue Mesa reservoir are shown in table 14, and alternative models are shown in appendix III. The equation is based upon data collected from 200 onsite interviews at the reservoir and thus incorporates the behavior of visitors and excludes potential use by nonvisitors. Based on this weighted least squares regression equation (using the TSP microcomputer software package) about 88% of the variation in log of visit rate is explained. Interpretation of four of the variables that are in log transforms will demonstrate the application of the equation. The coefficient on LV89 of 0.3277 indicates that for each 1 percent change in real visitor income a change of one third of one percent in the visitors per year will occur.[13] A positive sign on the income variable indicates that Blue Mesa visits are a "normal" good where consumption rates rise with income. Variable LV13 measures the log of fish catch and the positive coefficient of .6498 indicates that a 1 percent increase in expected (average) fish catch will increase visitors by nearly two thirds of one percent. A similar calculation could be made for gasoline costs, entry fees or other costs which affect the price of a visit to Blue Mesa reservoir. The coefficient on LCOST shows that a one percent rise in travel cost results in a 0.73 percent decline of visits per year.

Conventional travel cost methodology combines opportunity time cost and out-of-pocket spending to form a "full travel cost" variable in the demand

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[13] Assuming other variables are held constant. However, foregone income is part of the cost of time required to travel to the recreation site and this negative effect on visits must be factored in when finding the net effect of income change.

TABLE 14 WEIGHTED LEAST SQUARES REGRESSION (Dependent Variable is LTRIPS)

Number of observations: 200

Weighting series: IV33

VARIABLE	COEFFICIENT	STD. ERROR	T-STAT.	2-TAIL SIG.
C	1.1854902	0.3485107	3.4015891	0.001
LCOST	-0.7301854	0.0556731	-13.115585	0.000
LV13	0.6498406	0.0807023	8.0523212	0.000
LV18	0.5504286	0.0665448	8.2715696	0.000
LV89	0.3277049	0.0914267	3.5843467	0.000

Weighted Statistics

R-squared	0.899201	Mean of dependent var	1.467591
Adjusted R-squared	0.897133	S.D. of dependent var	2.981697
S.E. of regression	0.956314	Sum of squared resid	178.3346
		F-statistic	434.8865

Dependent Variable: LOG OF TRIPS PER YEAR TO
BLUE MESA RESERVOIR

Independent Variables:

C = CONSTANT TERM

LCOST = LOGARITHM OF OUT-OF-POCKET SPENDING FOR A TRIP PLUS OPPORTUNITY COST OF TIME SPENT TRAVELING TO THE SITE

LV13 = LOGARITHM OF EXPECTED FISH CATCH PER DAY (SUCCESS)

LV18 = LOGARITHM OF TOTAL DAYS PER YEAR INDIVIDUAL GOES FISHING (TASTES)

LV89 = LOGARITHM OF INDIVIDUAL GROUP'S INCOME (I)

V33 = TOTAL DAYS ON THIS FISHING TRIP (used to construct IV33)

IV33 = 1/V33 (used as a weighting factor, see later section) equation. Thus an increase of income has two effects, it increases demand (shifts demand up) as shown by the coefficient on variable LV89, and it decreases quantity demanded since the price of a visit is effectively raised when the opportunity cost of time spent travelling to the site is increased.

Demand Curve Functional Forms

For the travel cost demand model, a log transformation of all variables was performed prior to the estimation of the model. The basis for the transformation of the data into logarithms was the graphs shown below and trials with a linear functional form. Figure 2 shows a plot of the sample survey data for price and quantity. It is obvious from inspection of the plot that the demand relationship is not linear and it appears to be an inverse or hyperbolic relationship which can be estimated by transforming the data into logarithms. Figure 3 shows the transformed sample price and quantity survey data and the resultant distribution has a linear and negative slope as expected for a linear demand function (linear in logarithms). The multiple regression technique is designed to estimate linear relationships and hence the logarithmic transformation of the data is called for. Conversion of all data into natural logarithms allows estimation of a non-linear relationship known as a power function. Thus Q_D is transformed into $\ln(Q_D)$, P_V is transformed into $\ln(P_V)$, and so forth for all variables in the equation. Once the linear relationship among the logarithmic transformations of the variables is estimated it can be expressed as a power function:

$$Q_d = e^A \, P_V{}^{B1} \, P_s{}^{B2} \, P_c{}^{B3} \, I^{B4} \, \mathrm{TASTES}^{B5} \, \mathrm{SUCCESS}^{B6} \, e^U$$

The exponents, B_1 through B_6, are point[14] demand elasticities which show the percentage change in quantity demanded for a one percent change in the variable

---

[14] Point as apposed to arc elasticities.

FIGURE 2.

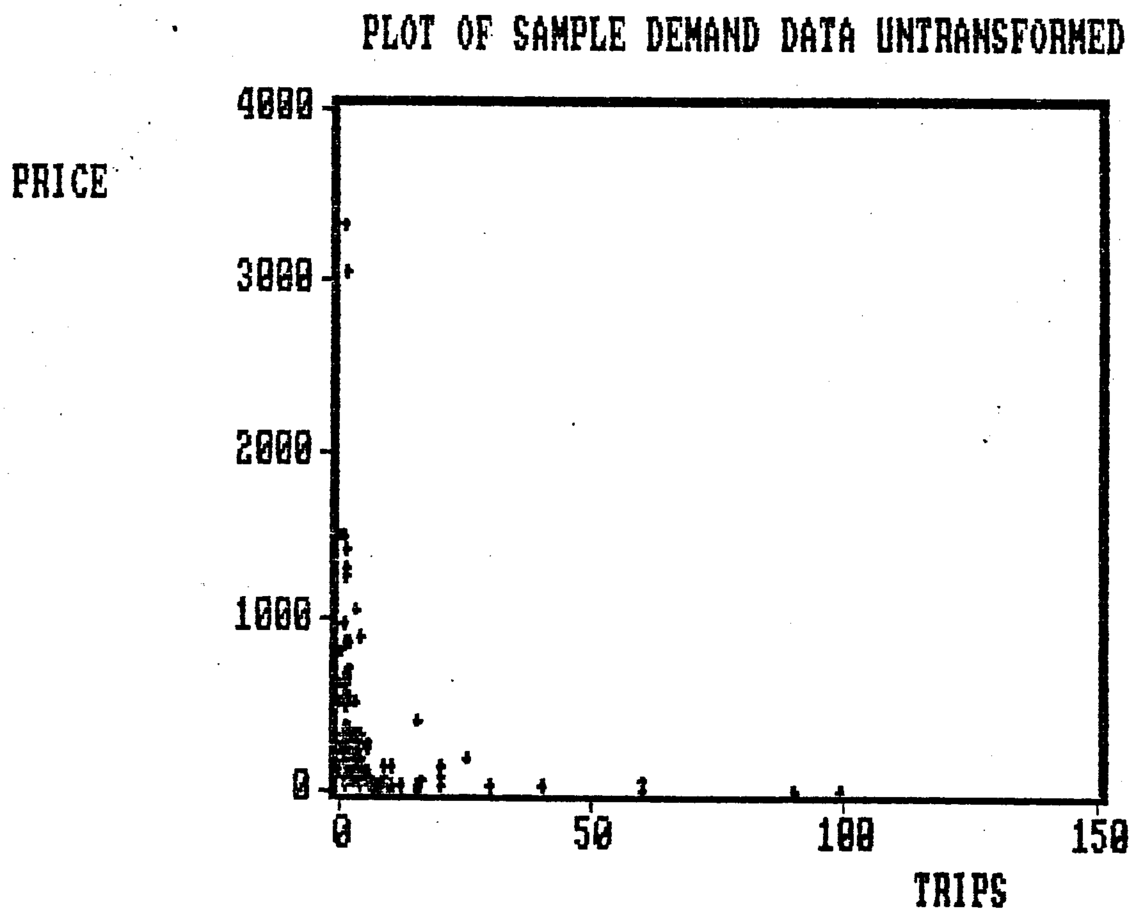
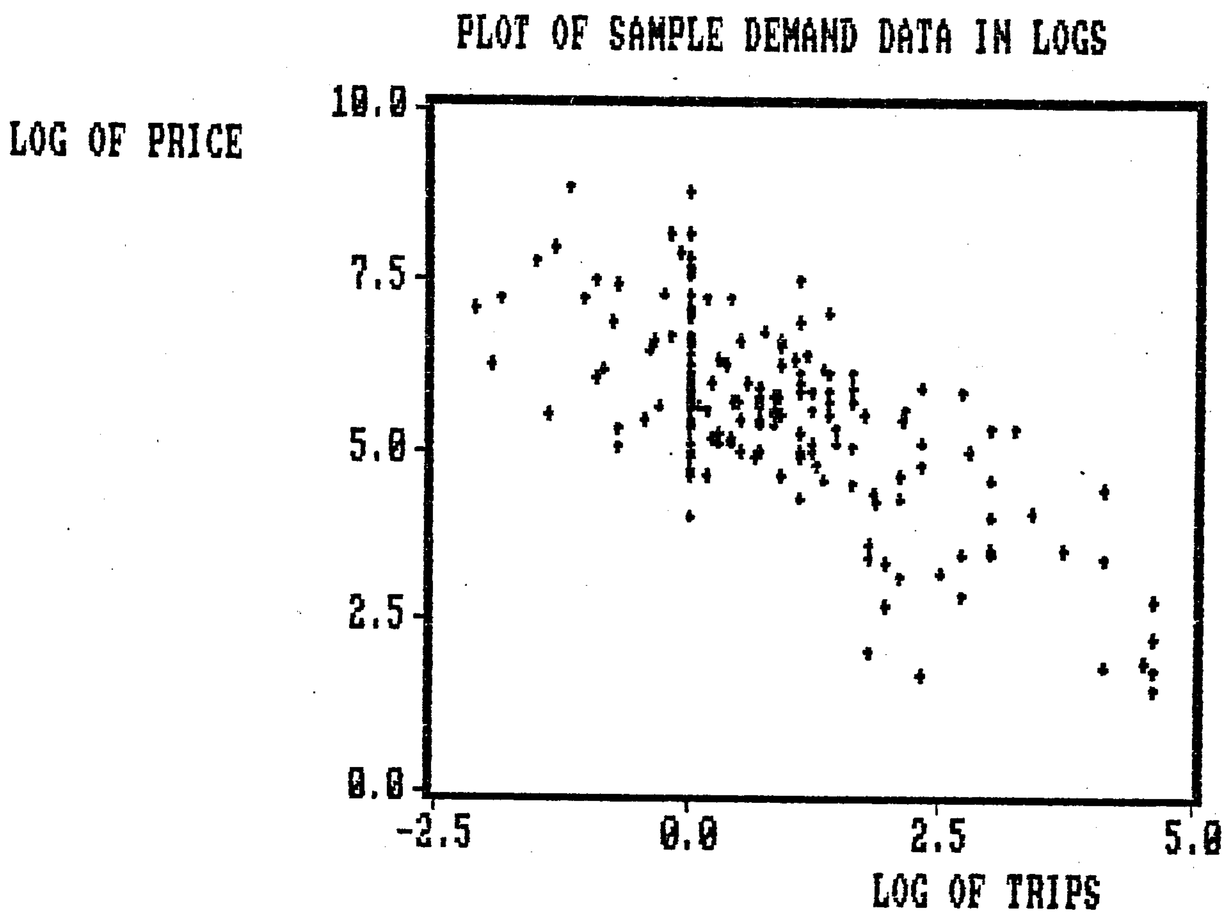

PLOT OF SAMPLE DEMAND DATA UNTRANSFORMED
PRICE
4000
3000
2000
1000
0
0
50
100
150
TRIPS

FIGURE 3.


PLOT OF SAMPLE DEMAND DATA IN LOGS
LOG OF PRICE
10.0
7.5
5.0
2.5
0.0
-2.5
0.0
2.5
5.0
LOG OF TRIPS

to which they are attached.[15] For example, the coefficient (exponent) B_1 shows the percentage change in quantity demanded for a one percent change in the cost of a trip to Blue Mesa reservoir. The elasticities are useful as a gauge of the sensitivity of quantity demanded to a very small change in the independent variables.

Forecasts involving relatively large changes in the independent variables require solution of the equation as discussed in Appendix X in more detail. Point price elasticities only provide accurate forecasts if very small (1%) change occurs in the independent variables. Price elasticity is of particular importance since price is a policy variable that sometimes can be adjusted in an attempt to ration a scarce or fragile resource or to increase revenue. If price elasticity of demand (B_1) is -1.0 then raising or lowering price will have no effect on total revenue since any price change is offset by an equal and opposite percentage change in quantity demanded.[16] If price elasticity is between -1 and $-\infty$ then raising price will reduce revenue and cutting price will increase revenue. If price elasticity is between -1 and 0 then raising price will increase revenue and cutting price will reduce revenue. The further that price elasticity differs from -1 the greater the influence of price changes on revenues. If protection of a resource is desired, price always has an inverse effect on quantity demanded, thus raising price will help protect or ration a fragile or scarce resource.

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[15] The e^U term stands for the error term in the regression model.

[16] In this situation it would probably be unwise to lower price since revenue will remain constant but to obtain the same revenue, production (and production cost) must increase.

Conditional Visit Rate Projections

Tables 15 and 16 show the change of annual visit rates from the current 6.86 per year as price is increased or decreased around the current price in 5% increments and as expected fish catch is increased or decreased around the current catch rate. The current average full price of a visit is $544.87 and the current average catch is 6.95 fish. Tables created by computer solution of the statistical demand curve using the 200 sample data points are required since the point price elasticity will give incorrect projections for anything above an infinitesimal change in price (see appendix X). The computer programs which created the projected visit rates are shown in Appendix XI. Actual survey price and catch data are incremented in order to solve for the changes using the estimated demand relationship. It is implicitly assumed in this procedure that the 200 sample data points represent the distribution of visit rates, travel costs, and catch rates of the population.

Weighted Least Squares Estimation Technique

The multiple regression technique used to estimate the demand for fishing at Blue Mesa reservoir requires that several conditions must hold in order to be a best linear unbiased estimator. If the assumptions made in the derivation of the estimation technique are violated, then the estimated equation is no longer the desired maximum likelihood statistic. One important assumption concerns homoscedasticity of the error term.

Simply stated, the distribution of the error term should not become more or less dispersed in a systematic fashion. Figure 4 shows a plot of the error term resulting from an unweighted regression of the demand model. Clearly, no statistical test is required to demonstrate that the dispersion (variance) of the error <u>decreases</u> systematically with the length of the trip. This effect is known as heteroscedasticity. The implication is that sample observations for

TABLE 15 PROJECTED QUANTITY DEMANDED AS PRICE IS INCREASED IN 5% INCREMENTS

EXPECTED ANNUAL VISITS	AVERAGE COST OF TRIP
6.86	$ 544.87
6.62	572.11
6.40	599.36
6.20	626.60
6.01	653.84
5.83	681.09
5.67	708.33
5.51	735.57
5.37	762.82
5.23	790.06
5.10	817.31
4.98	844.55
4.87	871.79
4.76	899.04
4.66	926.28
4.56	953.52
4.47	980.77
4.38	1,008.01
4.29	1,035.25
4.21	1,062.50
4.14	1,089.74
4.06	1,116.98
3.99	1,144.23
3.92	1,171.47
3.86	1,198.71
3.80	1,225.96
3.74	1,253.20
3.68	1,280.44
3.62	1,307.69
3.57	1,334.93
3.51	1,362.17
3.46	1,389.42
3.42	1,416.66
3.37	1,443.90
3.32	1,471.15
3.28	1,498.39
3.24	1,525.64
3.19	1,552.88
3.15	1,580.12
3.11	1,607.37
3.08	1,634.61

TABLE 15 PROJECTED QUANTITY DEMANDED AS PRICE IS DECREASED IN 5% INCREMENTS

EXPECTED ANNUAL VISITS	AVERAGE COST OF TRIP
6.86	$ 544.87
7.12	517.63
7.41	490.38
7.73	463.14
8.08	435.90
8.47	408.65
8.90	381.41
9.40	354.17
9.96	326.92
10.62	299.68
11.38	272.43
12.29	245.19
13.40	217.95
14.77	190.70
16.53	163.46
18.88	136.22
22.23	108.97
27.42	81.73
36.87	54.49
61.16	27.24

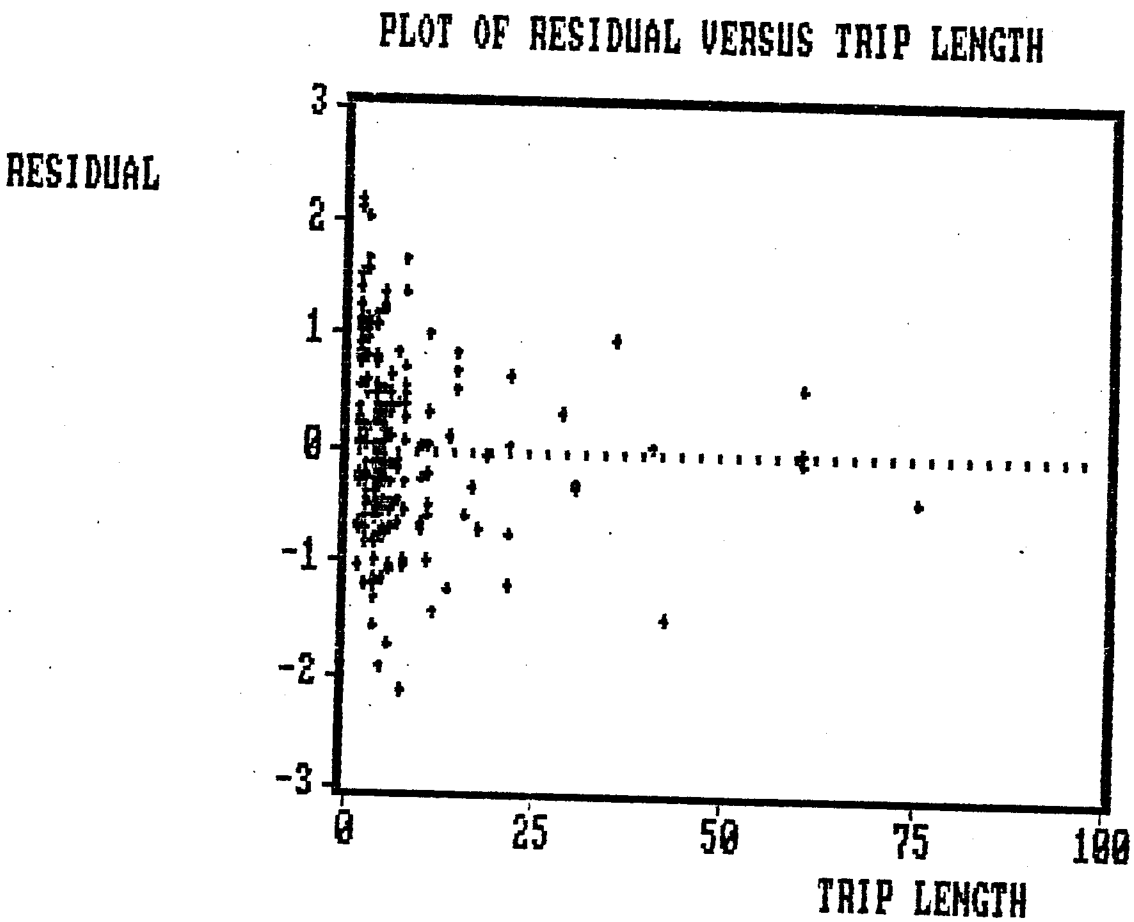
TABLE 16 PROJECTED QUANTITY DEMANDED AS EXPECTED FISH CATCH IS INCREASED IN 5% INCREMENTS

EXPECTED ANNUAL VISITS	EXPECTED FISH CATCH
6.86	6.95
7.08	7.29
7.30	7.64
7.51	7.99
7.73	8.33
7.93	8.68
8.14	9.03
8.34	9.38
8.54	9.72
8.74	10.07
8.93	10.42
9.12	10.76
9.31	11.11
9.50	11.46
9.69	11.81
9.87	12.15
10.05	12.50
10.24	12.85
10.41	13.20
10.59	13.54
10.77	13.89
10.94	14.24
11.11	14.58
11.29	14.93

TABLE 16 PROJECTED QUANTITY DEMANDED AS EXPECTED FISH CATCH IS DECREASED IN 5% INCREMENTS

EXPECTED ANNUAL VISITS	EXPECTED FISH CATCH
6.86	6.95
6.64	6.60
6.41	6.25
6.17	5.90
5.94	5.56
5.69	5.21
5.44	4.86
5.19	4.51
4.92	4.17
4.65	3.82
4.37	3.47
4.08	3.13
3.78	2.78
3.47	2.43
3.14	2.08
2.79	1.74
2.41	1.39
2.00	1.04
1.54	.69
.98	.35

FIGURE 4.


PLOT OF RESIDUAL VERSUS TRIP LENGTH
RESIDUAL
3
2
1
0
-1
-2
-3
0
25
50
75
100
TRIP LENGTH

long trips have higher explanatory power to predict quantity demanded than do sample observations from short trips. Weighting all variables (both dependent and independent) to place higher emphasis on data from the longer trips will make the regression more statistically "efficient" without creating a bias in the relationship, if persons on longer trips have the same underlying demand as for persons on shorter trips (If not, then length of trip can be adjusted for by including it as an independent variable). Comparison of weighted least squares regression adjusted R^2 to that for the unweighted regression (see appendix III) shows that the percent of the variation in the dependent variable explained by the weighted regression is 89.7 while for the unweighted regression it is 61.2. The "t" value on the estimated coefficient for expected fish catch doubles from 4.00 to 8.05. Thus the weighted regression, among other advantages, provides a more precise estimate of the partial effect of expected catch on quantity demanded.

The TSP microcomputer program used for estimating the weighted (or unweighted) multiple regressions describes its weighting procedure as follows: "The W option works in the following way. First Micro TSP calculates the mean of the weighting series. It then multiplies both dependent and all independent variables by the ratio of the weighting series to its mean." (emphasis added) Given this weighting scheme, it is necessary to designate the weight as the reciprocal of trip length in order to obtain the desired result of placing more weight on the data obtained from observations for longer trips.

APPENDIX I. THE INPUT-OUTPUT PROJECTION TECHNIQUE

Introduction

Input-Output comprises both a well defined system of economic accounts and a tool for economic analysis and forecasting. Users of the Input-Output (I/O) forecasting technique require a knowledge of the definitions of the I/O accounts and then an understanding of how the accounts are utilized to model the economic interdependencies for a region. This appendix provides a concise definition of the I/O accounts and compares and relates them to the income and product accounts. The concept of economic interdependencies is introduced with a small numerical example showing an I/O forecast. Many other forecasting and multiplier analyses are possible with the I/O technique beyond the preliminary discussion included here.

Definitions of the I/O Transactions-Among-Sectors Table

Spending flows among sectors in the Input-Output (I/O) framework are displayed as a table or matrix. An I/O table of gross flows (transactions-among-sectors) can be broken down into the four quadrants shown in figure 1; (1) the intermediate processing transactions matrix, (2) the columns of final demands, (3) the rows of primary inputs to processing, and (4) the rows of primary inputs to final demands. Quadrants (3) and (4) together are often referred to as final payments. Each of component quadrants will be discussed, in that order, with reference to a numerical example shown in figure 2.

Quadrant 1 - I/O intermediate Processing Transactions

This quadrant constitutes the bulk of the I/O table. To maintain a double entry accounting framework, the n number of purchasing (column headings) sectors are the same n number of producing (row headings) sectors. Thus, quadrant 1 is a square n by n matrix, where n is the number of intermediate

Figure 1. SCHEMATIC OF A REGIONAL I/O TRANSACTIONS TABLE SHOWING THE FOUR QUADRANTS OF ACCOUNTS

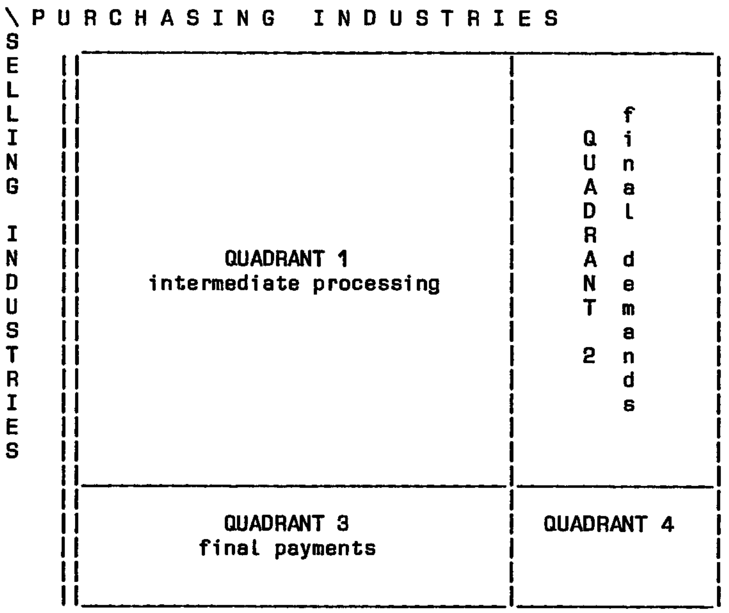


Figure 2. INTERINDUSTRY MODEL TRANSACTIONS AMONG SECTORS

	1 FARMING	2 MANUFACTUR	3 HOUSEHOLDS	4 GOVT
1 FARMING	8,000	18,000	22,000	2,000
2 MANUFACTUR	10,000	2,000	3,000	1,000
3 HOUSEHOLDS	15,000	5,000	2,000	10,000
4 TAXES	0	1,000	3,000	0
5 DEPREC	4,000	1,000	0	1,000
6 RENTS	6,000	5,000	4,000	1,000
7 IMPORTS	12,000	4,000	1,000	6,000
COL TOTALS	55,000	36,0000	35,000	21,000

	5 INVESTMENT	6 EXPORTS	7 CAP LOSSES	ROW TOTALS
1 FARMING	0	4,000	1,000	55,000
2 MANUFACTUR	1,000	19,000	0	36,000
3 HOUSEHOLDS	0	3,000	0	35,000
4 TAXES	0	0	0	4,000
5 DEPREC	0	0	0	6,000
6 RENTS	0	0	0	16,000
7 IMPORTS	0	0	0	23,000
COL TOTALS	1,000	26,000	1,000	175,000

processing industries in the regional economy. The intermediate processing quadrant only contains industries that purchase inputs to combine, transform, or use them in production. End users of inputs, such as governments or exports are excluded from the first quadrant. An exception to this delineation may exist for the household sector. Households may be treated as part of the processing sector if it is assumed that households, like other processors, have stable spending or input purchase functions. Alternatively, households may be treated as possessing discretionary spending power leading to unstable spending distributions which must be projected and entered prior to making a forecast. The latter technique may understate the interdependence within an economy when business expansion leads to immigration and higher household spending. Thus, forecasts using models with households excluded from the first quadrant may tend to understate cumulative expansions or contractions in an economy. Conversely, putting households in the first quadrant may introduce some error also if household spending patterns are unstable.

By convention, columns of an I/O transactions table are the purchasing sectors and rows are the producing or supply sectors. As with standard matrix notation, an entry in the transactions-among-sectors table is denoted as the ith row and the jth column.

In order to maintain equality of row sums and column sums (total industry spending equals total industry income), rows exist for profit and saving as well as spending. Consider the interindustry processing quadrant in the example I/O table shown in figure 2. Reading <u>across</u> the first row, farming's total sales (output) are $55 thousand. $8 thousand is sold among farmers, $18 thousand to manufacturing, $22 thousand is sold to households and $7 thousand is distributed among the final demand sectors. Reading <u>down</u> the first column displays farm purchases (inputs), or how farmers used their total sales revenues (the $55 thousand) to buy goods and services as factors of production. Purchases from farmers were again $8 thousand; $10 thousand was spent for manufactured goods; $15 thousand for household labor inputs, and $22 thousand was spent for all primary inputs, including saving (quadrant 3). Each industry can be analyzed similarly.

An important concept is interdependence; each entry in the I/O account shown as a sale by one sector is also a purchase by another sector. In our example, the $5 thousand at the intersection of the household row and the manufacturing column is a $5 thousand sale by households to manufacturing and conversely a $5 thousand purchase by manufacturing from households.

Quadrant 2 - Final Demands

This quadrant accounts for the independent demand for goods and services made upon regional production capabilities. Since final demand is independently determined, it is in effect the driving force for the economy. According to the I/O model framework, if all spending in quadrant 2 were to disappear, i.e. go to zero, the total economy of the region would also disappear. By independent, we mean that purchases of these goods and services are either made by sectors located outside the region or factors which influence changes in these demands are outside the control of local business or personal spending decisions. In our small example table in figure 2, the final demands are $7 thousand, $21 thousand, and $13 thousand for farming, manufacturing, and households, respectively (if households are assumed to be in quadrant 1, i.e. dependent). The final demand spending represents sales which are not inputs to local processors but include all other sales. For example, exports could be for final use outside the region, final use inside the region by tourists or intermediate inputs to processors located outside the region.

Quadrant 3 - Primary Inputs (final payments sector)

This quadrant accounts for the purchases of inputs from industries outside the region and for other money flows which are not respent in the study region. Primary inputs are often termed leakages because they are the flow of money out of the economy to savings or to imports. The more self-sufficient a region is, the smaller these purchases of primary inputs will be and the more a region will depend upon its own industry. In the example transactions table, the farming, manufacturing, and household sectors purchase from primary inputs $22 thousand, $11 thousand, and $8 thousand dollars of goods and services respectively (if households are assumed to be dependent).

Quadrant 4 - Primary Inputs to Final Demands (final payments sector)

The fourth quadrant records the primary inputs purchased directly by the sectors of final demand. If households are assumed to be independent, a major entry in this quadrant will be the imports consumed directly by households and the state and federal taxes paid by households. Wages and transfers paid by government to households would also show up here. If households are dependent (contained in quadrant I), then only savings and imports by government will appear in this quadrant. In our example, governments purchased $8 thousand of goods and services from primary inputs.

The I/O Accounting Identity

Armed with the definitions of double entry accounts and the descriptions of four quadrants we can demonstrate the accounting identity embedded in the I/O matrix. To do this we can use figure 3 which shows the four quadrants with notation for the highly aggregated accounts within each quadrant. The accounting identity is obtained by summing down all the columns and across all the rows.

Figure 3. SCHEMATIC OF A REGIONAL I/O ACCOUNTS TABLE, LABELING THE ACCOUNTS IN THE 4 QUADRANTS [1/]

SELLING INDUSTRY \ PURCHASING INDUSTRIES							
	z_{11}	z_{12}	C_1	G_1	I_1	E_1	L_1
	z_{21}	z_{22}	C_2	G_2	I_2	E_2	L_2
	H_1	H_2	H_3	G_4	I_5	E_6	L_7
	T_1	T_2	T_3	T_4	T_5	T_6	T_7
	D_1	D_2	D_3	D_4	D_5	D_6	D_7
	R_1	R_2	R_3	R_4	R_5	R_6	R_7
	M_1	M_2	M_3	M_4	M_5	M_6	M_7

1/ The normally large intermediate processing sector in quadrant one is aggregated to 2 sectors to save space.

Gross outlay by the ith industry, X_i, is obtained by summing down the ith column. Correspondingly, total gross outlay by all sectors in the region is obtained from summing the column totals:

$$X = (X_1 + X_2 + X_3 \ldots + X_n) + C + G + I + E + L,$$

where, C is consumption, G is government, I is investment, E is exports, and L is capital losses. Thus, total regional outlay is the sum of all column totals of interindustry spending plus the sum of household consumption, state and federal government, investment, exports, and capital losses.

Gross output by the ith industry, X_i, is obtained by summing across the ith row. Correspondingly, total gross output by all sectors in the region is obtained by summing row totals:

$$X = (X_1 + X_2 + X_3 \ldots + X_n) + H + T + D + R + M,$$

where; H is household wages, T is taxes, D is depreciation, R is rents, and M is imports. Thus, total regional output is the sum of the row totals of interindustry spending plus the sum of wages paid to households, taxes, depreciation, rents, and imports.

We can equate the two parts of the identity using the definition inherent in our I/O double entry accounting principle, total regional outlay is defined to equal total regional output and thus:

$$(X_1 + X_2 + X_3 \ldots + X_n) + C + G + I + E + L = (X_1 + X_2 + X_3 \ldots + X_n) + H + T + D + R + M.$$

By further noting that for intermediate processing sectors, total output equals total input, we can cancel the processing quadrant flows $(X_1 + X_2 + X_3 \ldots + X_n)$ for the above equation. This gives the desired result of regional output measured in terms of final payments to factors (supply) equaling regional output measured by final demand (demand).

$$H + T + D + M + R = C + G + I + E + L.$$

This accounting identity holds only for the total of all final payment and final demand sectors of the region not for each sector individually.

Perhaps a more familiar manner of expressing this accounting identity is to net out exports and imports to create net-exports (E-M). The accounting identity can now be displayed as:

$$H + T + D + R = C + G + I + (E - M) + L.$$

In this form, the identity shows that gross regional product (receipts) composed of wages, indirect business taxes, depreciation, and rents equals gross regional product (purchases) composed of gross consumer spending, plus gross government spending plus gross new investment plus net exports, less capital losses. The equation excludes the spending flows in quadrant I so that conceptually, all intermediate transactions have been purged from the accounts. By doing this, we convert the I/O accounts to regional product accounts analogous to the national income accounts (NIPA).

I/O Direct Input Coefficients

The direct input coefficients depict the fixed relationship between any sector's flow of output measured in dollars and inputs measured in dollars. A direct input coefficient tells us the direct requirements as a fraction of total spending by an industry. A direct input coefficient is the cents of each input an industry needs to produce a dollar of output. A direct input coefficient is found by dividing the payment flow to each input supply sector (z_{ij}) by the purchasing industry's column total (X_j) and thus is a fraction of the total. The direct input coefficients for our example region are shown in figure 4. To compute the coefficient of .1454, for farmers buying from farmers (coefficient a_{11}) we divide $8 thousand by the column total of $55 thousand. The direct requirements for an industry can be found by reading down a column in figure 4. For each dollar of final demand output from farming, farmers buy

Figure 4. DIRECT INPUT COEFFICIENTS FOR THE EXAMPLE REGIONAL ECONOMY

$$\begin{array}{ccc|}
a_{11} & a_{12} & c_1 \\
a_{21} & a_{22} & c_2 \\
h_1 & h_2 & h_3 \\
\hline
t_1 & t_2 & t_3 \\
d_1 & d_2 & d_3 \\
r_1 & r_2 & r_3 \\
m_1 & m_2 & m_3
\end{array}$$

	1 FARMING	2 MANUFACTUR	3 HOUSEHOLDS	
1 FARMING	.145454545	.500000000	.628571429	Local
2 MANUFACTUR	.181818181	.055555555	.085714286	<—–spending
3 HOUSEHOLDS	.272727272	.138888888	.057142857	
4 TAXES	.000000000	.02777777777	.085714286	
5 DEPREC	.072727272	.02777777777	.000000000	
6 RENTS	.109090909	.13888888888	.114285714	<—–Leakages
7 IMPORTS	.218181818	.11111111111	.028571429	
COL TOTALS	1.000000000	1.00000000000	1.000000000	

.1454 from other farmers, .1818 from manufacturing, and .2727 from households for a total of .60 from industries in the region. Another .40 is purchased from primary inputs (taxes, profits imports).

I/O Output Equilibrium

The accounting identity and the definition of direct input coefficients provide the information necessary to complete the I/O forecasting technique. We began by using the accounting identity for the demand side of the I/O accounts (column sums of the transactions table);

$$X = (X_1 + X_2 + X_3 \ldots X_n) + C + G + I + E + L.$$

For our condensed example, these accounts would be: $175,000 = ($55,000 + $36,000 + $35,000) + $21,000 + $1,000 + $26,000 + $1,000.

To develop the I/O as a forecasting model we now turn our attention away from aggregated regional output and focus on the interindustry relations among the accounts. Each industry in the economy is in equilibrium when the sum of the interindustry demands plus the sum of the final demands equals total gross output for that same industry. For the i^{th} industry, in the notation above, output equilibrium can be expressed as:

$$X_i = z_{i1} + \ldots + z_{ij} + \ldots + z_{in}) + (C_i + G_i + I_i + E_i + L_i).$$

Notice the similarity between this equation and the above regional aggregate. All that has changed is that we are dealing with a single industry (row of the transactions table) instead of the aggregates of industries. Thus we have used the interindustry flows for the i^{th} industry ($z_{i1} + \ldots + z_{ij} + \ldots + z_{in}$) instead of the aggregate for all industries ($X_1 + X_2 + X_3 + \ldots + X_n$) and also the final demands for the i^{th} industry instead of the aggregate final demands. For the household sector in the example this would be: $35,000 = ($15,000 + $5,000 + $2,000) + $10,000 + $0 + $3,000 + $0. Similar balance identities can be written for manufacturing and farming, the other two intermediate processing sectors in our example.

Conceptually the three processing sectors of the example must always move toward a stable equilibrium where sales equal receipts in each industry. Receipts can be disturbed when final demands such as exports or government purchases from industry change. Changes in final demand set off a series of transactions as each industry responds to either direct or indirect changes in their demands. An example of direct change in demand would occur if agricultural exports increased, while an example of an indirect demand change could be the response of farms to increase output and in so doing they purchase more fuel, fertilizer, machinery, labor and similar inputs thus creating the indirect or "derived" demand for other sectors of the economy. When the other sectors find their demand rising they too will buy more inputs and thus the original export change causes a series of reactions and reverberations throughout the economy. These reverberations gradually die out since during each round of spending part of the spending leaks out to saving, taxes, and imports. The greater the leakage the faster the effects die out and the smaller the multiplier effect will be.

In our example model, there are three balance equations corresponding to the three dependent sectors of the model, farming, manufacturing, and households. These 3 sectors are assumed to react to satisfy all increased demands through a profit motive. Aggregating all independent final demand variables together as,

$Y_i = C_i + G_i + I_i + E_i + L_i$, $i=1...3$; the three balance equations are:

$$X_1 = z_{11} + z_{12} + z_{13} + Y_1$$

$$X_2 = z_{21} + z_{22} + z_{23} + Y_2$$

$$X_3 = z_{31} + z_{32} + z_{33} + Y_3$$

where X_i is total output in industry i, the z's are transactions among the intermediate processing sectors, and Y_i stands for the total final demand for industry i. It is evident that we now have 9 unknowns (the z's) which are the dependent intermediate spending flows among industries and only 3 equations. A solution will not be possible for this system of simultaneous equations unless the number of unknowns can be reduced to equal the number of equations.

In order to reduce the number of unknowns to be equal with the number of balance equations, we can substitute the definition of direct input coefficients in place of the z_{ij}'s. A sector's direct input coefficient was defined as $a_{ij} = z_{ij}/X_j$. Thus we can replace the z's above with $z_{ij} = (a_{ij})(X_j)$. For our example economy the direct input coefficients are shown in figure 4 above. Now we can write the 3 balance equations as:

$$X_1 = .1454\ X_1 + .5000\ X_2 + .6286\ X_3 + Y_1$$
$$X_2 = .1818\ X_1 + .0556\ X_2 + .0857\ X_3 + Y_2$$
$$X_3 = .2727\ X_1 + .1389\ X_2 + .0571\ X_3 + Y_3$$

Equation sets of this type are easily solved by a microcomputer, and even a set of over 100 equations can be solved in less than 5 minutes. The input-output forecast procedure requires entry of new values for the independent final demands Y_1, Y_2, and Y_3 and the computer will solve for the values of X_1, X_2, and X_3 which are the total outputs for the three intermediate processing sectors, farming, manufacturing, and households.

Figure 5 is used for a discussion of the input-output forecasting process. The economist provides estimates of future values of Y_1, Y_2, and Y_3 and enters these new final demands (or in the case of the IMS program the changes in final demand are entered) into an I/O forecasting computer program. The computer solves the three equations shown above for the X_1, X_2, and X_3 values. Note that the data in quadrant 3 and quadrant 4 have not entered into the solution

Figure 5. THE I/O FORECASTING PROCESS

\ P U R C H A S I N G   I N D U S T R I E S

S E L L I N G I N D U S T R I E S	FARMING	MANUFACT	HOUSEHOLDS	FINAL DEMAND	
	z_{11}	z_{12}	z_{13}	Y_1	X_1
	z_{21}	z_{22}	z_{23}	Y_2	X_2
	z_{31}	z_{32}	z_{33}	Y_3	X_3
	QUADRANT 3			QUADRANT 4	
	X_1	X_2	X_3		

process directly. It might appear that quadrants 3 and 4 were unnecessary but that is not true. Without the knowledge of the leakages to saving, profit, taxes and imports we could not have estimated the direct input coefficients and without the direct input coefficients we had 9 unknowns and only 3 equations which is a system which cannot be solved.

Now that the computer has solved for the new total outputs (row totals) by industry, X_1, X_2, and X_3, the direct input coefficients are again necessary to distribute the X's down each column (in the same proportions as in the initial transactions table). This is possible because the column total for each processing industry is equal to the new row total which was solved for in the three equations. In this fashion, the computer provides us with a new transactions table which is consistent with the new final demands which we entered.

APPENDIX II SECTOR DEFINITIONS AND DETAILED EMPLOYMENT

I/O SECTOR	IMPLAN SECTOR	SECTOR DESCRIPTION	EMPLOYMENT
1	3	ranch fed cattle	1.30
1	4	range fed cattle	51.13
1	6	sheep, lambs and goats	20.87
1	8	other meat animals	23.27
1	9	misc. livestock	.70
1	11	food grains	3.11
1	12	feed grains	.36
1	13	hay and pasture	8.69
1	23	greenhouse/nursery	2.34
3	28	iron ores	2.88
3	29	ferroalloy ores	12.35
3	37	uranium	105.53
2	40	coal	414.62
3	41	crude petroleum	.20
3	42	natural gas	.22
3	58	misc. nonmetallic minerals	.21
4	66	new residential structures	153.61
4	67	new industrial buildings	88.83
4	68	new utility structures	48.82
4	69	new streets and highways	5.06
4	70	new farm structures	3.81
4	71	new mineral extrac. fac.	2.25
5	73	residential maintenance	31.64
5	74	other facilities maintenance	56.62
5	75	oil and gas well maintenance	.23
6	89	ice cream and frozen deserts	2.32
6	160	logging camps and contractors	9.00
6	172	wood products, n.e.c.	1.46
6	200	newspapers	26.88
6	205	commercial printing	20.43
6	269	ready-mix concrete	8.35
6	308	fabricated structural metal	12.78
6	311	sheet metal work	1.25
6	312	architectural metal work	.62
6	313	prefabricated metal buildings	9.87
6	361	machinery except electrical	21.44
6	403	motor vehicles	1.49
6	404	motor vehicle parts	.53
6	447	local passenger transit	8.18
6	448	motor freight & warehousing	37.38
6	449	water transportation	11.08
6	450	air transportation	71.94
6	453	arrangement of pass. trans.	7.87
6	454	commun. except radio and TV	18.06

6	455	radio and TV broadcasting	24.12
6	457	gas product. and dist.	7.97
6	458	water supply and sewerage	1.82
77	461	wholesale trade	64.91
8	462	recreational related retail	52.58
9	463	other retail trade	536.46
10	464	banking	83.31
10	465	credit agencies	16.26
10	467	insurance carriers	5.77
10	468	insurance agents and brok.	7.51
11	470	real estate	169.51
12	471	hotels and lodging places	274.35
17	472	laundry, cleaning and shoe	41.73
17	473	funeral services	2.29
17	474	photo studios	5.92
17	475	electrical repair shops	8.80
17	477	beauty and barber shops	7.33
17	478	misc. repair shops	4.90
17	479	services to buildings	24.52
17	481	computer and data processing	2.91
17	484	equipment rental	4.87
17	485	commercial photography	6.97
17	486	other business services	11.35
17	487	advertising	1.62
17	488	legal services	53.89
17	489	engineering/architectural	13.86
17	490	accounting	7.49
13	491	eating and drinking places	21.60
17	493	auto repair	34.38
16	495	motion pictures	46.67
16	501	clubs	6.85
16	502	amusement services	246.67
14	503	doctors and dentists	29.74
14	505	nursing services	24.13
14	506	other medical services	32.31
15	507	elem. and second. schools	63.16
15	508	colleges and prof. schools	73.43
15	509	other educational services	.23

18	510	business associations	1.98
18	511	labor and civic organ.	85.75
18	512	religious organizations	25.51
18	513	other organizations	9.12
17	515	social services, n.e.c.	2.62
19	516	U.S. postal services	12.91
19	518	other federal govt. enter.	2.72
19	519	local govt. transit	5.20
19	520	state and local electric ut.	2.93
19	521	other st. and loc. govt. ent	39.64
19	525	government industry	881.02
19	527	household industry	12.62

APPENDIX III FORECASTING EQUATIONS FOR VISITS TO BLUE MESA RESERVOIR

DEPENDENT VARIABLE: LOG OF TRIPS PER YEAR TO BLUE MESA RESERVOIR

INDEPENDENT VARIABLES:

C = CONSTANT TERM

LCOST = LOGARITHM OF OUT-OF-POCKET SPENDING FOR A TRIP PLUS OPPORTUNITY COST OF TIME SPENT TRAVELING TO THE SITE

LV13 = LOGARITHM OF EXPECTED FISH CATCH PER DAY

LV18 = LOGARITHM OF TOTAL DAYS PER YEAR INDIVIDUAL GOES FISHING

V19 = MILES TO NEAREST SUBSTITUTE FISHING SITE

LV89 = LOGARITHM OF INDIVIDUAL GROUP'S INCOME

V33 = TOTAL DAYS ON THIS FISHING TRIP

IV33 = 1/V33

<u>MODEL USED TO PROJECT VISIT RATE</u>

LS // Dependent Variable is LTRIPS
Date: 7-06-1988 / Time: 7:18
SMPL range: 1 - 200
Number of observations: 200
Weighting series: IV33

VARIABLE	COEFFICIENT	STD. ERROR	T-STAT.	2-TAIL SIG.
C	1.1854902	0.3485107	3.4015891	0.001
LCOST	-0.7301854	0.0556731	-13.115585	0.000
LV13	0.6498406	0.0807023	8.0523212	0.000
LV18	0.5504286	0.0665446	8.2715696	0.000
LV89	0.3277049	0.0914267	3.5843467	0.000

Weighted Statistics

R-squared	0.899201	Mean of dependent var	1.467591
Adjusted R-squared	0.897133	S.D. of dependent var	2.981697
S.E. of regression	0.956314	Sum of squared resid	178.3346
Durbin-Watson stat	1.699361	F-statistic	434.8865
Log likelihood	-272.3221		

```
=======================================================================
            Residual Plot                 obs RESIDUAL  ACTUAL   FITTED
=======================================================================
|         *  :    |    :           |       1 -1.09206  0.18232  1.27438
|            :    |    :*          |       2  0.85417 -0.18232 -1.03649
|       *    :    |    :           |       3 -1.45790 -0.45199  1.00591
|            :    |*   :           |       4  0.11435  0.73089  0.61654
|    *       :    |    :           |       5 -1.94052 -1.38629  0.55423
|            :    |  * :           |       6  0.48840  0.69315  0.20475
|        *   :    |    :           |       7 -1.30682  0.00000  1.30682
|            :*   |    :           |       8 -0.61532  0.00000  0.61532
|            :   *|    :           |       9 -0.15564  0.00000  0.15564
|            :    | *  :           |      10  0.32739  1.44692  1.11953
|            : *  |    :           |      11 -0.50420  0.84730  1.35150
|            :    | *  :           |      12  0.32089  0.87547  0.55457
|            :    | *  :           |      13  0.23693  2.70805  2.47112
|            :    | *  :           |      14  0.31449  1.32176  1.00726
|            :   *|    :           |      15 -0.17885  0.00000  0.17885
|            :    |*   :           |      16  0.17161  0.91629  0.74468
|            :  * |    :           |      17 -0.26960  0.28768  0.55729
|          * :    |    :           |      18 -1.04821  1.79176  2.83997
|            :   *|    :           |      19 -0.10066  0.00000  0.10066
|            : *  |    :           |      20 -0.50351  0.58779  1.09129
|            *    |    :           |      21 -0.74574  0.00000  0.74574
|            :    |    : *         |      22  0.96606  2.99573  2.02968
|            :    |  * :           |      23  0.37260  0.84730  0.47470
|            :    |  * :           |      24  0.40720  1.38629  0.97909
|          * :    |    :           |      25 -1.03462  0.00000  1.03462
|            :    |  * :           |      26  0.44945  0.18232 -0.26713
|            :  * |    :           |      27 -0.31295  1.85630  2.16925
|            :*   |    :           |      28 -0.58821  0.00000  0.58821
|            :    |*   :           |      29  0.20544  0.00000 -0.20544
|           *:    |    :           |      30 -0.80524 -0.28768  0.51756
|            :    |   *:           |      31  0.62301  1.16315  0.54014
|            *    |    :           |      32 -0.70452  0.63599  1.34051
|            :    |    :  *        |      33  1.20729  1.38629  0.17900
|            : *  |    :           |      34 -0.39815  1.79176  2.18991
|            :    |   *:           |      35  0.53598  0.00000 -0.53598
|            :    | *  :           |      36  0.35619  1.38629  1.03011
|            :*   |    :           |      37 -0.56231  0.00000  0.56231
|            :    |*   :           |      38  0.20974  2.99573  2.78600
|            *    |    :           |      39 -0.71858  0.00000  0.71858
|            :    |  * :           |      40  0.48170 -0.40547 -0.88717
|            :    |    :  *        |      41  1.15167  0.28768 -0.86398
|            :*   |    :           |      42 -0.51741  0.00000  0.51741
|       *    :    |    :           |      43 -1.25223 -1.87180 -0.61957
|        *   :    |    :           |      44 -1.14560  0.00000  1.14560
|            :  * |    :           |      45 -0.30151  1.09861  1.40012
|            :   *|    :           |      46 -0.16139  0.69315  0.85454
|            :    |   *:           |      47  0.52432  1.09861  0.57429
|            :    |*   :           |      48  0.18588  0.00000 -0.18588
|            :    | *  :           |      49  0.32561  0.00000 -0.32561
```

```
|           :    |    :*          |   50  0.91678  4.59512  3.67834
|           *    |    :           |   51 -0.70413  0.69315  1.39727
|           :    | *  :           |   52  0.31382  1.83258  1.51877
|           :    |    :*          |   53  0.84265  4.59512  3.75247
|           :    |    *           |   54  0.79486  4.59512  3.80026
|           *    |    :           |   55 -0.78290  0.00000  0.78290
|           :  * |    :           |   56 -0.29555  1.25276  1.54831
|     *     :    |    :           |   57 -1.74741 -0.91629  0.83112
|           :    *    :           |   58  0.00923  0.00000 -0.00923
|           :*   |    :           |   59 -0.56477  0.18232  0.74709
|           :    *    :           |   60  0.02220  0.00000 -0.02220
|      *    :    |    :           |   61 -1.58349  0.00000  1.58349
|           :    |   *:           |   62  0.53395  1.60944  1.07549
|           :  * |    :           |   63 -0.24703  1.09861  1.34565
|           *    |    :           |   64 -0.68480  0.44183  1.12664
|           :    |  * :           |   65  0.39510  0.47000  0.07491
|           :    |    :   *       |   66  1.34960  2.78809  1.43849
|           *    |    :           |   67 -0.66200  0.00000  0.66200
|          *:    |    :           |   68 -0.80421  0.00000  0.80421
|           :   *|    :           |   69 -0.12317  0.91629  1.03946
|           : *  |    :           |   70 -0.45424 -0.18232  0.27192
|           :    | *  :           |   71  0.28232  0.35667  0.07436
|           :    *    :           |   72  0.00430  0.51083  0.50652
|           :*   |    :           |   73 -0.51598  0.00000  0.51598
|           :    |*   :           |   74  0.15762  0.00000 -0.15762
|           :    |    :   *       |   75  1.25221  0.91629 -0.33592
|           :    |    :     *     |   76  1.65826  2.30258  0.64433
|          *:    |    :           |   77 -0.83727  0.00000  0.83727
|           :    *    :           |   78 -0.06684  1.32176  1.38860
|           :*   |    :           |   79 -0.59680  0.00000  0.59680
|           : *  |    :           |   80 -0.36558  0.84730  1.21287
|           : *  |    :           |   81 -0.47577 -0.69315 -0.21738
|           :    |    : *         |   82  1.06280  3.40120  2.33840
|           :    |  * :           |   83  0.40835  0.00000 -0.40835
|           : *  |    :           |   84 -0.46334  0.00000  0.46334
|           *    |    :           |   85 -0.71874  0.00000  0.71874
|           :  * |    :           |   86 -0.32560  0.00000  0.32560
|           :*   |    :           |   87 -0.56801  0.28768  0.85569
|           :    |    : *         |   88  1.02651  1.60944  0.58293
|           :    |    *           |   89  0.78886  1.38629  0.59743
|           :    |    :  *        |   90  1.10594  2.30258  1.19665
|           : *  |    :           |   91 -0.39695  0.40547  0.80242
|           :    |*   :           |   92  0.21447  0.00000 -0.21447
|           :    |    :*          |   93  0.83711  0.00000 -0.83711
|          *:    |    :           |   94 -0.85079  0.00000  0.85079
|           :*   |    :           |   95 -0.56652  0.00000  0.56652
|           :   *|    :           |   96 -0.20479  2.70805  2.91284
|           :  * |    :           |   97 -0.28878  0.00000  0.28878
|           :    |    :         * |   98  2.17501  4.09435  1.91933
|           :   *|    :           |   99 -0.11902  0.84730  0.96632
|           :    |  * :           |  100  0.46556  1.73460  1.26904
|           :    *    :           |  101  0.01231  0.69315  0.68084
|           :    |    :*          |  102  0.80787  1.09861  0.29074
|          *:    |    :           |  103 -0.83901  0.00000  0.83901
```

```
|          * :    |    :           |  104 -1.02548 -0.84730  0.17818
|            : *  |    :           |  105 -0.45107  0.00000  0.45107
|            :*   |    :           |  106 -0.56547  0.00000  0.56547
|            :  * |    :           |  107 -0.34833  0.00000  0.34833
|            :    |*   :           |  108  0.09244  0.00000 -0.09244
|            : *  |    :           |  109 -0.36890  0.51083  0.87972
|            :    *    :           |  110 -0.04697  0.00000  0.04697
|            :    |    :  *        |  111  1.10056  1.20397  0.10341
|            :    |*   :           |  112  0.08181  0.69315  0.61133
|            :    |    *           |  113  0.71664  0.69315 -0.02349
|            : *  |    :           |  114 -0.49232  0.22314  0.71546
|            :    *    :           |  115  0.00367  0.00000 -0.00367
|            :  * |    :           |  116 -0.33380  0.69315  1.02695
|            : *  |    :           |  117 -0.45002  0.00000  0.45002
|            : *  |    :           |  118 -0.41907 -1.32176 -0.90269
|            :   *|    :           |  119 -0.09394  1.60944  1.70338
|            :  * |    :           |  120 -0.32667  0.69315  1.01981
|            :    |*   :           |  121  0.13163  0.91629  0.78466
|            :    *    :           |  122 -0.02651  0.84730  0.87381
|            :    | *  :           |  123  0.30122  0.00000 -0.30122
|            :    *    :           |  124 -0.02942  0.00000  0.02942
|            :    |    :   *       |  125  1.24107  3.68888  2.44781
|            :    |   *:           |  126  0.64513  1.04982  0.40469
|            :*   |    :           |  127 -0.57972 -0.35667  0.22304
|            :    |    :  *        |  128  1.13991  4.59512  3.45521
|            :    |*   :           |  129  0.08153  2.07944  1.99791
|            :    |    : *         |  130  1.05636  4.09435  3.03799
|            :    |  * :           |  131  0.40073  1.38629  0.98556
|            :    |    :    *      |  132  1.52212  3.21888  1.69676
|            :*   |    :           |  133 -0.50950  0.09531  0.60481
|            :    *    :           |  134  0.03959  1.94591  1.90632
|         *  :    |    :           |  135 -1.21011 -0.74194  0.46817
|            :    |   *:           |  136  0.54878  1.09861  0.54983
|         *  :    |    :           |  137 -1.16069  0.28768  1.44838
|            *    |    :           |  138 -0.70389 -1.04145 -0.33757
|            :*   |    :           |  139 -0.60456  1.09861  1.70318
|            :  * |    :           |  140 -0.30485  1.94591  2.25076
|         *  :    |    :           |  141 -1.20192 -0.69315  0.50877
|            :    |    *           |  142  0.74532  2.12026  1.37495
|            :    |  * :           |  143  0.47208  0.51083  0.03874
|          * :    |    :           |  144 -1.01201  0.00000  1.01201
|            :  * |    :           |  145 -0.26182  0.00000  0.26182
|            :    | *  :           |  146  0.32557  0.00000 -0.32557
|            :    | *  :           |  147  0.35149  4.09435  3.74286
|            :    |  * :           |  148  0.49623  0.00000 -0.49623
|            :    | *  :           |  149  0.21963  0.69315  0.47352
|  *         :    |    :           |  150 -2.15579 -1.94591  0.20988
|            :  * |    :           |  151 -0.23760 -0.91629 -0.67869
|            :    |    *           |  152  0.75650  2.07944  1.32295
|         *  :    |    :           |  153 -1.18174  2.07944  3.26118
|            :  * |    :           |  154 -0.21768  0.40547  0.62314
|           *:    |    :           |  155 -0.80378  0.00000  0.80378
|            :    | *  :           |  156  0.27835  1.09861  0.82026
|            :    |*   :           |  157  0.16736  1.79176  1.62440
```

```
|         *  :    |    :           |  158 -1.18569  0.00000  1.18569
|            :    |   *:           |  159  0.54589  2.99573  2.44984
|            :  * |    :           |  160 -0.22829  0.00000  0.22829
|            :  * |    :           |  161 -0.25771  0.22314  0.48085
|       *    :    |    :           |  162 -1.47176 -2.12823 -0.65647
|            :    |    :        *  |  163  2.03257  0.00000 -2.03257
|            :    *    :           |  164  0.00960  0.00000 -0.00960
|            :  * |    :           |  165 -0.26412  0.00000  0.26412
|            :    |*   :           |  166  0.20216  2.48491  2.28274
|            :    |    :     *     |  167  1.57883  2.99573  1.41690
|            :    |   *:           |  168  0.57612  1.60944  1.03332
|            :   *|    :           |  169 -0.10241  0.00000  0.10241
|            :  * |    :           |  170 -0.28028  1.20397  1.48425
|            :    |    :   *       |  171  1.35085  2.14843  0.79759
|            :    |  * :           |  172  0.47336  1.45529  0.98193
|            *    |    :           |  173 -0.68236  0.51083  1.19319
|            :    |    *           |  174  0.76539  2.99573  2.23034
|            :    |    : *         |  175  1.00519  0.40547 -0.59972
|            :  * |    :           |  176 -0.34537 -1.16315 -0.81778
|            :   *|    :           |  177 -0.19137  1.20397  1.39535
|            :    |*   :           |  178  0.07559 -0.33647 -0.41206
|            :    |    :   *       |  179  1.37189  1.09861 -0.27328
|            :    *    :           |  180  0.02857 -1.50408 -1.53265
|            *    |    :           |  181 -0.73771  0.00000  0.73771
|            :    |    : *         |  182  1.02283  4.49981  3.47698
|            :    |    : *         |  183  1.06464  1.20397  0.13934
|            :    |    :         * |  184  2.11026  2.70805  0.59779
|            :    *    :           |  185  0.02324 -0.69315 -0.71639
|            :    |    : *         |  186  0.96293 -0.08961 -1.05255
|            :   *|    :           |  187 -0.07569 -0.25131 -0.17563
|          * :    |    :           |  188 -0.98792  0.00000  0.98792
|            :    |    :    *      |  189  1.40257  2.30258  0.90001
|            :    |    :  *        |  190  1.09191  1.60944  0.51752
|            :    |    :      *    |  191  1.66803  1.09861 -0.56942
|            :    |    *           |  192  0.67491  0.91629  0.24138
|            :   *|    :           |  193 -0.19842  0.00000  0.19842
|            :  * |    :           |  194 -0.26600  2.30258  2.56858
|          * :    |    :           |  195 -1.00060  0.00000  1.00060
|            :    | *  :           |  196  0.27045  0.00000 -0.27045
|            *    |    :           |  197 -0.71171  0.00000  0.71171
|            :  * |    :           |  198 -0.29735  0.00000  0.29735
|            :    |  * :           |  199  0.45889  1.38629  0.92740
|            :  * |    :           |  200 -0.26682  0.00000  0.26682
=====================================================================
```

OTHER MODELS TESTED

LS // Dependent Variable is LTRIPS
Date: 7-06-1988 / Time: 5:26
SMPL range: 1 - 200
Number of observations: 200

VARIABLE	COEFFICIENT	STD. ERROR	T-STAT.	2-TAIL SIG.
C	2.5020463	0.4027296	6.2127201	0.000
LCOST	-0.7964062	0.0538709	-14.783618	0.000
LV13	0.3494418	0.0874329	3.9966857	0.000
LV18	0.2870455	0.0676833	4.2410069	0.000
V19	0.0050426	0.0023567	2.1396617	0.032
LV89	0.3122738	0.1042459	2.9955502	0.003

R-squared	0.622115	Mean of dependent var	0.762910
Adjusted R-squared	0.612376	S.D. of dependent var	1.268723
S.E. of regression	0.789900	Sum of squared resid	121.0447
Durbin-Watson stat	1.990668	F-statistic	63.87676
Log likelihood	-233.5720		

LS // Dependent Variable is LTRIPS
Date: 7-06-1988 / Time: 5:28
SMPL range: 1 - 200
Number of observations: 200
Weighting series: ILC

VARIABLE	COEFFICIENT	STD. ERROR	T-STAT.	2-TAIL SIG.
C	1.9111174	0.3400810	5.6195946	0.000
LCOST	-0.8867053	0.0460813	-19.242197	0.000
LV13	0.3791347	0.0821673	4.6141794	0.000
LV18	0.4996989	0.0686546	7.2784517	0.000
V19	0.0033857	0.0032215	1.0509427	0.293
LV89	0.4159139	0.0839002	4.9572453	0.000

Weighted Statistics

R-squared	0.886727	Mean of dependent var	1.118497
Adjusted R-squared	0.883808	S.D. of dependent var	2.377369
S.E. of regression	0.810374	Sum of squared resid	127.4008
Durbin-Watson stat	2.093212	F-statistic	303.7355
Log likelihood	-238.6898		

LS // Dependent Variable is LTRIPS
Date: 7-06-1988 / Time: 7:16
SMPL range: 1 - 200
Number of observations: 200
Weighting series: IV33

VARIABLE	COEFFICIENT	STD. ERROR	T-STAT.	2-TAIL SIG.
C	1.3341989	0.3580107	3.7267012	0.000
LCOST	-0.7310276	0.0554171	-13.191375	0.000
LV13	0.6467798	0.0803485	8.0496780	0.000
LV18	0.5173454	0.0691016	7.4867306	0.000
V19	-0.0072711	0.0043283	-1.6798871	0.093
LV89	0.3392355	0.0912610	3.7172011	0.000

Weighted Statistics

R-squared	0.900646	Mean of dependent var	1.467591
Adjusted R-squared	0.898086	S.D. of dependent var	2.981697
S.E. of regression	0.951877	Sum of squared resid	175.7777
Durbin-Watson stat	1.889802	F-statistic	351.7244
Log likelihood	-270.8780		

LS // Dependent Variable is LTRIPS
Date: 7-06-1988 / Time: 7:17
SMPL range: 1 - 200
Number of observations: 200
Weighting series: IV33

VARIABLE	COEFFICIENT	STD. ERROR	T-STAT.	2-TAIL SIG.
C	1.4644132	0.3817410	3.8361433	0.000
LCOST	-0.7304961	0.0553834	-13.189804	0.000
LV13	0.6369426	0.0806212	7.9004391	0.000
LV18	0.5166462	0.0689686	7.4910367	0.000
LV19	-0.0901568	0.0516449	-1.7457065	0.081
LV89	0.3287212	0.0909523	3.6142148	0.000

Weighted Statistics

R-squared	0.900760	Mean of dependent var	1.467591
Adjusted R-squared	0.898202	S.D. of dependent var	2.981697
S.E. of regression	0.951333	Sum of squared resid	175.5765
Durbin-Watson stat	1.716420	F-statistic	352.1717
Log likelihood	-270.7635		

APPENDIX IV GUNNISON COUNTY TRANSACTIONS AMONG SECTORS, 1982

(Purchases by sectors listed at the top from sectors listed at the left)

	1 AGRICULTUR	2 COAL MINES	3 OTHER MINE	4 NEW CONSTR	5 MAINT CNST	6 MFG/TRN/UT	7 WHOLESALE
1 AGRICULTUR	2091000.	0.	0.	0.	0.	800.	0.
2 COAL MINES	0.	6057800.	4600.	0.	0.	1000.	0.
3 OTHER MINE	0.	0.	1463000.	100.	100.	47500.	0.
4 NEW CONSTR	0.	0.	0.	0.	0.	0.	0.
5 MAINT CNST	13100.	45600.	19900.	5000.	600.	29700.	100.
6 MFG/TRN/UT	132900.	377500.	166600.	535900.	57100.	2802600.	7500.
7 WHOLESALE	1200.	2600.	300.	3100.	400.	1000.	0.
8 REC RETAIL	800.	55700.	6200.	4100.	600.	6400.	100.
9 OTHER RETL	21700.	44100.	3000.	1183600.	183700.	20700.	200.
10 FIN/INSUR	239500.	276300.	43400.	157300.	21100.	155400.	1400.
11 REAL EST	347000.	769200.	149300.	56400.	6500.	282600.	2400.
12 LODGING	9300.	39900.	10100.	32600.	2700.	41300.	600.
13 RESTAURANT	2500.	69600.	16800.	30600.	2600.	428000.	5000.
14 HEALTH SER	131000.	0.	0.	0.	0.	0.	0.
15 EDUCATION	0.	28800.	4900.	0.	0.	8000.	0.
16 AMUSEMENTS	0.	1900.	200.	0.	0.	437300.	400.
17 OTHER SER	76400.	704200.	109300.	576700.	26200.	514400.	6000.
18 CLUBS	3800.	4900.	900.	500.	100.	13400.	100.
19 GOVT ENTS	26900.	133700.	54600.	41400.	4800.	145100.	700.
SUB-TOTALS	3097100.	8611800.	2053100.	2627300.	306500.	4935200.	24500.
20 HOUSEHOLDS	658800.	14556700.	3913300.	8635200.	1241000.	7047500.	65200.
21 IND BUS TX	229100.	1917600.	1153700.	307100.	54400.	699600.	19600.
22 PROFITS	454500.	139100.	-801400.	641900.	69100.	62100.	2900.
23 PROP INC	188300.	6389800.	487300.	441700.	47600.	2489900.	17600.
24 COMP IMPS	4485000.	13820800.	3351900.	16055000.	1645900.	10408500.	25700.
25 N-C IMPS	2146100.	537700.	254300.	700800.	83400.	1873300.	1900.
TOTALS	11258900.	45973500.	10412200.	29409000.	3447900.	27516100.	157400.

APPENDIX IV GUNNISON COUNTY TRANSACTIONS AMONG SECTORS, 1982

(Purchases by sectors listed at the top from sectors listed at the left)

	8 REC RETAIL	9 OTHER RETL	10 FIN/INSUR	11 REAL EST	12 LODGING	13 RESTAURANT	14 HEALTH SER
1 AGRICULTUR	0.	0.	0.	0.	1400.	1000.	0.
2 COAL MINES	0.	0.	0.	400.	0.	0.	0.
3 OTHER MINE	0.	0.	0.	0.	0.	0.	0.
4 NEW CONSTR	0.	0.	0.	0.	0.	0.	0.
5 MAINT CNST	1000.	10500.	738500.	326600.	23300.	11300.	2700.
6 MFG/TRN/UT	59300.	646100.	215000.	250800.	237900.	396300.	81100.
7 WHOLESALE	0.	100.	0.	0.	100.	1600.	100.
8 REC RETAIL	200.	1900.	300.	5200.	400.	700.	300.
9 OTHER RETL	1300.	14300.	18800.	8100.	5900.	7800.	1500.
10 FIN/INSUR	8800.	96100.	581100.	132700.	70900.	88200.	26500.
11 REAL EST	45400.	492900.	489400.	794800.	199800.	318100.	182100.
12 LODGING	1600.	17100.	11800.	6800.	3300.	4200.	8100.
13 RESTAURANT	5600.	61100.	74500.	64900.	47600.	28200.	33800.
14 HEALTH SER	0.	0.	3000.	0.	0.	0.	146700.
15 EDUCATION	0.	0.	300.	100.	0.	0.	600.
16 AMUSEMENTS	700.	7500.	1400.	1700.	1400.	2200.	100.
17 OTHER SER	33400.	362100.	548000.	138700.	248000.	262600.	137200.
18 CLUBS	200.	2900.	2800.	3200.	4900.	5800.	3500.
19 GOVT ENTS	7200.	79000.	109600.	47300.	75800.	53000.	26400.
SUB-TOTALS	164700.	1791600.	2794500.	1781300.	920700.	1181000.	650700.
20 HOUSEHOLDS	534000.	5800200.	2012400.	655400.	1270700.	3788400.	1581100.
21 IND BUS TX	171200.	1859900.	2691500.	1712300.	153800.	532300.	12500.
22 PROFITS	36700.	398200.	-159900.	-172700.	-109900.	285300.	345200.
23 PROP INC	90900.	987400.	9578400.	8141500.	576100.	706500.	206400.
24 COMP IMPS	142000.	1542500.	1600700.	826300.	1481600.	3880700.	846600.
25 N-C IMPS	8900.	97500.	224500.	57600.	114600.	2692200.	199100.
TOTALS	1148400.	12477300.	18742100.	13001700.	4407600.	13066400.	3841600.

APPENDIX IV GUNNISON COUNTY TRANSACTIONS AMONG SECTORS, 1982

(Purchases by sectors listed at the top from sectors listed at the left)

	15 EDUCATION	16 AMUSEMENTS	17 OTHER SER	18 CLUBS	19 GOVT ENTS	SUB-TOTALS	20 HOUSEHOLDS
1 AGRICULTUR	1200.	20000.	0.	100.	100.	2115600.	47600.
2 COAL MINES	2300.	0.	0.	0.	65500.	6131600.	7200.
3 OTHER MINE	0.	0.	0.	0.	0.	1510700.	0.
4 NEW CONSTR	0.	0.	0.	0.	0.	0.	0.
5 MAINT CNST	17600.	24100.	4900.	10700.	103100.	1388300.	0.
6 MFG/TRN/UT	200200.	271900.	342000.	94700.	253200.	7128600.	3746600.
7 WHOLESALE	0.	200.	100.	0.	0.	10800.	7500.
8 REC RETAIL	500.	800.	39300.	300.	1800.	125600.	959500.
9 OTHER RETL	2800.	3000.	13100.	800.	7500.	1541900.	7456500.
10 FIN/INSUR	13600.	62000.	46400.	4900.	4300.	2029900.	9867300.
11 REAL EST	297200.	195900.	250300.	80100.	24700.	4984100.	3718900.
12 LODGING	2400.	29600.	65200.	28500.	2600.	317700.	645700.
13 RESTAURANT	44800.	118400.	141000.	53600.	23300.	1251900.	5190200.
14 HEALTH SER	800.	17700.	0.	0.	300.	299500.	2626600.
15 EDUCATION	900.	0.	2000.	0.	700.	46300.	655200.
16 AMUSEMENTS	16600.	333100.	900.	1700.	700.	807800.	1000600.
17 OTHER SER	147800.	216400.	296500.	52000.	40300.	4496200.	2893800.
18 CLUBS	3800.	9600.	9400.	600.	500.	70900.	849000.
19 GOVT ENTS	32800.	34200.	65600.	24700.	51800.	1014600.	1068900.
SUB-TOTALS	785300.	1336900.	1276700.	352700.	580400.		40741100.
20 HOUSEHOLDS	2437500.	2802500.	3273300.	723600.	16897700.	77894500.	0.
21 IND BUS TX	1100.	424300.	120000.	400.	0.	12060400.	0.
22 PROFITS	1300.	43300.	1052000.	0.	200.	2287900.	0.
23 PROP INC	-1100.	1456000.	1366300.	2700.	273300.	33446600.	0.
24 COMP IMPS	815900.	1868500.	1774800.	424300.	1294100.	66290800.	44072900.
25 N-C IMPS	93000.	251200.	276800.	38500.	44400.	9695800.	0.
TOTALS	4133000.	8182700.	9139900.	1542200.	19090100.		84814000.

APPENDIX IV GUNNISON COUNTY TRANSACTIONS AMONG SECTORS, 1982

(Purchases by sectors listed at the top from sectors listed at the left)

	21 FED NON-MI	22 FED MIL	23 FED CCC	24 ST/LOC N-E	25 ST/LOC ED	26 INVENTORY	27 CAPTL FORM
1 AGRICULTUR	2600.	0.	0.	200.	0.	13500.	0.
2 COAL MINES	0.	0.	0.	7600.	14800.	0.	0.
3 OTHER MINE	500.	0.	0.	0.	0.	0.	1600.
4 NEW CONSTR	613600.	4000.	0.	1624400.	504000.	0.	13174600.
5 MAINT CNST	2600.	1700.	0.	355000.	442400.	0.	0.
6 MFG/TRN/UT	20800.	20400.	0.	97100.	217300.	0.	150700.
7 WHOLESALE	0.	0.	0.	0.	0.	0.	1500.
8 REC RETAIL	0.	0.	0.	0.	1600.	0.	61700.
9 OTHER RETL	0.	200.	0.	0.	0.	0.	34800.
10 FIN/INSUR	16500.	0.	0.	320900.	0.	0.	0.
11 REAL EST	0.	2100.	0.	0.	0.	0.	365300.
12 LODGING	2300.	3800.	0.	0.	0.	0.	2100.
13 RESTAURANT	1300.	1900.	0.	0.	0.	0.	0.
14 HEALTH SER	1900.	500.	0.	0.	0.	0.	0.
15 EDUCATION	44400.	1300.	0.	0.	12300.	0.	0.
16 AMUSEMENTS	1100.	0.	0.	0.	0.	0.	0.
17 OTHER SER	80800.	1200.	0.	0.	0.	0.	500.
18 CLUBS	300.	300.	0.	200.	0.	0.	0.
19 GOVT ENTS	256600.	358700.	0.	8154700.	7140900.	0.	8700.
SUB-TOTALS	1045300.	396100.	0.	10560100.	8333300.	13500.	13801500.
20 HOUSEHOLDS	0.	0.	0.	0.	0.	0.	0.
21 IND BUS TX	0.	0.	0.	0.	0.	0.	0.
22 PROFITS	0.	0.	0.	0.	0.	0.	0.
23 PROP INC	0.	0.	0.	0.	0.	0.	0.
24 COMP IMPS	0.	0.	0.	0.	0.	0.	0.
25 N-C IMPS	0.	0.	0.	0.	0.	0.	0.
TOTALS	1045300.	396100.	0.	10560100.	8333300.	13500.	13801500.

APPENDIX IV GUNNISON COUNTY TRANSACTIONS AMONG SECTORS, 1982

(Purchases by sectors listed at the top from sectors listed at the left)

	28 DMSTC EXP	29 FOR EXPORT	TOTALS
1 AGRICULTUR	8936800.	142600.	11258900.
2 COAL MINES	32087800.	7724500.	45973500.
3 OTHER MINE	6127700.	2771700.	10412200.
4 NEW CONSTR	13488300.	100.	29409000.
5 MAINT CNST	1256800.	1100.	3447900.
6 MFG/TRN/UT	15015800.	1118800.	27516100.
7 WHOLESALE	0.	137600.	157400.
8 REC RETAIL	0.	0.	1148400.
9 OTHER RETL	3440000.	3900.	12477300.
10 FIN/INSUR	6490300.	17200.	18742100.
11 REAL EST	3644700.	286600.	13001700.
12 LODGING	3431200.	4800.	4407600.
13 RESTAURANT	6611000.	10100.	13066400.
14 HEALTH SER	913100.	0.	3841600.
15 EDUCATION	3373500.	0.	4133000.
16 AMUSEMENTS	6316300.	56900.	8182700.
17 OTHER SER	1576800.	90600.	9139900.
18 CLUBS	611600.	9900.	1542200.
19 GOVT ENTS	1052600.	34400.	19090100.
SUB-TOTALS	114374300.	12410800.	
20 HOUSEHOLDS	6919500.	0.	84814000.
21 IND BUS TX	0.	0.	12060400.
22 PROFITS	0.	0.	2287900.
23 PROP INC	0.	0.	33446600.
24 COMP IMPS	0.	0.	110363700.
25 N-C IMPS	0.	0.	9695800.
TOTALS	121293800.	12410800.	

APPENDIX V DISTRIBUTION OF SALES BY INDUSTRY

(Fraction of total sales by industry at left sold to industries listed at the column heads)

	1 AGRICULTUR	2 COAL MINES	3 OTHER MINE	4 NEW CONSTR	5 MAINT CNST	6 MFG/TRN/UT	7 WHOLESALE
1 AGRICULTUR	.1857	.0000	.0000	.0000	.0000	.0001	.0000
2 COAL MINES	.0000	.1318	.0001	.0000	.0000	.0000	.0000
3 OTHER MINE	.0000	.0000	.1405	.0000	.0000	.0046	.0000
4 NEW CONSTR	.0000	.0000	.0000	.0000	.0000	.0000	.0000
5 MAINT CNST	.0038	.0132	.0058	.0015	.0002	.0086	.0000
6 MFG/TRN/UT	.0048	.0137	.0061	.0195	.0021	.1019	.0003
7 WHOLESALE	.0076	.0165	.0019	.0197	.0025	.0064	.0000
8 REC RETAIL	.0007	.0485	.0054	.0036	.0005	.0056	.0001
9 OTHER RETL	.0017	.0035	.0002	.0949	.0147	.0017	.0000
10 FIN/INSUR	.0128	.0147	.0023	.0084	.0011	.0083	.0001
11 REAL EST	.0267	.0592	.0115	.0043	.0005	.0217	.0002
12 LODGING	.0021	.0091	.0023	.0074	.0006	.0094	.0001
13 RESTAURANT	.0002	.0053	.0013	.0023	.0002	.0328	.0004
14 HEALTH SER	.0341	.0000	.0000	.0000	.0000	.0000	.0000
15 EDUCATION	.0000	.0070	.0012	.0000	.0000	.0019	.0000
16 AMUSEMENTS	.0000	.0002	.0000	.0000	.0000	.0534	.0000
17 OTHER SER	.0084	.0770	.0120	.0631	.0029	.0563	.0007
18 CLUBS	.0025	.0032	.0006	.0003	.0001	.0087	.0001
19 GOVT ENTS	.0014	.0070	.0029	.0022	.0003	.0076	.0000
20 HOUSEHOLDS	.0078	.1716	.0461	.1018	.0146	.0831	.0008
21 IND BUS TX	.0190	.1590	.0957	.0255	.0045	.0580	.0016
22 PROFITS	.1987	.0608	-.3503	.2806	.0302	.0271	.0013
23 PROP INC	.0056	.1910	.0146	.0132	.0014	.0744	.0005
24 COMP IMPS	.0406	.1252	.0304	.1455	.0149	.0943	.0002
25 N-C IMPS	.2213	.0555	.0262	.0723	.0086	.1932	.0002

APPENDIX V DISTRIBUTION OF SALES BY INDUSTRY

(Fraction of total sales by industry at left sold to industries listed at the column heads)

	8 REC RETAIL	9 OTHER RETL	10 FIN/INSUR	11 REAL EST	12 LODGING	13 RESTAURANT	14 HEALTH SER
1 AGRICULTUR	.0000	.0000	.0000	.0000	.0001	.0001	.0000
2 COAL MINES	.0000	.0000	.0000	.0000	.0000	.0000	.0000
3 OTHER MINE	.0000	.0000	.0000	.0000	.0000	.0000	.0000
4 NEW CONSTR	.0000	.0000	.0000	.0000	.0000	.0000	.0000
5 MAINT CNST	.0003	.0030	.2142	.0947	.0068	.0033	.0008
6 MFG/TRN/UT	.0022	.0235	.0078	.0091	.0086	.0144	.0029
7 WHOLESALE	.0000	.0006	.0000	.0000	.0006	.0102	.0006
8 REC RETAIL	.0002	.0017	.0003	.0045	.0003	.0006	.0003
9 OTHER RETL	.0001	.0011	.0015	.0006	.0005	.0006	.0001
10 FIN/INSUR	.0005	.0051	.0310	.0071	.0038	.0047	.0014
11 REAL EST	.0035	.0379	.0376	.0611	.0154	.0245	.0140
12 LODGING	.0004	.0039	.0027	.0015	.0007	.0010	.0018
13 RESTAURANT	.0004	.0047	.0057	.0050	.0036	.0022	.0026
14 HEALTH SER	.0000	.0000	.0008	.0000	.0000	.0000	.0382
15 EDUCATION	.0000	.0000	.0001	.0000	.0000	.0000	.0001
16 AMUSEMENTS	.0001	.0009	.0002	.0002	.0002	.0003	.0000
17 OTHER SER	.0037	.0396	.0600	.0152	.0271	.0287	.0150
18 CLUBS	.0001	.0019	.0018	.0021	.0032	.0038	.0023
19 GOVT ENTS	.0004	.0041	.0057	.0025	.0040	.0028	.0014
20 HOUSEHOLDS	.0063	.0684	.0237	.0077	.0150	.0447	.0186
21 IND BUS TX	.0142	.1542	.2232	.1420	.0128	.0441	.0010
22 PROFITS	.0160	.1740	-.0699	-.0755	-.0480	.1247	.1509
23 PROP INC	.0027	.0295	.2864	.2434	.0172	.0211	.0062
24 COMP IMPS	.0013	.0140	.0145	.0075	.0134	.0352	.0077
25 N-C IMPS	.0009	.0101	.0232	.0059	.0118	.2777	.0205

APPENDIX V DISTRIBUTION OF SALES BY INDUSTRY

(Fraction of total sales by industry at left sold to industries listed at the column heads)

	15 EDUCATION	16 AMUSEMENTS	17 OTHER SER	18 CLUBS	19 GOVT ENTS	20 HOUSEHOLDS	21 FED NON-MI
1 AGRICULTUR	.0001	.0018	.0000	.0000	.0000	.0042	.0002
2 COAL MINES	.0001	.0000	.0000	.0000	.0014	.0002	.0000
3 OTHER MINE	.0000	.0000	.0000	.0000	.0000	.0000	.0000
4 NEW CONSTR	.0000	.0000	.0000	.0000	.0000	.0000	.0209
5 MAINT CNST	.0051	.0070	.0014	.0031	.0299	.0000	.0008
6 MFG/TRN/UT	.0073	.0099	.0124	.0034	.0092	.1362	.0008
7 WHOLESALE	.0000	.0013	.0006	.0000	.0000	.0476	.0000
8 REC RETAIL	.0004	.0007	.0342	.0003	.0016	.8355	.0000
9 OTHER RETL	.0002	.0002	.0010	.0001	.0006	.5976	.0000
10 FIN/INSUR	.0007	.0033	.0025	.0003	.0002	.5265	.0009
11 REAL EST	.0229	.0151	.0193	.0062	.0019	.2860	.0000
12 LODGING	.0005	.0067	.0148	.0065	.0006	.1465	.0005
13 RESTAURANT	.0034	.0091	.0108	.0041	.0018	.3972	.0001
14 HEALTH SER	.0002	.0046	.0000	.0000	.0001	.6837	.0005
15 EDUCATION	.0002	.0000	.0005	.0000	.0002	.1585	.0107
16 AMUSEMENTS	.0020	.0407	.0001	.0002	.0001	.1223	.0001
17 OTHER SER	.0162	.0237	.0324	.0057	.0044	.3166	.0088
18 CLUBS	.0025	.0062	.0061	.0004	.0003	.5505	.0002
19 GOVT ENTS	.0017	.0018	.0034	.0013	.0027	.0560	.0134
20 HOUSEHOLDS	.0287	.0330	.0386	.0085	.1992	.0000	.0000
21 IND BUS TX	.0001	.0352	.0099	.0000	.0000	.0000	.0000
22 PROFITS	.0006	.0189	.4598	.0000	.0001	.0000	.0000
23 PROP INC	.0000	.0435	.0409	.0001	.0082	.0000	.0000
24 COMP IMPS	.0074	.0169	.0161	.0038	.0117	.3993	.0000
25 N-C IMPS	.0096	.0259	.0285	.0040	.0046	.0000	.0000

APPENDIX V DISTRIBUTION OF SALES BY INDUSTRY

(Fraction of total sales by industry at left sold to industries listed at the column heads)

	22 FED MIL	23 FED CCC	24 ST/LOC N-E	25 ST/LOC ED	26 INVENTORY	27 CAPTL FORM	28 DMSTC EXP
1 AGRICULTUR	.0000	.0000	.0000	.0000	.0012	.0000	.7938
2 COAL MINES	.0000	.0000	.0002	.0003	.0000	.0000	.6980
3 OTHER MINE	.0000	.0000	.0000	.0000	.0000	.0002	.5885
4 NEW CONSTR	.0001	.0000	.0552	.0171	.0000	.4480	.4586
5 MAINT CNST	.0005	.0000	.1030	.1283	.0000	.0000	.3645
6 MFG/TRN/UT	.0007	.0000	.0035	.0079	.0000	.0055	.5457
7 WHOLESALE	.0000	.0000	.0000	.0000	.0000	.0095	.0000
8 REC RETAIL	.0000	.0000	.0000	.0014	.0000	.0537	.0000
9 OTHER RETL	.0000	.0000	.0000	.0000	.0000	.0028	.2757
10 FIN/INSUR	.0000	.0000	.0171	.0000	.0000	.0000	.3463
11 REAL EST	.0002	.0000	.0000	.0000	.0000	.0281	.2803
12 LODGING	.0009	.0000	.0000	.0000	.0000	.0005	.7785
13 RESTAURANT	.0001	.0000	.0000	.0000	.0000	.0000	.5060
14 HEALTH SER	.0001	.0000	.0000	.0000	.0000	.0000	.2377
15 EDUCATION	.0003	.0000	.0000	.0030	.0000	.0000	.8162
16 AMUSEMENTS	.0000	.0000	.0000	.0000	.0000	.0000	.7719
17 OTHER SER	.0001	.0000	.0000	.0000	.0000	.0001	.1725
18 CLUBS	.0002	.0000	.0001	.0000	.0000	.0000	.3966
19 GOVT ENTS	.0188	.0000	.4272	.3741	.0000	.0005	.0551
20 HOUSEHOLDS	.0000	.0000	.0000	.0000	.0000	.0000	.0816
21 IND BUS TX	.0000	.0000	.0000	.0000	.0000	.0000	.0000
22 PROFITS	.0000	.0000	.0000	.0000	.0000	.0000	.0000
23 PROP INC	.0000	.0000	.0000	.0000	.0000	.0000	.0000
24 COMP IMPS	.0000	.0000	.0000	.0000	.0000	.0000	.0000
25 N-C IMPS	.0000	.0000	.0000	.0000	.0000	.0000	.0000

APPENDIX V DISTRIBUTION OF SALES BY INDUSTRY

(Fraction of total sales by industry at left sold to industries listed at the column heads)

	29 FOR EXPORT
1 AGRICULTUR	.0127
2 COAL MINES	.1680
3 OTHER MINE	.2662
4 NEW CONSTR	.0000
5 MAINT CNST	.0003
6 MFG/TRN/UT	.0407
7 WHOLESALE	.8742
8 REC RETAIL	.0000
9 OTHER RETL	.0003
10 FIN/INSUR	.0009
11 REAL EST	.0220
12 LODGING	.0011
13 RESTAURANT	.0008
14 HEALTH SER	.0000
15 EDUCATION	.0000
16 AMUSEMENTS	.0070
17 OTHER SER	.0099
18 CLUBS	.0064
19 GOVT ENTS	.0018
20 HOUSEHOLDS	.0000
21 IND BUS TX	.0000
22 PROFITS	.0000
23 PROP INC	.0000
24 COMP IMPS	.0000
25 N-C IMPS	.0000

APPENDIX VI DIRECT INPUT REQUIREMENTS

(Distribution of spending by sectors listed at the column heads among sectors listed at the left)

	1 AGRICULTUR	2 COAL MINES	3 OTHER MINE	4 NEW CONSTR	5 MAINT CNST	6 MFG/TRN/UT	7 WHOLESALE
1 AGRICULTUR	.18571974	.00000000	.00000000	.00000000	.00000000	.00002907	.00000000
2 COAL MINES	.00000000	.13176721	.00044179	.00000000	.00000000	.00003634	.00000000
3 OTHER MINE	.00000000	.00000000	.14050825	.00000340	.00002900	.00172626	.00000000
4 NEW CONSTR	.00000000	.00000000	.00000000	.00000000	.00000000	.00000000	.00000000
5 MAINT CNST	.00116352	.00099188	.00191122	.00017002	.00017402	.00107937	.00063532
6 MFG/TRN/UT	.01180400	.00821125	.01600046	.01822231	.01656081	.10185310	.04764930
7 WHOLESALE	.00010658	.00005655	.00002881	.00010541	.00011601	.00003634	.00000000
8 REC RETAIL	.00007105	.00121157	.00059546	.00013941	.00017402	.00023259	.00063532
9 OTHER RETL	.00192736	.00095925	.00028812	.04024618	.05327881	.00075229	.00127065
10 FIN/INSUR	.02127206	.00600998	.00416819	.00534870	.00611967	.00564760	.00889454
11 REAL EST	.03082006	.01673138	.01433895	.00191778	.00188521	.01027035	.01524778
12 LODGING	.00082601	.00086789	.00097002	.00110850	.00078309	.00150094	.00381194
13 RESTAURANT	.00022205	.00151392	.00161349	.00104050	.00075408	.01555453	.03176620
14 HEALTH SER	.01163524	.00000000	.00000000	.00000000	.00000000	.00000000	.00000000
15 EDUCATION	.00000000	.00062645	.00047060	.00000000	.00000000	.00029074	.00000000
16 AMUSEMENTS	.00000000	.00004133	.00001921	.00000000	.00000000	.01589251	.00254130
17 OTHER SER	.00678574	.01531752	.01049730	.01960964	.00759883	.01869451	.03811944
18 CLUBS	.00033751	.00010658	.00008644	.00001700	.00002900	.00048699	.00063532
19 GOVT ENTS	.00238922	.00290820	.00524385	.00140773	.00139215	.00527328	.00444727
20 HOUSEHOLDS	.05851371	.31663241	.37583796	.29362440	.35992923	.25612278	.41423126
21 IND BUS TX	.02034835	.04171099	.11080271	.01044238	.01577772	.02542511	.12452351
22 PROFITS	.04036806	.00302566	-.07696740	.02182665	.02004118	.00225686	.01842440
23 PROP INC	.01672455	.13898877	.04680087	.01501921	.01380550	.09048884	.11181703
24 COMP IMPS	.39835153	.30062536	.32192044	.54592132	.47736303	.37826945	.16327827
25 N-C IMPS	.19061365	.01169587	.02442327	.02382944	.02418864	.06808014	.01207116

APPENDIX VI DIRECT INPUT REQUIREMENTS

(Distribution of spending by sectors listed at the column heads among sectors listed at the left)

	8 REC RETAIL	9 OTHER RETL	10 FIN/INSUR	11 REAL EST	12 LODGING	13 RESTAURANT	14 HEALTH SER
1 AGRICULTUR	.00000000	.00000000	.00000000	.00000000	.00031763	.00007653	.00000000
2 COAL MINES	.00000000	.00000000	.00000000	.00003077	.00000000	.00000000	.00000000
3 OTHER MINE	.00000000	.00000000	.00000000	.00000000	.00000000	.00000000	.00000000
4 NEW CONSTR	.00000000	.00000000	.00000000	.00000000	.00000000	.00000000	.00000000
5 MAINT CNST	.00087078	.00084153	.03940327	.02511979	.00528632	.00086481	.00070283
6 MFG/TRN/UT	.05163706	.05178204	.01147150	.01928979	.05397495	.03032970	.02111100
7 WHOLESALE	.00000000	.00000801	.00000000	.00000000	.00002269	.00012245	.00002603
8 REC RETAIL	.00017416	.00015228	.00001601	.00039995	.00009075	.00005357	.00007809
9 OTHER RETL	.00113201	.00114608	.00100309	.00062300	.00133860	.00059695	.00039046
10 FIN/INSUR	.00766284	.00770199	.03100506	.01020636	.01608585	.00675014	.00689817
11 REAL EST	.03953326	.03950374	.02611234	.06113047	.04533079	.02434488	.04740212
12 LODGING	.00139324	.00137049	.00062960	.00052301	.00074871	.00032144	.00210850
13 RESTAURANT	.00487635	.00489689	.00397501	.00499165	.01079953	.00215821	.00879842
14 HEALTH SER	.00000000	.00000000	.00016007	.00000000	.00000000	.00000000	.03818721
15 EDUCATION	.00000000	.00000000	.00001601	.00000769	.00000000	.00000000	.00015618
16 AMUSEMENTS	.00060954	.00060109	.00007470	.00013075	.00031763	.00016837	.00002603
17 OTHER SER	.02908394	.02902070	.02923899	.01066784	.05626645	.02009735	.03571429
18 CLUBS	.00017416	.00023242	.00014940	.00024612	.00111172	.00044389	.00091108
19 GOVT ENTS	.00626959	.00633150	.00584780	.00363799	.01719757	.00405621	.00687214
20 HOUSEHOLDS	.46499478	.46486019	.10737324	.05040879	.28829749	.28993449	.41157330
21 IND BUS TX	.14907698	.14906270	.14360717	.13169816	.03489427	.04073808	.00325385
22 PROFITS	.03195751	.03191396	-.00853159	-.01328288	-.02493420	.02183463	.08985839
23 PROP INC	.07915361	.07913571	.51106333	.62618734	.13070605	.05406998	.05372761
24 COMP IMPS	.12365030	.12362450	.08540665	.06355323	.33614666	.29699841	.22037693
25 N-C IMPS	.00774991	.00781419	.01197838	.00443019	.02600054	.20603992	.05182736

APPENDIX VI DIRECT INPUT REQUIREMENTS

(Distribution of spending by sectors listed at the column heads among sectors listed at the left)

	15 EDUCATION	16 AMUSEMENTS	17 OTHER SER	18 CLUBS	19 GOVT ENTS	20 HOUSEHOLDS	21 FED NON-MI
1 AGRICULTUR	.00029035	.00244418	.00000000	.00006484	.00000524	.00056123	.00248732
2 COAL MINES	.00055650	.00000000	.00000000	.00000000	.00343110	.00008489	.00000000
3 OTHER MINE	.00000000	.00000000	.00000000	.00000000	.00000000	.00000000	.00047833
4 NEW CONSTR	.00000000	.00000000	.00000000	.00000000	.00000000	.00000000	.58700851
5 MAINT CNST	.00425841	.00294524	.00053611	.00693814	.00540071	.00000000	.00248732
6 MFG/TRN/UT	.04843939	.03322864	.03741835	.06140578	.01326342	.04417431	.01989859
7 WHOLESALE	.00000000	.00002444	.00001094	.00000000	.00000000	.00008843	.00000000
8 REC RETAIL	.00012098	.00009777	.00429983	.00019453	.00009429	.01131299	.00000000
9 OTHER RETL	.00067747	.00036663	.00143328	.00051874	.00039287	.08791591	.00000000
10 FIN/INSUR	.00329059	.00757696	.00507664	.00317728	.00022525	.11634046	.01578494
11 REAL EST	.07190902	.02394075	.02738542	.05193879	.00129386	.04384771	.00000000
12 LODGING	.00058069	.00361739	.00713356	.01848009	.00013620	.00761313	.00220033
13 RESTAURANT	.01083958	.01446955	.01542686	.03475554	.00122053	.06119509	.00124366
14 HEALTH SER	.00019356	.00216310	.00000000	.00000000	.00001571	.03096894	.00181766
15 EDUCATION	.00021776	.00000000	.00021882	.00000000	.00003667	.00772514	.04247584
16 AMUSEMENTS	.00401645	.04070783	.00009847	.00110232	.00003667	.01179758	.00105233
17 OTHER SER	.03576095	.02644604	.03244018	.03371807	.00211104	.03411937	.07729838
18 CLUBS	.00091943	.00117321	.00102846	.00038905	.00002619	.01001014	.00028700
19 GOVT ENTS	.00793612	.00417955	.00717732	.01601608	.00271345	.01260287	.24547977
20 HOUSEHOLDS	.58976530	.34249086	.35813302	.46919984	.88515513	.00000000	.00000000
21 IND BUS TX	.00026615	.05185330	.01312925	.00025937	.00000000	.00000000	.00000000
22 PROFITS	.00031454	.00529165	.11509973	.00000000	.00001048	.00000000	.00000000
23 PROP INC	-.00026615	.17793638	.14948741	.00175075	.01431632	.00000000	.00000000
24 COMP IMPS	.19741108	.22834761	.19418156	.27512644	.06778906	.51964180	.00000000
25 N-C IMPS	.02250181	.03069891	.03028480	.02496434	.00232581	.00000000	.00000000

APPENDIX VI DIRECT INPUT REQUIREMENTS

(Distribution of spending by sectors listed at the column heads among sectors listed at the left)

	22 FED MIL	23 FED CCC	24 ST/LOC N-E	25 ST/LOC ED	26 INVENTORY	27 CAPTL FORM	28 DMSTC EXP
1 AGRICULTUR	.00000000	.00000000	.00001894	.00000000	1.00000000	.00000000	.07367895
2 COAL MINES	.00000000	.00000000	.00071969	.00177601	.00000000	.00000000	.26454609
3 OTHER MINE	.00000000	.00000000	.00000000	.00000000	.00000000	.00011593	.05051948
4 NEW CONSTR	.01009846	.00000000	.15382430	.06048024	.00000000	.95457740	.11120354
5 MAINT CNST	.00429185	.00000000	.03361711	.05308821	.00000000	.00000000	.01036162
6 MFG/TRN/UT	.05150215	.00000000	.00919499	.02607610	.00000000	.01091910	.12379693
7 WHOLESALE	.00000000	.00000000	.00000000	.00000000	.00000000	.00010868	.00000000
8 REC RETAIL	.00000000	.00000000	.00000000	.00019200	.00000000	.00447053	.00000000
9 OTHER RETL	.00050492	.00000000	.00000000	.00000000	.00000000	.00252147	.02836089
10 FIN/INSUR	.00000000	.00000000	.03038797	.00000000	.00000000	.00000000	.05350892
11 REAL EST	.00530169	.00000000	.00000000	.00000000	.00000000	.02646814	.03004853
12 LODGING	.00959354	.00000000	.00000000	.00000000	.00000000	.00015216	.02828834
13 RESTAURANT	.00479677	.00000000	.00000000	.00000000	.00000000	.00000000	.05450402
14 HEALTH SER	.00126231	.00000000	.00000000	.00000000	.00000000	.00000000	.00752800
15 EDUCATION	.00328200	.00000000	.00000000	.00147601	.00000000	.00000000	.02781263
16 AMUSEMENTS	.00000000	.00000000	.00000000	.00000000	.00000000	.00000000	.05207438
17 OTHER SER	.00302954	.00000000	.00000000	.00000000	.00000000	.00003623	.01299984
18 CLUBS	.00075738	.00000000	.00001894	.00000000	.00000000	.00000000	.00504230
19 GOVT ENTS	.90557940	.00000000	.77221807	.85691143	.00000000	.00063037	.00867810
20 HOUSEHOLDS	.00000000	.00000000	.00000000	.00000000	.00000000	.00000000	.05704743
21 IND BUS TX	.00000000	.00000000	.00000000	.00000000	.00000000	.00000000	.00000000
22 PROFITS	.00000000	.00000000	.00000000	.00000000	.00000000	.00000000	.00000000
23 PROP INC	.00000000	.00000000	.00000000	.00000000	.00000000	.00000000	.00000000
24 COMP IMPS	.00000000	.00000000	.00000000	.00000000	.00000000	.00000000	.00000000
25 N-C IMPS	.00000000	.00000000	.00000000	.00000000	.00000000	.00000000	.00000000

APPENDIX VI DIRECT INPUT REQUIREMENTS

(Distribution of spending by sectors listed at the column heads among sectors listed at the left)

	29 FOR EXPORT
1 AGRICULTUR	.01148999
2 COAL MINES	.62240146
3 OTHER MINE	.22332968
4 NEW CONSTR	.00000806
5 MAINT CNST	.00008863
6 MFG/TRN/UT	.09014729
7 WHOLESALE	.01108712
8 REC RETAIL	.00000000
9 OTHER RETL	.00031424
10 FIN/INSUR	.00138589
11 REAL EST	.02309279
12 LODGING	.00038676
13 RESTAURANT	.00081381
14 HEALTH SER	.00000000
15 EDUCATION	.00000000
16 AMUSEMENTS	.00458472
17 OTHER SER	.00730009
18 CLUBS	.00079769
19 GOVT ENTS	.00277178
20 HOUSEHOLDS	.00000000
21 IND BUS TX	.00000000
22 PROFITS	.00000000
23 PROP INC	.00000000
24 COMP IMPS	.00000000
25 N-C IMPS	.00000000

APPENDIX VII INTERDEPENDENCY MATRIX FOR GUNNISON COUNTY
(I-A INVERSE MATRIX WITH HOUSEHOLDS ENDOGENOUS)

Each cell in a column shows the direct, indirect, and induced sales by the sector listed at the left when the sector at the column head increases sales to final demand (exports) by one dollar.

	1 AGRICULTUR	2 COAL MINES	3 OTHER MINE	4 NEW CONSTR	5 MAINT CNST	6 MFG/TRN/UT	7 WHOLESALE
1 AGRICULTUR	1.2282	.0003	.0004	.0003	.0004	.0004	.0004
2 COAL MINES	.0000	1.1519	.0007	.0001	.0001	.0001	.0001
3 OTHER MINE	.0001	.0001	1.1636	.0001	.0001	.0023	.0002
4 NEW CONSTR	.0000	.0000	.0000	1.0000	.0000	.0000	.0000
5 MAINT CNST	.0045	.0052	.0068	.0034	1.0040	.0046	.0056
6 MFG/TRN/UT	.0264	.0423	.0580	.0498	.0534	1.1412	.0935
7 WHOLESALE	.0001	.0001	.0001	.0001	.0002	.0001	1.0001
8 REC RETAIL	.0015	.0068	.0071	.0048	.0057	.0047	.0073
9 OTHER RETL	.0131	.0419	.0492	.0755	.0956	.0345	.0508
10 FIN/INSUR	.0423	.0641	.0730	.0549	.0656	.0536	.0788
11 REAL EST	.0499	.0501	.0527	.0294	.0345	.0376	.0540
12 LODGING	.0022	.0051	.0060	.0048	.0051	.0052	.0091
13 RESTAURANT	.0090	.0324	.0384	.0279	.0327	.0429	.0700
14 HEALTH SER	.0187	.0148	.0177	.0127	.0153	.0122	.0179
15 EDUCATION	.0009	.0043	.0048	.0031	.0037	.0033	.0043
16 AMUSEMENTS	.0019	.0065	.0078	.0058	.0068	.0236	.0111
17 OTHER SER	.0168	.0413	.0400	.0413	.0332	.0412	.0689
18 CLUBS	.0017	.0049	.0057	.0041	.0049	.0045	.0064
19 GOVT ENTS	.0055	.0110	.0152	.0083	.0096	.0124	.0143
20 HOUSEHOLDS	.1180	.4581	.5477	.3950	.4756	.3776	.5555
21 BUS. MULT.	1.5407	1.9411	2.0950	1.7214	1.8466	1.8022	2.0484

APPENDIX VII INTERDEPENDENCY MATRIX FOR GUNNISON COUNTY
(I-A INVERSE MATRIX WITH HOUSEHOLDS ENDOGENOUS)

Each cell in a column shows the direct, indirect, and induced sales by the sector listed at the left when the sector at the column head increases sales to final demand (exports) by one dollar.

	8 REC RETAIL	9 OTHER RETL	10 FIN/INSUR	11 REAL EST	12 LODGING	13 RESTAURANT	14 HEALTH SER
1 AGRICULTUR	.0005	.0005	.0001	.0001	.0007	.0004	.0004
2 COAL MINES	.0001	.0001	.0001	.0001	.0002	.0001	.0001
3 OTHER MINE	.0002	.0002	.0001	.0001	.0002	.0001	.0001
4 NEW CONSTR	.0000	.0000	.0000	.0000	.0000	.0000	.0000
5 MAINT CNST	.0067	.0067	.0428	.0280	.0105	.0046	.0064
6 MFG/TRN/UT	.1001	.1003	.0285	.0311	.0931	.0604	.0646
7 WHOLESALE	.0001	.0001	.0000	.0000	.0001	.0002	.0001
8 REC RETAIL	1.0074	.0073	.0023	.0016	.0053	.0045	.0067
9 OTHER RETL	.0551	1.0551	.0195	.0110	.0398	.0343	.0501
10 FIN/INSUR	.0835	.0836	1.0554	.0239	.0706	.0542	.0771
11 REAL EST	.0817	.0817	.0416	1.0726	.0783	.0507	.0892
12 LODGING	.0070	.0070	.0025	.0016	1.0051	.0038	.0074
13 RESTAURANT	.0462	.0463	.0170	.0125	.0411	1.0280	.0471
14 HEALTH SER	.0195	.0195	.0061	.0032	.0138	.0122	1.0577
15 EDUCATION	.0047	.0047	.0014	.0008	.0033	.0029	.0045
16 AMUSEMENTS	.0098	.0098	.0028	.0019	.0072	.0059	.0080
17 OTHER SER	.0615	.0614	.0413	.0179	.0817	.0404	.0671
18 CLUBS	.0065	.0065	.0021	.0013	.0056	.0044	.0067
19 GOVT ENTS	.0167	.0168	.0095	.0059	.0252	.0106	.0168
20 HOUSEHOLDS	.6048	.6047	.1825	.0994	.4263	.3775	.5568
21 BUS. MULT.	2.1121	2.1122	1.4557	1.3130	1.9079	1.6951	2.0669

APPENDIX VII INTERDEPENDENCY MATRIX FOR GUNNISON COUNTY
(I-A INVERSE MATRIX WITH HOUSEHOLDS ENDOGENOUS)

Each cell in a column shows the direct, indirect, and induced sales by the sector listed at the left when the sector at the column head increases sales to final demand (exports) by one dollar.

	15 EDUCATION	16 AMUSEMENTS	17 OTHER SER	18 CLUBS	19 GOVT ENTS	20 HOUSEHOLDS	TOTALS
1 AGRICULTUR	.0009	.0035	.0004	.0006	.0008	.0009	1.2401
2 COAL MINES	.0008	.0001	.0001	.0002	.0041	.0002	1.1594
3 OTHER MINE	.0002	.0001	.0002	.0002	.0002	.0002	1.1685
4 NEW CONSTR	.0000	.0000	.0000	.0000	.0000	.0000	1.0000
5 MAINT CNST	.0119	.0076	.0051	.0135	.0129	.0083	1.1991
6 MFG/TRN/UT	.1085	.0727	.0771	.1168	.0852	.0780	2.4811
7 WHOLESALE	.0001	.0001	.0001	.0001	.0001	.0001	1.0018
8 REC RETAIL	.0092	.0057	.0101	.0079	.0125	.0138	1.1326
9 OTHER RETL	.0692	.0427	.0445	.0587	.0958	.1060	2.0425
10 FIN/INSUR	.0994	.0674	.0658	.0851	.1324	.1471	2.4776
11 REAL EST	.1266	.0584	.0619	.0996	.0680	.0738	2.2922
12 LODGING	.0077	.0082	.0117	.0246	.0095	.0103	1.1439
13 RESTAURANT	.0631	.0475	.0486	.0796	.0716	.0781	1.8801
14 HEALTH SER	.0249	.0176	.0156	.0209	.0346	.0385	1.3934
15 EDUCATION	1.0062	.0037	.0040	.0051	.0084	.0093	1.0834
16 AMUSEMENTS	.0155	1.0495	.0074	.0112	.0148	.0162	1.2237
17 OTHER SER	.0766	.0535	1.0592	.0704	.0542	.0574	2.0252
18 CLUBS	.0089	.0061	.0061	1.0072	.0110	.0122	1.1167
19 GOVT ENTS	.0211	.0127	.0158	.0278	1.0198	.0189	1.2937
20 HOUSEHOLDS	.7658	.4726	.4822	.6481	1.0710	1.1939	10.4130
21 BUS. MULT.	2.4167	1.9299	1.9156	2.2773	2.7069	1.8633	.0000

APPENDIX VIII LIST OF SURVEY DATA COLLECTED

DEFINITIONS OF THE ORIGINAL 125 VARIABLE
DATA SET READ INTO MICRO TSP

VARIABLE NUMBER	DEFINITION AND COMMENTS
1	questionnaire identification number
2	interviewer code 1 through 6
3	location - 1=river, 2=shore, 3=boat
4	weather condition - 4 categories
5	temperature range - 5 categories
6	number of trout caught today
7	number kokanne caught today
8	most important species - 9 categories
9	second most important species - 9 categories
10	trout length - inches
11	kokanne length - inches
12	how many fish kept
13	expected fish catch at site
14	expected fish length at site
15	hours fished today
16	road miles one-way from home to site
17	days visit area per year (is this trips?)
18	days fish all areas/year
19	distance to substitute site - 10's of miles
20	where is it? 1=lake 2= stream
	one questions 21-25 - 5 is extremely important, 1 is not important
21	importance of numbers of fish - 1 to 5
22	importance of fish size - 1 to 5
23	importance of fish catching method - 1 to 5
24	importance of variety - 1 to 5
25	importance of environmental quality - 1 to 5
26	importance of crowding - 1 to 5
27	estimated cost of trip
28	how many people share cost of trip
29	individual cost of trip (share)
30	what part of trip costs are required?
31	is trip worth more than individual share - 1=no, 2=yes, 3=same amount
32	maximum value of trip to you
33	time spent away from home (time on site plus trip)
34	fishing percent of trip time
35	fishing percent of trip cost
36	fishing percent of trip benefits
37	relaxing percent of trip benefits
38	questionnaire identification number repeats
39	driving percent of trip time
40	driving percent of trip costs
41	driving percent of trip benefits
42	other areas percent of trip time
43	other areas percent of trip costs

44	other areas percent of trip benefits
45	willing to pay to maintain BM fishes - 1=no, 2=yes
46 to 54	fish numbers question
55 to 61	fish size question
62	questionnaire identification number repeats
63	does species caught matter? - 1=no, 2=yes
64	preferred species - 6 categories
65	substitute species - 6 categories
66	change in number of days (?)
67	change in number of dollars (?)
68	catch a wild fish - change in days
69	" " " " change in dollars
70	preservation value dollars
71	reason if no change - 8 categories
	fishing method used most
72	lures
73	bait
74	flies
75	skill level - 1 to 5, 5 is expert
76	total investment in equipment
77	annual days of vacation
78	sex - 1=female, 2=male
79	age
80	people in household
81	county code of residence
82	state code of residence
83	city population where live
84	years lived in Colorado
85	belong to sportsperson organization - 1=no, 2=yes
86	belong to environmental organization - 1=no, 2=yes
87	occupation - 1 student through 9 manager...roughly ordered by relative freedom of work schedule (in my opinion)
88	years of school completed
89	household income in $1,000
90	questionnaire identification number repeats
	the following are for the I-O model
91	total trip costs (only 29 have positive value here?)
92	total cost outside Colo
93	total cost inside Colo
94	total cost in Gunnison county
95	total vehicle cost
96	vehicle cost outside Colo
97	vehicle cost inside Colo
98	vehicle cost in Gunnison county
99	total lodging costs
100	lodging cost outside Colo
101	lodging cost inside Colo
102	lodging cost in Gunnison county
103	total equipment cost
104	equipment cost outside Colo
105	equipment cost inside Colo
106	equipment cost in Gunnison county
107	food store cost
108	food store cost outside Colo

109	food store cost inside Colo
110	food store cost in Gunnison county
111	total restaurant cost
112	restaurant cost outside Colo
113	restaurant cost inside Colo
114	restaurant cost in Gunnison county
115	total professional services cost
120	total other expenses
124	county
125	state

APPENDIX IX DATA FOR THE STATISTICAL DEMAND ANALYSIS

COST	V13	V18	V19	V75	V89	TRIPS
102.3250	6.0000	15.0000	15.0000	1.0000	23.0000	1.2000
3450.0000	2.0000	5.0000	160.0000	1.0000	100.0000	.8333
224.2500	15.0000	15.0000	10.0000	4.0000	28.0000	.6364
834.8440	20.0000	35.0000	22.0000	5.0000	63.0000	2.0769
245.5000	4.0000	40.0000	18.0000	1.0000	13.0000	.2500
318.1250	6.0000	5.0000	3.0000	2.0000	45.0000	2.0000
57.0000	3.0000	30.0000	3.0000	1.0000	8.0000	1.0000
452.2500	7.0000	20.0000	11.0000	2.0000	85.0000	1.0000
1989.1400	3.0000	99.0000	140.0000	1.0000	63.0000	1.0000
169.3000	6.0000	27.0000	8.0000	2.0000	33.0000	4.2500
257.5000	8.0000	60.0000	4.0000	2.0000	75.0000	2.3333
322.5000	6.0000	20.0000	25.0000	2.0000	28.0000	2.4000
31.9300	8.0000	30.0000	9.0000	2.0000	23.0000	15.0000
488.7500	10.0000	37.0000	49.0000	3.0000	75.0000	3.7500
341.0000	9.0000	4.0000	35.0000	3.0000	23.0000	1.0000
246.3000	5.0000	10.0000	22.0000	2.0000	63.0000	2.5000
188.5500	2.0000	30.0000	6.0000	1.0000	23.0000	1.3333
7.5750	6.0000	30.0000	1.0000	2.0000	3.0000	6.0000
310.2500	2.0000	20.0000	5.0000	1.0000	28.0000	1.0000
410.0000	9.0000	75.0000	1.0000	3.0000	80.0000	1.8000
334.7500	8.0000	41.0000	8.0000	2.0000	28.0000	1.0000
98.0000	8.0000	40.0000	5.0000	2.0000	80.0000	20.0000
248.3000	3.0000	30.0000	5.0000	1.0000	23.0000	2.3333
298.1250	8.0000	40.0000	8.0000	2.0000	45.0000	4.0000
210.2500	8.0000	13.0000	7.0000	2.0000	63.0000	1.0000
1371.7500	8.0000	10.0000	60.0000	2.0000	63.0000	1.2000
69.6000	13.0000	40.0000	10.0000	3.0000	28.0000	6.4000
274.4620	6.0000	24.0000	8.0000	1.0000	23.0000	1.0000
307.5000	1.0000	10.0000	1.0000	1.0000	45.0000	1.0000
277.5000	6.0000	10.0000	4.0000	1.0000	45.0000	.7500
583.2000	8.0000	32.0000	4.0000	2.0000	80.0000	3.2000
131.5000	6.0000	60.0000	4.0000	2.0000	18.0000	1.8889
460.8250	6.0000	18.0000	25.0000	2.0000	23.0000	4.0000
29.1000	11.0000	12.0000	4.0000	3.0000	13.0000	6.0000
1426.4000	2.0000	99.0000	56.0000	1.0000	18.0000	1.0000
358.8120	8.0000	99.0000	15.0000	2.0000	33.0000	4.0000
302.5000	3.0000	40.0000	25.0000	1.0000	28.0000	1.0000
35.4650	6.0000	99.0000	40.0000	2.0000	23.0000	20.0000
148.0000	3.0000	10.0000	22.0000	1.0000	28.0000	1.0000
662.4370	2.0000	5.0000	20.0000	1.0000	23.0000	.6667
555.6000	2.0000	5.0000	12.0000	1.0000	18.0000	1.3333
360.6000	3.0000	30.0000	10.0000	2.0000	63.0000	1.0000
1316.6200	2.0000	7.0000	100.0000	1.0000	63.0000	.1538
110.3750	3.0000	30.0000	10.0000	1.0000	23.0000	1.0000
146.6250	8.0000	30.0000	15.0000	2.0000	33.0000	3.0000
228.7500	8.0000	12.0000	10.0000	2.0000	45.0000	2.0000
350.6140	8.0000	20.0000	12.0000	3.0000	33.0000	3.0000
717.6000	8.0000	10.0000	24.0000	2.0000	28.0000	1.0000
368.2500	1.0000	30.0000	20.0000	1.0000	13.0000	1.0000
16.0250	9.0000	99.0000	1.0000	3.0000	63.0000	99.0000
140.2500	11.0000	4.0000	60.0000	4.0000	63.0000	2.0000

76.5750	8.0000	25.0000	4.0000	2.0000	13.0000	6.2500
4.3650	8.0000	99.0000	7.0000	2.0000	3.0000	99.0000
9.4400	9.0000	99.0000	4.0000	3.0000	23.0000	99.0000
339.6000	5.0000	35.0000	9.0000	1.0000	63.0000	1.0000
115.6000	8.0000	40.0000	28.0000	2.0000	18.0000	3.5000
417.6000	15.0000	50.0000	5.0000	3.0000	28.0000	.4000
1151.2500	4.0000	99.0000	1.0000	2.0000	63.0000	1.0000
259.6000	6.0000	20.0000	10.0000	2.0000	38.0000	1.2000
197.6000	2.0000	4.0000	1.0000	1.0000	28.0000	1.0000
99.0000	5.0000	50.0000	3.0000	1.0000	28.0000	1.0000
450.5000	14.0000	50.0000	20.0000	5.0000	63.0000	5.0000
189.7250	6.0000	80.0000	9.0000	1.0000	33.0000	3.0000
308.6000	10.0000	80.0000	7.0000	3.0000	33.0000	1.5555
299.7500	2.0000	10.0000	15.0000	1.0000	38.0000	1.6000
148.3000	7.0000	65.0000	12.0000	3.0000	23.0000	16.2500
163.5250	2.0000	20.0000	5.0000	1.0000	33.0000	1.0000
217.6000	5.0000	20.0000	25.0000	2.0000	28.0000	1.0000
101.1870	4.0000	25.0000	1.0000	1.0000	13.0000	2.5000
790.0000	5.0000	30.0000	100.0000	2.0000	28.0000	.8333
538.5500	8.0000	20.0000	3.0000	2.0000	23.0000	1.4286
227.5030	6.0000	10.0000	12.0000	2.0000	23.0000	1.6667
407.5000	2.0000	99.0000	10.0000	1.0000	45.0000	1.0000
424.5120	2.0000	12.0000	3.0000	1.0000	45.0000	1.0000
759.2500	10.0000	17.0000	5.0000	3.0000	13.0000	2.5000
362.6120	7.0000	40.0000	1.0000	2.0000	33.0000	10.0000
266.2500	3.0000	80.0000	1.0000	1.0000	38.0000	1.0000
92.6000	7.0000	20.0000	10.0000	2.0000	18.0000	3.7500
467.6870	5.0000	60.0000	32.0000	2.0000	33.0000	1.0000
208.7570	8.0000	25.0000	4.0000	3.0000	63.0000	2.3333
201.6000	1.0000	7.0000	9.0000	1.0000	18.0000	.5000
59.4000	8.0000	90.0000	6.0000	2.0000	28.0000	30.0000
278.7500	1.0000	10.0000	2.0000	1.0000	18.0000	1.0000
356.4000	2.0000	80.0000	1.0000	1.0000	38.0000	1.0000
275.5000	3.0000	60.0000	8.0000	1.0000	33.0000	1.0000
396.3000	7.0000	10.0000	22.0000	2.0000	38.0000	1.0000
164.4000	8.0000	10.0000	10.0000	2.0000	23.0000	1.3333
302.4000	7.0000	21.0000	7.0000	2.0000	28.0000	5.0000
252.4680	6.0000	12.0000	5.0000	2.0000	38.0000	4.0000
161.4000	11.0000	20.0000	1.0000	3.0000	28.0000	10.0000
169.8250	2.0000	30.0000	7.0000	1.0000	38.0000	1.5000
720.7500	7.0000	20.0000	1.0000	2.0000	23.0000	1.0000
2502.5000	6.0000	42.0000	1.0000	2.0000	45.0000	1.0000
257.2120	8.0000	30.0000	5.0000	2.0000	28.0000	1.0000
382.5000	8.0000	20.0000	5.0000	3.0000	45.0000	1.0000
17.8750	8.0000	42.0000	1.0000	2.0000	18.0000	15.0000
1852.5000	14.0000	40.0000	100.0000	4.0000	63.0000	1.0000
84.6500	7.0000	60.0000	1.0000	2.0000	33.0000	60.0000
256.6250	8.0000	40.0000	1.0000	2.0000	33.0000	2.3333
246.3750	8.0000	36.0000	2.0000	2.0000	85.0000	5.6667
213.4000	3.0000	35.0000	1.0000	1.0000	28.0000	2.0000
386.1510	5.0000	10.0000	3.0000	1.0000	63.0000	3.0000
200.2660	4.0000	30.0000	1.0000	1.0000	33.0000	1.0000
472.1250	7.0000	14.0000	10.0000	2.0000	33.0000	.4286
369.0000	5.0000	20.0000	9.0000	2.0000	45.0000	1.0000

303.5720	7.0000	10.0000	17.0000	2.0000	45.0000	1.0000
759.5300	18.0000	30.0000	10.0000	5.0000	33.0000	1.0000
712.4000	8.0000	17.0000	1.0000	2.0000	33.0000	1.0000
144.5000	3.0000	30.0000	15.0000	1.0000	18.0000	1.6667
686.4000	4.0000	80.0000	5.0000	1.0000	23.0000	1.0000
337.7500	1.0000	30.0000	25.0000	1.0000	38.0000	3.3333
148.3000	4.0000	8.0000	6.0000	1.0000	23.0000	2.0000
367.9000	4.0000	21.0000	4.0000	1.0000	13.0000	2.0000
175.7500	15.0000	35.0000	4.0000	4.0000	3.0000	1.2500
511.7000	2.0000	50.0000	1.0000	1.0000	33.0000	1.0000
233.9000	4.0000	99.0000	5.0000	2.0000	28.0000	2.0000
228.0000	6.0000	30.0000	4.0000	2.0000	8.0000	1.0000
2781.4000	6.0000	30.0000	3.0000	2.0000	63.0000	.2667
89.6500	6.0000	40.0000	1.0000	2.0000	33.0000	5.0000
282.3000	8.0000	30.0000	3.0000	3.0000	63.0000	2.0000
525.6250	10.0000	50.0000	10.0000	3.0000	63.0000	2.5000
324.0000	13.0000	36.0000	2.0000	3.0000	28.0000	2.3333
2159.0600	10.0000	50.0000	7.0000	3.0000	75.0000	1.0000
6312.5000	10.0000	60.0000	200.0000	3.0000	125.0000	1.0000
33.5600	15.0000	50.0000	5.0000	4.0000	8.0000	40.0000
563.0000	9.0000	60.0000	20.0000	3.0000	18.0000	2.8571
745.0000	12.0000	40.0000	4.0000	3.0000	28.0000	.7000
5.9800	3.0000	99.0000	5.0000	1.0000	8.0000	99.0000
71.8500	11.0000	30.0000	9.0000	3.0000	28.0000	8.0000
30.8800	20.0000	60.0000	1.0000	5.0000	28.0000	60.0000
1075.0000	18.0000	80.0000	10.0000	5.0000	250.0000	4.0000
207.8280	22.0000	35.0000	10.0000	5.0000	63.0000	25.0000
275.8570	7.0000	14.0000	1.0000	2.0000	38.0000	1.1000
28.9000	4.0000	10.0000	7.0000	1.0000	18.0000	7.0000
961.2500	20.0000	60.0000	5.0000	5.0000	45.0000	.4762
449.6250	6.0000	45.0000	1.0000	2.0000	45.0000	3.0000
161.6250	16.0000	20.0000	15.0000	4.0000	33.0000	1.3333
1398.0000	12.0000	21.0000	10.0000	3.0000	38.0000	.3529
74.1000	5.0000	12.0000	12.0000	2.0000	63.0000	3.0000
15.6000	3.0000	15.0000	25.0000	1.0000	8.0000	7.0000
149.3000	2.0000	7.0000	20.0000	1.0000	33.0000	.5000
224.4800	8.0000	90.0000	6.0000	2.0000	38.0000	8.3333
742.1620	12.0000	5.0000	35.0000	3.0000	63.0000	1.6667
522.6250	11.0000	99.0000	40.0000	3.0000	38.0000	1.0000
524.7500	5.0000	27.0000	10.0000	1.0000	45.0000	1.0000
1066.8700	2.0000	50.0000	34.0000	1.0000	45.0000	1.0000
6.4100	4.0000	60.0000	4.0000	2.0000	28.0000	60.0000
1862.2500	7.0000	99.0000	4.0000	2.0000	23.0000	1.0000
294.5000	4.0000	16.0000	6.0000	1.0000	45.0000	2.0000
520.5000	2.0000	50.0000	6.0000	1.0000	63.0000	.1428
1823.0000	6.0000	21.0000	1.0000	2.0000	63.0000	.4000
100.4250	9.0000	8.0000	7.0000	2.0000	33.0000	8.0000
22.6000	17.0000	24.0000	30.0000	4.0000	45.0000	8.0000
171.2000	10.0000	3.0000	1.0000	3.0000	33.0000	1.5000
312.0830	7.0000	80.0000	7.0000	2.0000	18.0000	1.0000
136.6250	2.0000	20.0000	8.0000	1.0000	33.0000	3.0000
37.0000	8.0000	8.0000	5.0000	2.0000	8.0000	6.0000
139.3000	8.0000	20.0000	25.0000	2.0000	18.0000	1.0000
31.1000	8.0000	25.0000	11.0000	2.0000	23.0000	20.0000

616.2500	21.0000	8.0000	9.0000	5.0000	38.0000	1.0000
405.3570	8.0000	10.0000	5.0000	3.0000	75.0000	1.2500
1154.2500	3.0000	30.0000	1.0000	1.0000	33.0000	.1190
3599.7500	3.0000	5.0000	1.0000	1.0000	38.0000	1.0000
291.7500	4.0000	3.0000	4.0000	1.0000	45.0000	1.0000
270.5000	2.0000	10.0000	5.0000	1.0000	63.0000	1.0000
24.1000	8.0000	15.0000	2.0000	2.0000	13.0000	12.0000
206.2500	8.0000	40.0000	5.0000	2.0000	75.0000	20.0000
155.1250	8.0000	21.0000	9.0000	2.0000	18.0000	5.0000
1090.6500	10.0000	85.0000	10.0000	3.0000	28.0000	1.0000
161.6250	11.0000	30.0000	25.0000	3.0000	33.0000	3.3333
270.5300	4.0000	60.0000	11.0000	1.0000	28.0000	8.5714
196.6000	7.0000	30.0000	10.0000	2.0000	23.0000	4.2857
233.0000	8.0000	40.0000	22.0000	2.0000	38.0000	1.6667
56.9500	8.0000	60.0000	1.0000	3.0000	28.0000	20.0000
1321.9000	4.0000	30.0000	5.0000	1.0000	38.0000	1.5000
7150.0000	10.0000	80.0000	24.0000	3.0000	150.0000	.3125
141.6450	16.0000	20.0000	6.0000	4.0000	23.0000	3.3333
745.0000	6.0000	10.0000	5.0000	2.0000	28.0000	.7143
992.0000	5.0000	12.0000	80.0000	1.0000	28.0000	3.0000
2323.0000	2.0000	8.0000	1.0000	1.0000	63.0000	.2222
373.2500	8.0000	30.0000	12.0000	2.0000	45.0000	1.0000
6.5600	4.0000	99.0000	4.0000	1.0000	8.0000	90.0000
258.0000	2.0000	10.0000	23.0000	1.0000	28.0000	3.3333
344.5000	6.0000	30.0000	2.0000	2.0000	38.0000	15.0000
1680.2000	8.0000	25.0000	1.0000	2.0000	28.0000	.5000
2713.1500	4.0000	32.0000	44.0000	2.0000	28.0000	.9143
1462.5000	9.0000	99.0000	12.0000	3.0000	23.0000	.7778
390.5000	8.0000	99.0000	20.0000	2.0000	33.0000	1.0000
120.4550	8.0000	10.0000	5.0000	2.0000	13.0000	10.0000
362.5500	6.0000	12.0000	15.0000	2.0000	63.0000	5.0000
1745.0000	3.0000	21.0000	53.0000	1.0000	75.0000	3.0000
700.9600	10.0000	90.0000	12.0000	2.0000	13.0000	2.5000
788.7500	4.0000	25.0000	50.0000	2.0000	75.0000	1.0000
5.4725	1.0000	30.0000	20.0000	1.0000	3.0000	10.0000
131.8500	6.0000	25.0000	7.0000	2.0000	13.0000	1.0000
1065.5000	7.0000	10.0000	60.0000	2.0000	38.0000	1.0000
341.7500	8.0000	20.0000	16.0000	2.0000	45.0000	1.0000
220.7800	4.0000	7.0000	2.0000	1.0000	28.0000	1.0000
241.5000	6.0000	30.0000	20.0000	2.0000	33.0000	4.0000
683.0000	6.0000	60.0000	5.0000	1.0000	38.0000	1.0000

APPENDIX X DEFICIENCIES OF POINT ELASTICITY FOR POLICY ANALYSIS OR FORECASTS

INTRODUCTION

Despite widespread acceptance of point elasticity among economists, attempts to formulate policy recommendations based upon the information provided reveals deficiencies. Arc elasticity is much more useful than point elasticity but the complete estimated equation provides the most policy relevant information.

PRICE ELASTICITY AND INVERSE PRICE ELASTICITY

Managers who administer prices of publicly supplied goods must consider effects on sales and revenues. As is well known, price elasticity directly indicates the sensitivity of quantity demanded to exogenous changes in price.[17] One major purpose for measuring price elasticity of demand is to find out the effect of a price change on total revenue.[18] (Samuelson) Additionally, resource economists working with non-market demands (McKean and Walsh, 1987), and agricultural economists working with farm market and farm program issues,

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[17] Exogenous meaning that either supply shifted along a stable demand curve or an administered price was changed causing quantity demanded to change.

[18] A more direct summary economic descriptor of demand is "revenue elasticity." (McKean and Miller, 1976) Revenue elasticity, which is the percentage change in total revenue for a one percent change in price is found by adding one to the price elasticity. Thus, if price elasticity of demand is $e_p = -1$, the percentage change of total revenue for a one percent increase in price is $(-1 + 1 = 0)$. For example, when price elasticity is unitary, raising price has no effect on total revenue and revenue elasticity, accordingly, is zero.

If price elasticity was zero, $e_p = 0$, the percentage change of total revenue for a one percent increase of price would be $(0 + 1 = 1)$. Thus a one percent increase of price causes total revenue to rise by one percent when demand is perfectly inelastic to price. This can only occur when the demand curve is vertical. For a vertical demand curve, revenue elasticity is unitary. For a horizontal demand curve both price elasticity and revenue elasticity are infinite $(-\infty + 1 = -\infty)$. Some examples of empirical estimates of point price elasticity and point revenue elasticity are shown in Table 1.

often need to answer policy questions concerning the effects of exogenous changes in supply on marginal net benefits and total net benefits. The *inverse* of price elasticity is the apparent relevant measure in these circumstances.[19]

POINT ELASTICITY AND ARC ELASTICITY

Point price elasticity is the demand slope times quantity divided by price, $_{POINT} = (\partial Q/\partial P)(P/Q)$. This measure is only meaningful for very small changes in the independent variable. Point elasticity, by definition, must apply to an interval that is very small since it contains a derivative which is defined in terms of a limit approaching zero for ∂P.

Forecasts based on point elasticity are not correct for large changes *even if demand has constant price elasticity*. Elasticity can be approximated (averaged) over large price change intervals by calculating "arc" elasticity. Arc elasticity can be used to forecast changes in quantity demanded over large intervals, point elasticity cannot. Arc elasticity supplies an approximate measure of point price elasticity but an exact quantity or revenue forecast *over the price interval for which it is defined*. Arc elasticity is an empirical measure which has great usefulness in predicting the effects on quantity or revenue of marginal or non-marginal price adjustments. In like manner, the reciprocal of arc price elasticity is useful for predicting effects on marginal benefits for non-marginal quantity adjustments. Conversely, point elasticity is a theoretically appealing measure which is only

---

[19] The inverse of price elasticity is known as "price flexibility."

useful for predicting the effects of marginal changes of price on quantity or revenue.[20]

When intervals are large, the base for the percentage changes of P and Q must be the average of the starting and ending values. Thus the "arc" elasticity method calculates the ratio

$$\text{ARC} = \frac{(Q_1 - Q_2)/[(0.5)(Q_1 + Q_2)]}{(P_1 - P_2)/[(0.5)(P_1 + P_2)]} = \frac{(Q_1 - Q_2)/(Q_1 + Q_2)}{(P_1 - P_2)/(P_1 + P_2)}\text{a}$$

where the denominators for the percent change of Q and percent change of P are averages using values at the end points of the intervals.

A NUMERICAL EXAMPLE

The following example is meant to show that the discrepancy between forecasts based upon point and arc elasticity constructs is nontrivial. Suppose that the demand curve is given by the equation Q = 10,000/P which can be written $Q = 10{,}000\ P^{-1}$. Total revenue which is (P)(Q) will always be \$10,000 with this demand function. Price elasticity is shown by the exponent on price ($e_p = -1$). Suppose that the initial price is \$100 per unit, then Q_1 must be 100 also since demand is $Q_1 = 10{,}000/100$. If price is increased by one percent to \$101 per unit then quantity demanded is: $Q_2 = 10{,}000/101 = 99.01$, a decline of about one percent. Thus the point elasticity formula, percentage change in quantity divided by percent change in price, provides a fairly accurate estimate if the price change is relatively small (1%).

Now suppose that a non-marginal change of price from 100 to 150 is made. The quantity demanded at the new price is: $Q_2 = 10{,}000/150 = 66.66$. The

[20] Point elasticity uses calculus rather than crude increments which contributes to its theoretical appeal but this same attribute makes it virtually useless.

decline in quantity is not 50 percent of the original amount of 100 as the point elasticity formula would indicate, i.e. quantity did not decline to 50. Using the "arc" elasticity formula one can solve for Q_2:

$$\frac{(100 - Q_2)/(100 + Q_2)}{(100 - 150)/(100 + 150)} = -1$$

$$\frac{(100 - Q_2)}{(100 + Q_2)} = (-1)(-50/250) \text{ or}$$

$$100 - Q_2 = 20 + 1/5\ Q_2$$

$$\text{or } Q_2 = 80/1.2 = 66.66.$$

The arc elasticity forecast of quantity demanded is the same as was found above by substituting p = 150 into the demand equation, $Q_2 = 10{,}000/150 = 66.66$. This example shows the large error in forecasting quantity or revenue if point rather than arc elasticity is used (66.66 true or by arc elasticity versus 50 which was estimated using point elasticity).

In this case, the point elasticity and arc elasticity are both unitary since the demand curve has a corresponding revenue curve TR = constant. Forecasts of quantity or revenue based upon the point elasticity formula are incorrect unless price changes are very small. Forecasts based upon the arc elasticity formula are exactly right (in this special case this holds for any price change interval). In general, when demand is not a rectangular hyperbola such that TR = constant, forecasts based upon arc elasticity will be most accurate for the particular price interval for which it was measured.

CONCLUSIONS

Point price elasticity is often reported in empirical demand studies. Arc elasticity is virtually never mentioned in theoretical or even in applied work. Ironically, point elasticity has almost no practical policy use since it fails to supply correct information about the quantity demanded or revenue effects of incremental (non-marginal) price adjustments. In the case of supply shifts, the inverse of point price elasticity is equally useless in forecasting the effects on price or marginal and total benefits. The most useful way to summarize demand estimates is to report the demand equation itself, or tables of "if-then" outcomes for various increments to quantity, price, or other exogenous variables. If demand is estimated with all variables transformed by logarithms (the rectangular hyperbola case described above), then reported arc elasticity is sufficient to allow accurate forecasts of price changes on quantity and revenue for any incremental change of price or the effects of quantity change on marginal and total benefits for all intervals on the demand function. Point elasticity, however, is a theoretical artifact that has little value as a summary descriptor. Hence, the only useful information contained in all the point elasticity estimates shown in table 1 is that demand is different for diverse goods. No policy-relevant information is contained in the table of point elasticities.

PRICE ELASTICITY OF DEMAND IN THE U.S.

Commodity or service	Price Elasticity	Revenue Elasticity
corn	−0.77	+0.23
beef	−0.5	+0.5
beer	−1.13	−0.13
butter	−0.7	+0.3
milk	−0.31	+0.69
cigarettes	−0.51	+0.49
shoes (sr)	−0.70	+0.3
shoes (lr)	−1.20	−0.20
newspapers (sr)	−0.10	+0.90
newspapers (lr)	−0.52	+0.48
medical insurance (sr)	−0.31	+0.69
medical insurance (lr)	−0.92	+0.08
glassware (sr)	−1.34	−0.34
glassware (lr)	−8.80	−7.80
wheat	−0.03	+0.97
hay	−0.43	+0.57
cotton	−0.12	+0.88
potatoes	−0.31	+0.69
Florida Oranges	−3.01	−2.01
California Oranges	−2.76	−1.76
all citrus fruit	−0.80	+0.20
sugar	−0.31	+0.69
short run gasoline	−0.14	+0.86
long run gasoline	−0.52	+0.48
air Transport (foreign)	−0.70	+0.30
air transport (local)	−1.10	−0.10
bus transport (local)	−0.77	+0.23
bus transport (intercity)	−0.20	+0.80
rail travel (commute) (sr)	−0.54	+0.46
rail travel (commute) (lr)	−1.70	−0.70
water residential	−0.52	+0.48
wool	−1.32	−0.32
millinery products	−3.00	−2.00
furniture	−3.04	−2.04
resid. electricity (sr)	−0.13	+0.87
resid. electricity (lr)	−1.04 to −1.90	−0.04 to −.090
commercial electricity	−1.16	−0.16
indust. electricity	−1.40	−0.40
resid. nat. gas (sr)	−0.15	+0.85
resid. nat. gas (lr)	−10.74	−9.75
school Lunches	−0.47	+0.53
legal gambling	−1.91	−0.91
restaurant meals	−1.63	−0.63
taxi service	−1.24	−0.24
alcohol	−3.63	−2.63
short run alcohol	−0.92	+0.08
housing rental	−0.8 to −1.0	+0.20 to 0.00
house Purchases	−0.7 to −1.5	+0.3 to −0.5
house loans	−0.15	+0.85
outdoor Recreation	−0.12 to −0.56	+0.88 to +0.44

deer Hunting	−0.21 to −0.87	+0.79 to +0.13
cold Water Fishing	−0.38 to −0.97	+0.63 to 0.03
spectator sports	−0.21	+0.79
Chevrolet Impala	−14.79	−13.79
Ford Galaxy	−5.16	−4.16
AMC Rebel Matador	−6.02	−5.02
all domestic autos	−1.36	−0.36

Sources: Econometric demand studies reported in the following books: Managerial Economics, Peppas and Hirschey; Fundamentals of Managerial Economics, Keating and Wilson; Managerial Economics: Analysis and Cases, Coyne; Managerial Economics and Operations Research, Mansfield ed.; Managerial Economics: Theory and Applications for Decision Making, Peppers and Bails; Managerial Economics, Maurice and Smithson; Managerial Economics: Concepts, Applications, and Cases, Wilson and Darr; Managerial Economics, McGuigan and Moyer; Intermediate Microeconomics: Theory and Applications, Kohler.

APPENDIX XI SALES PROJECTION FORTRAN PROGRAMS

```
                                                                PAGE   1
                                                                07-07-88
                                                                20:59:45

Line# Source Line          Microsoft FORTRAN Optimizing Compiler Version 4.01

c23456789112345678911234567891123456789112345678911234567891123456789112
c Iterative projections of quantity demanded (trips) (direct spending)
c (direct, indirect, and induced spending) as travel cost, fish catch,
c or income are incremented.

      PROGRAM FISHPAC
      real LTT
      dimension x(200,7)
      k=0
      STT=0.0
      SLTT=0.0
      SX1=0.0
      SX2=0.0
      SX3=0.0
      SX4=0.0
      SX5=0.0
      SX6=0.0
      SX6=0.0
      W=1.0
      U=1.0
c means of regression variables
      c=EXP(1.1854902)
      cost=544.87022
      v13=6.945
      v18=35.795
      v19=15.325
      v75=2.035
      v89=38.135
      TRIPS=6.6743256
      open(unit=4,file='bludat')
      open(unit=3,file='fish')
      do 2 i=1,200
      read(unit=4,fmt=3)(x(i,j),j=1,7)
 3    format(15x,7(f8.0,4x))
 2    continue
      do 4 i=1,200
      write(unit=3,fmt=5)(x(i,j),j=1,7)
 5    format(7f10.4)
 4    continue
 10   continue
      STT=0.0
      SLTT=0.0
      SX1=0.0
      SX2=0.0
      SX3=0.0
      SX4=0.0
```

```
      SX5=0.0
      SX6=0.0
      SWW=0.0
      do 6 i=1,200
      LTT=1.1854902-(0.7301854*LOG(x(i,1)))+(0.6498406*LOG(x(i,2)))
     1+(0.5504286*LOG(x(i,3)))+(0.3277049*LOG(x(i,6)))
      LTT=EXP(LTT)
      WW=W*x(i,1)
      TT=c*(WW**(-0.7301854))*(x(i,2)**.6498406)*(x(i,3)**0.5504286)
     1*(x(i,6)**0.3277049)
      STT=STT+TT
      SLTT=SLTT+LTT
```



```
      SX1=SX1+LOG(x(i,1))
      SX2=SX2+LOG(x(i,2))
      SX3=SX3+LOG(x(i,3))
      SX4=SX4+x(i,4)
      SX6=SX6+LOG(x(i,6))
      SX7=SX7+LOG(x(i,7))
      SWW=SWW+WW
c     write(*,fmt=8)TT
  8   format(f20.10)
  6   continue
      STTA=STT/200.0
      SWWA=SWW/200.0
      SLTTA=SLTT/200.0
      SX1A=SX1/200.0
      SX2A=SX2/200.0
      SX3A=SX3/200.0
      SX4A=SX4/200.0
      SX6A=SX6/200.0
      SX7A=SX7/200.0
      TR=765355.685*STTA
      XJOB=24.825*STTA
      write(unit=3,fmt=7)STTA,SWWA,TR,XJOB
  7   format(4f20.2)
      W=W+.05*U
      if(k.gt.2)go to 12
      if(W.gt.3.0)go to 11
      go to 10
 11   continue
      k=k+1
      W=1.0
      U=-1.0
      go to 10
 12   continue
      stop
      end
```

main Local Symbols

Name	Class	Type	Size	Offset
V19	local	REAL*4	4	0002
SWW	local	REAL*4	4	0006
SWWA.	local	REAL*4	4	000a
V75	local	REAL*4	4	000e
C	local	REAL*4	4	0012
V89	local	REAL*4	4	0016
SLTT.	local	REAL*4	4	001a
SLTTA	local	REAL*4	4	001e
I	local	INTEGER*4	4	0022
J	local	INTEGER*4	4	0026
K	local	INTEGER*4	4	002a
TRIPS	local	REAL*4	4	002e
U	local	REAL*4	4	0032
W	local	REAL*4	4	0036
X	local	REAL*4	5600	003a
SX1	local	REAL*4	4	161a
SX1A.	local	REAL*4	4	161e

main Local Symbols

Name	Class	Type	Size	Offset
SX2	local	REAL*4	4	1622
SX2A.	local	REAL*4	4	1626
SX3	local	REAL*4	4	162a
SX3A.	local	REAL*4	4	162e
SX4	local	REAL*4	4	1632
SX4A.	local	REAL*4	4	1636
SX5	local	REAL*4	4	163a
SX6	local	REAL*4	4	163e
SX6A.	local	REAL*4	4	1642
SX7	local	REAL*4	4	1646
SX7A.	local	REAL*4	4	164a
TR.	local	REAL*4	4	164e
TT.	local	REAL*4	4	1652
WW.	local	REAL*4	4	1656
XJOB.	local	REAL*4	4	165a
LTT	local	REAL*4	4	165e
COST.	local	REAL*4	4	1662
V13	local	REAL*4	4	1666
STT	local	REAL*4	4	166a
STTA.	local	REAL*4	4	166e
V18	local	REAL*4	4	1672

```
Global Symbols

Name                      Class   Type              Size   Offset

main. . . . . . . . . . . FSUBRT  ***                ***    0000

Code size = 0515 (1301)
Data size = 009a (154)
Bss size  = 1676 (5750)

No errors detected
```

```
                                                              PAGE   1
                                                              07-07-88
                                                              21:33:22

 Line#  Source Line          Microsoft FORTRAN Optimizing Compiler Version 4.01

c23456789112345678911234567891123456789112345678911234567891123456789112
c Iterative projections of quantity demanded (trips) (direct spending)
c (direct, indirect, and induced spending) as travel cost, fish catch,
c or income are incremented.

      PROGRAM FISHPAC
      real LTT
      dimension x(200,7)
      k=0
      STT=0.0
      SLTT=0.0
      SX1=0.0
      SX2=0.0
      SX3=0.0
      SX4=0.0
      SX5=0.0
      SX6=0.0
      SX6=0.0
      W=1.0
      U=1.0
c means of regression variables
      c=EXP(1.1854902)
      cost=544.87022
      v13=6.945
      v18=35.795
      v19=15.325
      v75=2.035
      v89=38.135
      TRIPS=6.6743256
      open(unit=4,file='bludat')
      open(unit=3,file='fishb')
      do 2 i=1,200
      read(unit=4,fmt=3)(x(i,j),j=1,7)
```

```
 3    format(15x,7(f8.0,4x))
 2    continue
      do 4 i=1,200
      write(unit=3,fmt=5)(x(i,j),j=1,7)
 5    format(7f10.4)
 4    continue
 10   continue
      STT=0.0
      SLTT=0.0
      SX1=0.0
      SX2=0.0
      SX3=0.0
      SX4=0.0
      SX5=0.0
      SX6=0.0
      SWW=0.0
      do 6 i=1,200
      LTT=1.1854902-(0.7301854*LOG(x(i,1)))+(0.6498406*LOG(x(i,2)))
     1+(0.5504286*LOG(x(i,3)))+(0.3277049*LOG(x(i,6)))
      LTT=EXP(LTT)
      WW=W*x(i,2)
      TT=c*(x(i,1)**(-0.7301854))*(WW**.6498406)*(x(i,3)**0.5504286)
     1*(x(i,6)**0.3277049)
      STT=STT+TT
      SLTT=SLTT+LTT
```

PAGE 2
07-07-88
21:33:22

Line# Source Line Microsoft FORTRAN Optimizing Compiler Version 4.01

```
      SX1=SX1+(x(i,1))
      SX2=SX2+(x(i,2))
      SX3=SX3+(x(i,3))
      SX4=SX4+x(i,4)
      SX6=SX6+(x(i,6))
      SX7=SX7+(x(i,7))
      SWW=SWW+WW
c     write(*,fmt=8)TT
 8    format(f20.10)
 6    continue
      STTA=STT/200.0
      SWWA=SWW/200.0
      SLTTA=SLTT/200.0
      SX1A=SX1/200.0
      SX2A=SX2/200.0
      SX3A=SX3/200.0
      SX4A=SX4/200.0
      SX6A=SX6/200.0
      SX7A=SX7/200.0
      TR=765355.685*STTA
      XJOB=24.825*STTA
      write(unit=3,fmt=7)STTA,SWWA,TR,XJOB
 7    format(4f20.2)
```

```
      W=W+.05*U
      if(k.gt.2)go to 12
      if(W.gt.3.0)go to 11
      go to 10
11    continue
      k=k+1
      W=1.0
      U=-1.0
      go to 10
12    continue
      stop
      end
```

main Local Symbols

Name	Class	Type	Size	Offset
V19	local	REAL*4	4	0002
SWW	local	REAL*4	4	0006
SWWA.	local	REAL*4	4	000a
V75	local	REAL*4	4	000e
C	local	REAL*4	4	0012
V89	local	REAL*4	4	0016
SLTT.	local	REAL*4	4	001a
SLTTA	local	REAL*4	4	001e
I	local	INTEGER*4	4	0022
J	local	INTEGER*4	4	0026
K	local	INTEGER*4	4	002a
TRIPS	local	REAL*4	4	002e
U	local	REAL*4	4	0032
W	local	REAL*4	4	0036
X	local	REAL*4	5600	003a
SX1	local	REAL*4	4	161a
SX1A.	local	REAL*4	4	161e

main Local Symbols

Name	Class	Type	Size	Offset
SX2	local	REAL*4	4	1622
SX2A.	local	REAL*4	4	1626
SX3	local	REAL*4	4	162a
SX3A.	local	REAL*4	4	162e
SX4	local	REAL*4	4	1632
SX4A.	local	REAL*4	4	1636
SX5	local	REAL*4	4	163a
SX6	local	REAL*4	4	163e

```
SX6A. . . . . . . . . . . . local   REAL*4           4     1642
SX7 . . . . . . . . . . . . local   REAL*4           4     1646
SX7A. . . . . . . . . . . . local   REAL*4           4     164a
TR. . . . . . . . . . . . . local   REAL*4           4     164e
TT. . . . . . . . . . . . . local   REAL*4           4     1652
WW. . . . . . . . . . . . . local   REAL*4           4     1656
XJOB. . . . . . . . . . . . local   REAL*4           4     165a
LTT . . . . . . . . . . . . local   REAL*4           4     165e
COST. . . . . . . . . . . . local   REAL*4           4     1662
V13 . . . . . . . . . . . . local   REAL*4           4     1666
STT . . . . . . . . . . . . local   REAL*4           4     166a
STTA. . . . . . . . . . . . local   REAL*4           4     166e
V18 . . . . . . . . . . . . local   REAL*4           4     1672


Global Symbols

Name                        Class   Type             Size  Offset

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Code size = 04ca (1226)
Data size = 009c (156)
Bss size  = 1676 (5750)

No errors detected
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