ESTIMATING THE IMPACT OF A LARGE WATER-BASED NATURAL RESOURCE PROJECT ON THE LOCAL ECONOMY BY MEANS OF A SAM

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PROBLEM STATEMENT

Large federal water-based natural resource projects in eastern Oklahoma provide significant national benefits through navigation, hydroelectric power, flood control, recreation, municipal and industrial water supply, and fish and wildlife habitat. The national benefits are adequately quantified and evaluated in the master plan for each project. What is not adequately evaluated are the local benefits. Because these projects are frequently very large relative to the local economy and because federal guidelines are increasingly shifting portions of these project costs to local governments and project participants, it is becoming important to estimate local impacts and benefits.

This research tests a methodology for estimating the impacts and benefits from one project in eastern Oklahoma on the local (county) economy. Do most of the benefits of such projects flow out of the region? The project may have significant national benefits but few local benefits. Is the project well integrated with the rest of the local economy? How much local income and employment does the project generate? What is the capacity of the project to produce new growth and economic development for the local area? Does the (federal) project represent a significant proportion of the local resource base and thus represent a potential loss of tax revenue to local governmental units? Does the project generate benefits to a limited number of area residents, or are the benefits broadly distributed? To answer these questions and to better understand the integration of a large water-based natural resource project with the rest of the local economy requires an extensive area accounting methodology. A social accounting matrix (SAM) represents such an accounting procedure. This type of research is made possible because of (1) advances in impact and benefit analysis methodology represented by the regional SAM and (2) availability of extensive local area data bases for purposes of estimating SAMs.

OBJECTIVES

The overall purpose of this research is to quantify the impacts of the Broken Bow Lake project on the local economy of McCurtain County in southeastern Oklahoma. The specific objectives include: (1) estimation of the structure of the McCurtain County economy,

including the Broken Bow Lake project, by means of a SAM; (2) utilization of the SAM for estimation of local (county) impacts and distribution of those impacts due to the Broken Bow Lake project; and (3) evaluation of the SAM methodology as applied to objectives (1) and (2) for purposes of estimating and evaluating local impacts of large water-based projects.

The principal benefit of this research is the testing of a research methodology on a limited scale before application to larger research efforts. Once estimated, the SAM is used to evaluate the impact of Broken Bow Lake on the McCurtain County economy. Impacts are measured in terms of economic sector output; region value added (including employment compensation); region household income; factor payments, including imputed factor payments to the resource project (Broken Bow Lake); commodity supplies, including nonmarket commodities (recreation, flood control, and fish and wildlife habitat); and region exports. The SAM is also used to evaluate public policy related to the federal project, including increases or decreases in any of the outputs of the project.

A principal outcome of this research is the estimation of the impact and importance of the federal Broken Bow Lake project on the economy of McCurtain County.

METHODOLOGY

The research procedure is development and estimation of a SAM for McCurtain County. The SAM is an array of accounts that describe the interdependent economic structure of the region, including the activities of the Broken Bow Lake project. Activities of the project include recreation, hydroelectric power, flood control, fish and wildlife habitat, and municipal and industrial water. The accounts in the SAM are grouped into six major categories: (1) activity account; (2) commodity account; (3) factor payment account; (4) institution (household) account; (5) saving/investment; and (6) rest of world. Accounts 5 and 6 are exogenous accounts, while the other accounts are endogenous.

The accounts for the SAM form a square matrix where each account is represented by a row and a column. Row accounts show sources of revenue or receipts from all other accounts. Column accounts show expenditures or payments to all other accounts. The individual accounts describe the economic structure of the county and, to a large degree, are assumed endogenously determined. However, certain row and column accounts (variables) can be identified as exogenously associated with the Broken Bow Lake project, and thus, their effects determine the remaining endogenous row and column variables. For example,

recreation expenditures can be associated with production activities, factor payments, household incomes, and government revenues.

Structure of the SAM is expressed by a system of linear matrix equations. The system is identified by a set of $Z_1, \bullet\bullet\bullet, Z_5$ vector variables and a set of A_{ij} coefficient matrices. The A_{ij}s are linear expenditure coefficients that determine direct dependence between the vector variables. Direct and indirect dependence can be determined between a subset of variables identified to be endogenously determined and the remaining subset of exogenously determined variables. This relationship is specified by forming the (I-A) matrix for the endogenous variables and obtaining the $(I-A)^{-1}$. The resulting a_{ij} coefficients are the direct and indirect interdependence coefficients. Their interpretation is that the a_{ij} is the direct and indirect change associated with the ith endogenous variable for each unit change in the jth exogenous variable.

The sources of data for estimating the inter- and intra- account flows and coefficient matrices include IMPLAN, the master plan for Broken Bow Lake, and other secondary data. The extensive local data base made available through IMPLAN and applicable to social accounting is discussed in Alward, Davis, Despotakis, and Lofting (1985). The aggregated nature of the SAM facilitates estimation procedures, but at the same time allows integration of the large natural resource project into the economy of the county.

Social accounting methodology was introduced internationally by Richard Stone (1961) with many additional contributing authors, including Pyatt and Round (1985). Regional applications have been made by Stone (1961); Bell, Hazell, and Slade (1982); and Rose, Stevens, and Davis (1988). Sector (agriculture) applications include Adelman and Robinson (1986) and Suprapto (1988). Applications to natural resource projects include Rose, Stevens, and Davis (1988) and Bell, Hazell, and Slade (1982).

Estimation and distribution of recreation benefits from water-based natural resource projects are contained in Schreiner and Cannock (1989). In that study, the authors show recreation development contributing to national welfare, Oklahoma (state) welfare, and recreationist welfare. What is lacking is an accounting of benefits to local economies and incorporating other outputs from water-based natural resource projects, including hydroelectric power, flood control, fish and wildlife habitat, and municipal and industrial water. The following section describes the process of integrating the Broken Bow Lake project activities into the McCurtain County SAM.

ESTIMATION OF THE McCURTAIN COUNTY SAM

First, the aggregate SAM was estimated for McCurtain County using data from IMPLAN. Second, the aggregate SAM was expanded (disaggregated) to include six activities, six commodity groups, four factor payments, and three household income levels. The corresponding interdependence coefficients were determined using the $(I-A)^{-1}$ matrix. The disaggregated SAM included the effects of the Broken Bow Lake project but did not identify the contributing components. This SAM is not presented here but can be found in Uwakonye (1990).

Third, the effects of Broken Bow Lake were identified by expanding the disaggregated McCurtain County SAM to include five additional activities, five additional commodities, and one additional factor payment. A new set of interdependence coefficients was estimated and the effects of Broken Bow Lake on the local McCurtain County economy were determined.

The Aggregate SAM

The initial SAM is presented in a highly aggregated form containing five rows and columns plus the row of total outlay and the column of total output. The five row and column accounts are shown in Table I (p. 20) as activities, commodities, factor payments, households, and aggregated exogenous accounts. The estimated aggregate SAM uses data from IMPLAN (Alward, et al. 1989) and other secondary sources.

As with all social accounting matrices, the columns represent expenditures, and the rows represent receipts. For example, the activities account had a total expenditure or outlay of $645,393,000 in 1982. Of this amount, $120,440,000 went for the purchase of commodities within the county. Factor payments accounted for $257,506,000, and expenditures on imports, government payments, and other exogenous payments accounted for $267,447,000.

The row accounts record the sources of receipts or incomes. For example, households received $185,639,000 from factor payments (primarily labor) and $82,010,000 as government transfers and payments from outside the region. Total household income for McCurtain County was $267,649,000.

Commodity output was $652,591,000 and was made up of outputs of activities equal to $645,266,000 and government stocks and other miscellaneous sources equal to $8,325,000. Commodities were distributed to activities as intermediate inputs, to households as personal consumption expenditures, and to exogenous accounts, including government purchases, capital formation, and exports.

Factor receipts show receipts from activities, households, and government employment. Factor payments show expenditures to McCurtain County households and to exogenous accounts including governments, retained earnings in the savings/investment account, and payment for resources owned by residents outside of the county.

The disaggregated SAM activities were separated into six sectors: agriculture, forestry, mining and manufacturing, transportation, trade, and services. Commodities were classified into six categories using the same descriptors used with activities. Factor payments were separated into four categories: employee compensation, proprietary income, property income, and indirect business tax. Households were separated into three categories, low, medium, and high income households. The three income groups for the households account are defined by IMPLAN as follows: low income is less than $10,000 per year (in 1982 dollars); medium income is $10,000 to $30,000 per year; and high income is over $30,000 per year. This allows analysis of the income distribution effects from exogenous developments in McCurtain County.

The disaggregated SAM for McCurtain County includes the effects of the Broken Bow Lake project, but these effects are not distinguished. The next section identifies these effects and incorporates results of the Broken Bow Lake project into the activity account, the commodity account, and the factor payment account.

The Broken Bow Lake Project

The final disaggregation of the McCurtain County SAM identifies the Broken Bow Lake project purposes as separate activities and commodities. The project purposes are recreation, hydroelectric power, flood, and municipal and industrial water supply. The project purpose of fish and wildlife habitat was excluded because of minor importance in the current project operations. Included, however, is the U.S. Army Corps of Engineers activity that provides the basis for supplying the other four project activities (purposes). In addition, Broken Bow Lake is added to the factor payments account to further identify factor returns to

the fixed resource. Each of these additions to the McCurtain County SAM are explained with the results presented in Table II (p. 21).

Recreation. A total of 1,033,000 visitor days of recreation were recorded at Broken Bow Lake for 1982. Project personnel estimate that approximately 95 percent of these visitor days represent people residing outside of McCurtain County and that 5 percent represent McCurtain County residents. These percentages were used to represent recreation exports and local consumption, respectively.

Using results of the McClellan-Kerr Arkansas River Navigation System (Badger, et al. 1977), the average expenditure per recreation visitor day was $5.10 in 1974. When expressed in 1982 prices, this expenditure is equal to $9.98. This visitor day expenditure was assumed to be representative for the Broken Bow Lake expenditure. Thus the aggregate expenditure for 1,033,000 visitor days was estimated at $10,309,340.

The same study (Badger, et al. 1977) was used to distribute the expenditures by commodity groupings. Data from IMPLAN were used to estimate the proportions of expenditures coming from domestic (county) production and imports. The per dollar distribution of recreation expenditures by commodity grouping and the distribution by local production and imports is the following:

Commodity	Expenditure Per Dollar (producers value)	Import Proportion (percent)	Local Expenditure Per Dollar	Import Expenditure Per Dollar
(1) Agriculture	0.0138	0.2837	0.0099	0.0039
(2) Forestry	0.0093	0.3124	0.0064	0.0029
(3) Min. & Manuf.	0.4235	0.2583	0.3141	0.1094
(4) Transportation	0.0378	0.6458	0.0134	0.0244
(5) Trade	0.3337	0.2966	0.2347	0.0990
(6) Services	0.1242	0.3094	0.0858	0.0384
Non-competitive imports	0.0051	0.0051	0	0
Government	0.0526	0	0.0526	0
Total	1.000	0.2780	0.7220	0.2780

Applying these coefficients to the aggregate recreation expenditures of McCurtain County residents and to the aggregate recreation expenditures by those recreationists coming from outside McCurtain County yields the following results for households and exports as included in Table II:

Commodity	Households ($) Local Production	Households ($) Imports	Exports ($) Local Production	Exports ($) Imports
(1) Agriculture	5,103	2,010	96,959	38,196
(2) Forestry	3,300	1,495	62,681	28,402
(3) Min. & Manuf.	161,908	56,392	3,076,256	1,071,450
(4) Transportation	6,907	12,577	131,238	238,971
(5) Trade	120,980	51,031	2,298,622	969,593
(6) Services	44,227	19,794	840,314	376,085
Non-competitive imports	2,629	--	49,949	--
Government	27,114	--	515,158	--
Total	372,167	143,300	7,071,176	2,722,697

One final allocation was made to distribute aggregate household recreation expenditures to the three household income levels consistent with IMPLAN. These household recreation expenditures were allocated in proportion to aggregate household expenditures as given by IMPLAN. This assumes no income effect or a zero income elasticity of demand for water-based recreation. Although the McClellan-Kerr study of recreation demand (Schreiner, et al. 1985) indicated a positive income elasticity of demand, the regression coefficients for the income variable were seldom statistically different from zero. The distribution of locally produced recreation expenditures by household income level are the following:

Commodity	Household Recreation Expenditures ($) Low Income	Medium Income	High Income	Total
(1) Agriculture	1,602	2,618	883	5,103
(2) Forestry	1,036	1,693	571	3,300
(3) Min. & Manuf.	50,839	83,059	28,010	161,908
(4) Transportation	2,169	3,543	1,195	6,907
(5) Trade	37,988	62,063	20,930	120,980
(6) Services	13,887	22,688	7,651	44,227
Imports & Government	54,335	88,770	28,936	173,042
Total	161,857	264,434	89,176	515,467
Visitor Days	16,218	26,497	8,935	51,650

The above data are used in the following section to identify McCurtain County exogenous changes associated with Broken Bow Lake.

Recreation is identified in the SAM of Table II as an activity and as a commodity. The activity output is defined in visitor days and produces 1,033,000 visitor days for delivery to the commodity account. The recreation activity produces no other commodities.

The recreation activity has expenditures (column account) of $11,000 to the U. S. Army Corps of Engineers' commodity account and $2,314,000 expenditures to the Broken Bow Lake factor payment account. These transactions are discussed later.

The recreation commodity account shows deliveries (receipts) to the household accounts and to the exogenous account in the form of exports. That is, low income households within McCurtain County consume about 16,000 visitor days, middle income households consume about 27,000 visitor days, high income households consumed about 9,000 visitor days, and 981,000 visitor days are consumed by outside residents coming to the lake.

Hydroelectric Power. A total of 190,558,400 kilowatt hours of electricity was generated at the Broken Bow Lake in 1982. Of this amount, project personnel estimated that approximately 95 percent was consumed outside of McCurtain County and 5 percent was consumed within McCurtain County. The wholesale value of electricity was approximately three cents per kwh; thus, the value of generated electricity was $5,716,752.

Electricity consumption is part of the utilities commodity group that is classified under services in the McCurtain County SAM. It was assumed that electricity consumed within McCurtain County from the hydroelectric power source is completely substitutable for an equal amount of consumption of services (electric utilities) by households. Therefore, an equivalent amount of consumption of services is separated out and identified with the hydroelectric activity in the McCurtain County SAM of Table II. The following allocations of hydroelectric power were made:

	Hydroelectric Power	
	($)	KWH (1,000)
Households		
Low Income	89,753	2,992
Medium Income	146,635	4,888
High Income	49,450	1,648
Subtotal	285,838	9,528
Exports	5,430,914	181,030
Total	5,716,752	190,558

Allocation to household income class size is proportional to aggregate household expenditure as given by IMPLAN.

Expenditures of the hydroelectric power activity include $170,000 to the U.S. Army Corps of Engineers and $5,717,000 to Broken Bow Lake factor payment account. These transactions are discussed later.

The hydroelectric power commodity account shows distributions (receipts) to the three household accounts and the exogenous (exports) account according to the kwh distributions given above.

Flood Control. Benefits from flood control were estimated by U.S. Army Corps personnel at $1,870,000 for 1982. Because flood control benefits represent losses avoided due to prevention of flooding, it was assumed that the benefits represent net additions to income. Project personnel indicated that all flood control benefits accrued in agriculture and that approximately 75 percent of the benefits were within McCurtain County and 25 percent were outside of the county.

Data from Rose, et al. (1988) indicate that income from agriculture accrued to households in the following income classes:

Household Income Class Size	Household Income ($)	Distribution of Agricultural Income
Low	< 10,0000	0.255
Medium	10,000 - 30,000	0.522
High	> 30,000	0.223
		1.000

The same percentage distribution of agricultural income was applied to net benefits from flood control for McCurtain County households:

Household Income Class Size	Distribution of Agricultural Income	Flood Control Benefits ($)
Low	0.255	357,638
Medium	0.522	732,105
High	0.223	312,758
Total	1.000	1,402,501

The remaining flood control benefits of $467,500 accrued to households outside of McCurtain County.

The flood control activity in the SAM (Table II) has an output level of $1,870,000, and all flows to the flood control commodity account. Expenditures of the flood control activity were $6,000 for the U.S. Army Corps of Engineers and $1,870,000 for the Broken Bow Lake factor account.

The flood control commodity account shows distribution to households and to the exogenous (exports) account according to the distribution of net benefits presented above.

Municipal and Industrial Water. Only minor usage of water from Broken Bow Lake occurred in 1982 for municipal and industrial purposes. Three million gallons of water per day were used with a value of 8 cents per 1,000 gallons. The annual volume of water used was 1.095 billion gallons and the annual value of water used was $87,600. All of the water was used within McCurtain County.

Municipal and industrial water is classified as a utility and included in the services activity and commodity accounts for the McCurtain County SAM. Therefore, this project purpose is substitutable for an equivalent output of the services activity account.

Distribution of this commodity output was assumed to go directly to households and in proportion to household aggregate expenditures. This assumes no income effect on water consumption by households. The distribution is the following:

Household Income Class	Water Use Distribution	
	mg	($)
Low	344	27,506
Medium	562	44,939
High	189	15,155
Total	1,095	87,600

Expenditures of the municipal and industrial water supply activity were $10,000 for the U.S. Army Corps of Engineers and $88,000 for the Broken Bow Lake factor account.

U.S. Army Corps of Engineers. The U.S. Army Corps of Engineers' Broken Bow Lake project receives an annual appropriation from the federal budget. The operating budget for fiscal year 1982 was $197,000.

The U.S. Army Corps of Engineers is included as an activity of the McCurtain County SAM (Table II) to show that it provides a level of services (shown as the U.S. Army Corps of Engineers commodity), which in turn is used as input for the various project purposes. The level of activity output is shown to be equal to the U.S. Army Corps of Engineers' budget, and the entire output of the activity is allocated to the commodity of U.S. Army Corps of Engineers' services. Therefore, the transaction between U.S. Army Corps of Engineers activity and U.S. Army Corps of Engineers commodity is $197,000.

Expenditures of the U.S. Army Corps of Engineers activity is distributed to commodity and factor purchases according to items of cost contained in the operating budget. The following allocations were made ($1,000):

Cost Item	Commodity Account (3) Min.&Manuf.	(4) Transp.	(6) Services	Factor Account (1) Employ. Comp.	Total
Direct labor				115.0	115.0
Misc.	3.8				3.8
Plant & equip.	9.0				9.0
Water & supply	16.3				16.3
Travel		1.0			1.0
Rent & util.			1.3		1.3
Contracts:					
1. Cleaning			15.3		15.3
2. Mowing			10.8		10.8
3. Janitorial			5.1		5.1
4. Law enforc.			6.4		6.4
5. Misc.			13.0		13.0
Total	29.1	1.0	51.9	115.0	197.0
Import proportion (%)	25.8	64.5	38.9	0	14.4
Imports	7.5	0.6	20.2	--	28.3
Local production	21.6	0.4	31.7	115.0	168.7

This distribution is shown in the activity column for U.S. Army Corps of Engineers (Table II, p. 19). Because the U.S. Army Corps of Engineers would be included in the government account for IMPLAN, these expenditures were taken out of the exogenous column account as originally allocated.

Allocation of the U.S. Army Corps of Engineers commodity account is shown as proportional to the annual operation and maintenance (O&M) costs given in the original evaluation of the project. That is, the O&M costs for hydropower were estimated at 0.8652 of total O&M costs; thus, $170,000 of the 1982 budget of $197,000 was allocated to the hydroelectric power activity from the U.S. Army Corps of Engineers commodity output. Similar allocations were made for the other project purposes.

Broken Bow Lake Factor Payments. Broken Bow Lake represents a fixed resource for McCurtain County. Returns to this resource arise because of the activity outputs (purposes) of the project. Outputs of hydroelectric power and municipal and industrial water activities were valued at market prices. Output of the flood control activity is equal to losses prevented and is assumed to be equal to net income. Value of output of recreation is on the basis of a net benefit per visitor day. This is a nonmarket transaction and is estimated using information from recreation studies.

Because the U.S. Army Corps of Engineers' budget is from the National Treasury, and thus, not an allocated cost against the Broken Bow Lake project activities, the entire value of project activities can be attributed to the Broken Bow Lake factor account. For this reason,

the market value of hydroelectric power of $5,717,000 and the market value of municipal and industrial water of $88,000 were allocated as factor payments to Broken Bow Lake. This does not mean that there is an actual transaction of this amount to Broken Bow Lake, but rather it represents a return to society because of the public project. Some payments to the National Treasury do actually occur because of contractual arrangements made for power generation and municipal water.

Visitor day net benefits for the Broken Bow Lake recreation activity were estimated using data from Cannock (1988). Average net benefits per visitor day for lakes Tenkiller and Fort Gibson were estimated by Cannock (1988) at $1.25 in 1975 prices. In 1982 prices the estimated benefit is $2.24. Assuming equal benefits per visitor day existed for Broken Bow Lake as existed for Lakes Tenkiller and Fort Gibson, the estimated net benefits for 1,033,000 visitor days are equal to $2,313,920. This was the value recorded as a payment to the Broken Bow Lake factor account.

Because these benefits accrued to recreationists (consumer surplus), the distribution of these benefits were assumed to equal the distribution of visitor days. Thus, the distribution would be the following:

	Recreation Visitor Day Benefits ($)
Households	
Low Income	36,329
Medium Income	59,352
High Income	20,015
Subtotal	115,696
Exogenous (exports)	2,198,224
Total	2,313,920

A summary of the distributions of Broken Bow Lake factor payments by project purpose to the household accounts and the exogenous account is the following ($1,000):

	Recreation	Hydroelectric Power	Flood Control	Mun.& Ind. Water	Total
Households					
Low income	36		(358)		36
Medium income	60		(732)		60
High income	20		(313)		20
Subtotal	116		(1,403)		116
Exogenous (Gov't, ROW, etc.)	2,198	5,717	1,870	88	9,873
Total	2,314	5,717	1,870	88	9,989

The results above should be interpreted carefully because they do not necessarily measure actual transactions that occurred within the McCurtain County economy. The total Broken Bow Lake factor payments were estimated to be $9,989,000 and included both market and nonmarket transactions. Recreation net benefits of $2,314,000 are a nonmarket transaction and were distributed among households within McCurtain County and households outside of McCurtain County. The distributions to households were added to household incomes as presented in the aggregate SAM Table I; thus, the total households rows indicate market and nonmarket values.

Hydroelectric power benefits were valued at market prices for electricity; thus, they represent opportunity costs of electricity purchased from alternative sources. Part of the value is captured through contracts with electric cooperatives. Flood control represents losses prevented. The data above indicate which households received the losses prevented, but these data were not added to the household rows because the incomes were already valued through other factors and included in county incomes. The figures are shown in ( ) to avoid doubling counting. Municipal and industrial water was valued at market prices; thus, it was handled in the same way as hydroelectric power.

The SAM Interdependence Coefficients

Direct requirements coefficients for the SAM of Table II were computed by dividing each endogenous column vector of inputs by the same column total. The results form the direct requirements coefficient matrix or the A matrix. Subtracting this matrix from the identity matrix I and inverting yields the interdependence coefficients (a_{ij}'s) or the $(I-A)^{-1}$ multiplier matrix. These results are in Table III (p. 24).

The interdependence coefficients for the McCurtain County SAM with Broken Bow Lake identified have the following interpretation. For a $1,000 change in the agriculture activity, the direct and indirect change, or total change, in agriculture is $1,077 (Activity column 1 and Activity row 1). For the same change in Agriculture, the direct and indirect change in the Services activity is $100 (Activity column 1 and Activity row 6).

The demand for agricultural commodities from McCurtain County will change by $76.70, mining and manufacturing commodities by $8.20, and services commodities by $104.60. Employee compensation will change by $92.80, proprietary income by $70.10, property income by $55, indirect business tax by $22.40, and returns to Broken Bow Lake by $1.10. Income to low income households (in the aggregate) will change by $47.60, medium income

households by $77.50, and high income households by $25.70. The total McCurtain County income effect will be the sum of the households effect, or $150.80.

Exogenous changes in the activities account, however, have little meaning other than to show the interdependence of the production activities with the rest of the economy. The exogenous account for activities in Table II contains only minor entries indicating that the importance of the activities account is in the deliveries to the commodities account.

Interpretation of the agricultural commodities has more significance. For a $1,000 change in agricultural commodities, presumably for export out of the county, the total change in the agricultural activity will be $1,071, for mining and manufacturing activity $10.50, and for services activity $99.70. Similarly, the total change in agricultural commodities will be $1,076 of which $1,000 will be exported and $76 will be used by other endogenous accounts in McCurtain County.

Total demand for other commodities is interpreted from the interdependence coefficients of the agricultural commodities column with the rows for the commodities account. Similarly, the interdependence coefficients for the agricultural commodities column and the factor payments rows and the households rows give the respective changes in factor payments and household incomes.

The interdependence coefficients for the Broken Bow Lake activities and commodities have similar interpretations. However, some of the accounts were defined in physical units rather than monetary units. For example, for a 1,000 change in visitor days of the recreation activity, the mining and manufacturing activity will change by $2.20, the services activity will change by $7.50, the hydroelectric power activity will change by 1 kwh, and the U.S. Army Corps of Engineers activity will change by $10.70. Employee compensation in the factor accounts will change by $2.60, and the Broken Bow Lake factor account will change by $2,240. Household income in the aggregate will change by $28.80.

The interdependence coefficients form the basis for estimating the impact Broken Bow Lake has on the economy of McCurtain County. The next section presents the impact results of Broken Bow Lake on McCurtain County.

ESTIMATED IMPACTS OF BROKEN BOW LAKE
ON McCURTAIN COUNTY

The impacts of Broken Bow Lake on the McCurtain County economy are estimated in two parts. The first part is the impact of the exogenous changes in the commodities account associated with the functions of Broken Bow Lake. The second part is the estimated impact of the Broken Bow Lake on the endogenous accounts, such as the effects of McCurtain County residents participating in recreation activities. Finally, the sum of the impacts of Broken Bow Lake on household income is compared with total household income for the county.

Exogenous Impacts of Broken Bow Lake

The exogenous commodity accounts associated with functions of the Broken Bow Lake are summarized below and are the results of data presented earlier:

		Exogenous Commodity Accounts (Exports) Associated with Broken Bow Lake			
	Commodity	Recreation	Hydroelectric	Flood	Total
(1)	Agriculture ($)	96,959			96,959
(2)	Forestry ($)	62,681			62,681
(3)	Min. & Manuf. ($)	3,076,256			3,076,256
(4)	Transportation ($)	131,238			131,238
(5)	Trade ($)	2,298,622			2,298,622
(6)	Services ($)	840,314			840,314
(7)	Recreation (VD)	981,000			981,000
(8)	Hydroelectric Power (1,000 kwh)		181,030		181,030
(9)	Flood Control ($)			467,500	467,500

The impact of Broken Bow Lake can now be estimated for any of the endogenous accounts by multiplying the above commodity accounts by the appropriate interdependence coefficients. The impact of the Broken Bow Lake exogenous commodity accounts on the household income accounts is shown in Table IV (p. 27). Income for low income households associated with the exogenous commodity account for Broken Bow Lake (recreation expenditures, hydroelectric power, and flood control) is estimated at $789,000. Income for medium income households is $1,288,000 and income for high income households is $430,000. Total McCurtain County household income associated with the exogenous commodity account is $2,507,000.

Impact of the Broken Bow Lake exogenous commodity accounts on the Broken Bow Lake factor payments account is presented in Table V (p. 28). This represents an estimate of the national benefits of the exogenous components of the Broken Bow Lake project. Benefits associated with recreation is equal to $2,198,000, hydroelectric power is equal to $5,431,000, and flood control is equal to $468,000. Total national benefits, including indirect benefits through other sectors, are equal to $8,114,000.

Endogenous Impacts of Broken Bow Lake

The endogenous effects of Broken Bow Lake are associated with household consumption of commodities produced by the project purposes and by increased household incomes from losses avoided through flood control. The following represents the endogenous effects:

Endogenous Commodity Accounts (Households) Associated with Broken Bow Lake

Commodities	Recreation	Hydroelectric Power	Flood Control	Municipal Water	Total
(1) Agriculture ($)	5,103				5,103
(2) Forestry ($)	3,300				3,300
(3) Min. & Manuf. ($)	161,908				161,908
(4) Transportation ($)	6,907				6,907
(5) Trade ($)	120,980				120,980
(6) Services ($)	44,227				44,227
(7) Recreation (VD)	52,000				52,000
(8) Hydroelectric Power (1,000 kwh)		9,528			9,528
(9) Flood Control ($)			1,402,501		1,402,501
(10) Mun. & Ind. Water (mg)				1,095	1,095
Households					
(1) Low Income ($)			357,638		357,638
(2) Medium Income ($)			732,105		732,105
(3) High Income ($)			312,758		312,758

Income associated with the endogenous commodity and household income accounts (recreation expenditures, hydroelectric power, municipal water, and flood control) for Broken Bow Lake is shown in Table VI (p. 29). Income for low income households was estimated at $434,000, for medium income households it was $861,000, and for high income households it was $359,000. The majority of this income impact is due to losses prevented from flood control, which was a direct increase in income of households. The total McCurtain County household income associated with the endogenous commodity and household income accounts was $1,654,000.

Impact of the Broken Bow Lake endogenous commodity and household accounts on the Broken Bow Lake factor payments account is shown in Table VII (p.30). Payments associated with recreation was $116,000, hydroelectric power was $286,000, flood control was $1,403,000, and municipal and industrial water was $88,000. Total payments, including indirect payments through other accounts, were equal to $1,904,000.

Total Impacts of Broken Bow Lake

The income impact of Broken Bow Lake is compared with total McCurtain County income in Table VIII (p.31). The income impact associated with the exogenous commodity accounts was $2,507,000, or about 0.9 percent of total McCurtain County income. The income impact associated with the endogenous accounts was $1,654,000, or about 0.6 percent. The total income impact of Broken Bow Lake was $4,161,000, or about 1.6 percent of McCurtain County income.

The distribution of the income impact by household income class size shows that Broken Bow Lake accounts for the smallest share for low income households (1.5 percent) and the highest share for high income households (1.7 percent). The differences among household income class sizes was because of differences in participation of households in employee compensation, proprietary income, and property income. Broken Bow Lake impacts apparently were marginally associated with factor returns and more beneficial to the higher income households.

These results indicate that the Broken Bow Lake project had very minimal impact on the McCurtain County economy. The overall income impact of this large federal water-based natural resource project had less than a two percent impact on county income. This is not the case, however, when viewing the distribution of factor payments to the Broken Bow Lake project (Table IX, p. 32). The distinction between distributions associated with the exogenous accounts and endogenous accounts can be viewed as an association with McCurtain County residents for the latter (endogenous accounts) and with non-county residents for the former (exogenous accounts). McCurtain County residents share in the benefits of the project by about 19 percent ($1,893,000) of the total versus about 81 percent ($8,097,000) for the non-county residents.

Among project purposes, hydroelectric power generates about 57.2 percent of Broken Bow Lake factor payments versus 23.2 percent for recreation, 18.7 percent for flood control, and 0.9 percent for municipal and industrial water. For McCurtain County residents, flood

control provides about 74.1 percent of the Broken Bow Lake factor payments versus 15.1 percent for hydroelectric power, 6.1 percent for recreation, and 4.7 percent for municipal and industrial water.

Care must be used in the interpretation of the Broken Bow Lake factor payments because these payments do not necessarily relate to market value transactions. In the case of recreation, these benefits were valued indirectly through a travel cost method and for flood control through losses avoided. However, it appears that McCurtain County residents benefited from the Broken Bow Lake project through county income generated directly and indirectly and through the value of services provided directly through recreation, hydroelectric power, flood control, and municipal and industrial water.

SUMMARY AND CONCLUSIONS

The Broken Bow Lake is a large federal water-based natural resource project located in McCurtain County of southeastern Oklahoma. The project is perceived to be a significant part of the local (county) economy. However, no estimates are available, for example, on how much of county income is directly and indirectly associated with the project.

A Social Accounting Matrix (SAM) was constructed for McCurtain County that identifies the project within the overall structure of the economy. The project purposes of recreation, hydroelectric power, flood control, municipal and industrial water supply, and fish and wildlife habitat were separated into components identified as serving commodity markets outside of the local (county) area, and those serving commodity markets inside the county. These were identified as exogenous and endogenous accounts, respectively.

Results of the analysis of income impacts for 1982 are that the project directly and indirectly is associated with less than two percent of total county income. Total income impact is estimated at about $4,161,000 out of a total county personal income of $267,679,000. Income effects are broadly distributed by household income class size. However, high income households apparently are impacted proportionately more from the project than are low income households.

The Broken Bow Lake project represents a fixed resource that can be imputed as a factor payment. When these factor payments are separated into those payments associated with the exogenous accounts (non-county residents) versus those associated with endogenous accounts (county residents), the results indicate a relatively high proportion of

factor payments associated with project outputs going to county residents. About 19 percent of the total factor payments of $9,990,000 are associated with county residents versus 81 percent associated with non-county residents. Hence, even though Broken Bow Lake is a federal project, a large share of factor payments are associated with the local area of McCurtain County.

TABLE I

AGGREGATE SOCIAL ACCOUNTING MATRIX
FOR MCCURTAIN COUNTY,
1982 ($1,000)

Account	Activities	Commodities	Factor Payments	Households	Gov'ts, S/I, ROW, Discrep[a]	Total Output
Activities		645,266			127	645,393
Commodities	120,440			58,871	474,280	653,591
Factor Payments	257,506			592	29,832	287,930
Households			185,639		82,010	267,649
Governments, Savings/Invest., Rest of World[a] Discrepancies	267,447	8,325	102,291	208,186		586,249
Total Outlay	645,393	653,591	287,930	267,649	586,249	2,440,812

Sources: IMPLAN (1) USE matrix, (2) Regional MAKE matrix, (3) Regional consumption demand, (4) Factor payments, (5) Regional non-competitive imports to consumption demand, (6) Regional competitive imports to consumption demand.
Regional Economic Information System, 1982-1987, Bureau of Economic Analysis.

a) Rest of World is abbreviated ROW: Savings/Investments is abbreviated S/I.

TABLE II

SOCIAL ACCOUNTING MATRIX FOR MCCURTAIN COUNTY, DETAILED AND DISAGGREGATED FOR BROKEN BOW LAKE, 1982

		Unit	Activity (1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	Subtotal
Activity														
(1)	Agriculture	$1,000												
(2)	Forestry	$1,000												
(3)	Min. & Manuf.	$1,000												
(4)	Transportation	$1,000												
(5)	Trade	$1,000												
(6)	Services	$1,000												
(7)	Recreation	1,000 VD												
(8)	Hydroelectric Power	1,000 kwh												
(9)	Flood Control	$1,000												
(10)	Municipal and Ind. Water	mg												
(11)	U.S. Army Corps of Engineers	$1,000												
Commodities														
(1)	Agriculture	$1,000	3922		23501			103						27526
(2)	Forestry	$1,000		63	5720			2						5785
(3)	Min. & Manuf.	$1,000	135	628	50398	27	101	1685					22	52976
(4)	Transportation	$1,000	314	88	2418	288	168	357						3633
(5)	Trade	$1,000	121	24	3601	33	99	194						4072
(6)	Services	$1,000	3578	2255	10828	184	4659	4965					32	26501
(7)	Recreation	1,000 VD												0
(8)	Hydroelectric Power	1,000 kwh												0
(9)	Flood Control	$1,000												0
(10)	Municipal and Ind. Water	mg												0
(11)	U.S. Army Corps of Engineers	$1,000							11	170	6	10		197
Factor Payments														
(1)	Employee Compensation	$1,000	3162	2149	98214	2169	32332	23703					115	161844
(2)	Proprietary Income	$1,000	3529	3617	3103	165	2216	1488						14118
(3)	Property Income	$1,000	1466	7858	19155	512	5523	23989						58503
(4)	Indirect Business Tax	$1,000	831	1795	4608	154	10364	5402						23154
(5)	Broken Bow Lake	$1,000							2314	5717	1870	88		9989
Households														
(1)	Low Income	$1,000												
(2)	Medium Income	$1,000												
(3)	High Income	$1,000												
Governments Savings/Invest. Rest-of-World Discrepancies		$1,000	38,763	11,855	167,683	1,863	14,143	33,140	- -	- -	- -	- -	28	267,475
Total Output		NA	55821	30332	389230	5395	69605	95010	1023	190559	1870	1095	197	NA

TABLE II (Continued)

		Commodities											
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	Subtotal
Activity													
(1)	Agriculture	54652	57	257	1		904						55871
(2)	Forestry		30331	1									30332
(3)	Mln. & Manuf.	55		387922			1129						389106
(4)	Transportation				5289		103						5392
(5)	Trade					69605							69605
(6)	Services			200	275	201	94334						95010
(7)	Recreation							1033					1033
(8)	Hydroelectric Power								190558				190558
(9)	Flood Control									1870			1870
(10)	Municipal and Ind. Water										1095		1095
(11)	U.S. Army Corps of Engineers											197	197
Commodities													
(1)	Agriculture												
(2)	Forestry												
(3)	Mln. & Manuf.												
(4)	Transportation												
(5)	Trade												
(6)	Services												
(7)	Recreation												
(8)	Hydroelectric Power												
(9)	Flood Control												
(10)	Municipal and Ind. Water												
(11)	U.S. Army Corps of Engineers												
Factor Payments													
(1)	Employee Compensation												
(2)	Proprietary Income												
(3)	Property Income												
(4)	Indirect Business Tax												
(5)	Broken Bow Lake												
Households													
(1)	Low Income												
(2)	Medium Income												
(3)	High Income												
Governments Savings/Invest. Rest-of-World Discrepancies		253	23	1575	16	4084	2374	- -	- -	- -	- -	- -	8325
Total Output		54910	30411	389955	5581	73890	98844	1033	190558	1870	1095	197	

TABLE II (Continued)

		Factor Payments						Households					
		(1)	(2)	(3)	(4)	(5)	Subtotal	(1)	(2)	(3)	Subtotal	Exogenous	Total Output
Activity													
(1)	Agriculture											-50	55821
(2)	Forestry												30332
(3)	Min. & Manuf.											124	389230
(4)	Transportation											3	5395
(5)	Trade												68605
(6)	Services												95010
(7)	Recreation											-10	1023
(8)	Hydroelectric Power												190558
(9)	Flood Control												1870
(10)	Municipal and Ind. Water												1095
(11)	U.S. Army Corps of Engineers												197
Commodities													
(1)	Agriculture							205	291	82	578	26806	54910
(2)	Forestry							7	11	4	22	24604	30411
(3)	Min. & Manuf.							1433	2295	798	4526	332453	389955
(4)	Transportation							464	544	211	1219	729	5581
(5)	Trade							6	9	3	18	69800	73890
(6)	Services							16028	26781	9699	52508	19835	98844
(7)	Recreation							16	27	9	52	981	1033
(8)	Hydroelectric Power							2992	4888	1648	9528	181030	190558
(9)	Flood Control							358	732	313	1403	467	1870
(10)	Municipal and Ind. Water							344	562	189	1095		1095
(11)	U.S. Army Corps of Engineers												197
Factor Payments													
(1)	Employee Compensation								237	355	592	26128	188564
(2)	Proprietary Income											-43	14075
(3)	Property Income											3632	62135
(4)	Indirect Business Tax											2	23156
(5)	Broken Bow Lake Subtotal												9989
Households													
(1)	Low Income	52567	3957	2239		36	58859					25149	84008
(2)	Medium Income	81629	6144	7650		60	95483					41841	137324
(3)	High Income	24616	1853	4924		20	31413					15020	46433
	Subtotal	158812	11954	14873		116	185755					82010	
Governments Savings/Invest. Rest-of-World Discrepancies		29752	2121	47262	23156	9757	112048	65829	107096	35261	208186	- -	596034	
Total Output		188564	14075	62135	23156	9989		84008	137324	46433			

Sources: IMPLAN: (1) Use matrix data, (2) Regional make matrix data, (3) Regional consumption demand data, (4) Final payment-factors data, (5) Regional non-competitive imports to consumption demand data, (6) Regional competitive imports to consumption demand data.
U.S. Army Corps of Engineers, Tulsa, Oklahoma.
Recreation benefits were measured by travel cost method developed for the McClellan Kerr Arkansas River Navigation System study (Badger, et al 1977).

TABLE III

MULTIPLIER MATRIX $(I-A)^{-1}$ FOR MCCURTAIN COUNTY (1982 DATA BASE) WITH BROKEN BOW LAKE PROJECT DETAILED OR IDENTIFIED

		Activity										
	Accounts	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Activity												
(1)	Agriculture	1.0772	0.0043	0.0768	0.0038	0.0041	0.0053	0.0003	0.0000	0.0001	0.0001	0.0112
(2)	Forestry	0.0002	1.0026	0.0170	0.0003	0.0003	0.0005	0.0000	0.0000	0.0000	0.0000	0.0020
(3)	Min. & Manuf.	0.0094	0.0334	1.1582	0.0192	0.0168	0.0305	0.0022	0.0001	0.0008	0.0013	0.1356
(4)	Transportation	0.0073	0.0050	0.0096	1.0561	0.0056	0.0061	0.0002	0.0000	0.0001	0.0000	0.0022
(5)	Trade	0.0025	0.0013	0.0106	0.0065	1.0019	0.0025	0.0000	0.0000	0.0000	0.0000	0.0016
(6)	Services	0.1002	0.1303	0.1028	0.1300	0.1656	1.1195	0.0075	0.0002	0.0031	0.0019	0.1854
(7)	Recreation	0.0000	0.0001	0.0001	0.0001	0.0001	0.0001	1.0000	0.0000	0.0000	0.0000	0.0000
(8)	Hydroelectric Power	0.0054	0.0097	0.0113	0.0162	0.0175	0.0117	0.0010	1.0000	0.0005	0.0001	0.0031
(9)	Flood Control	0.0008	0.0014	0.0017	0.0024	0.0026	0.0017	0.0002	0.0000	1.0001	0.0000	0.0005
(10)	Municipal and Ind. Water	0.0006	0.0011	0.0013	0.0019	0.0020	0.0013	0.0001	0.0000	0.0001	1.0000	0.0004
(11)	U.S. Army Corps of Engineers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0107	0.0009	0.0032	0.0091	1.0000
Commodities												
(1)	Agriculture	0.0767	0.0030	0.0761	0.0025	0.0026	0.0041	0.0002	0.0000	0.0001	0.0001	0.0094
(2)	Forestry	0.0002	0.0026	0.0171	0.0003	0.0003	0.0005	0.0000	0.0000	0.0000	0.0000	0.0020
(3)	Min. & Manuf.	0.0082	0.0320	0.1577	0.0178	0.0149	0.0292	0.0021	0.0001	0.0007	0.0012	0.1340
(4)	Transportation	0.0076	0.0051	0.0101	0.0591	0.0057	0.0063	0.0002	0.0000	0.0001	0.0000	0.0021
(5)	Trade	0.0027	0.0014	0.0112	0.0070	0.0020	0.0026	0.0000	0.0000	0.0000	0.0000	0.0017
(6)	Services	0.1046	0.1363	0.1071	0.1332	0.1732	0.1248	0.0079	0.0003	0.0032	0.0020	0.1941
(7)	Recreation	0.0000	0.0001	0.0001	0.0001	0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000
(8)	Hydroelectric Power	0.0054	0.0097	0.0113	0.0162	0.0175	0.0117	0.0010	0.0000	0.0005	0.0001	0.0031
(9)	Flood Control	0.0008	0.0014	0.0017	0.0024	0.0026	0.0017	0.0002	0.0000	0.0001	0.0000	0.0005
(10)	Municipal and Ind. Water	0.0006	0.0011	0.0013	0.0019	0.0020	0.0013	0.0001	0.0000	0.0001	0.0000	0.0004
(11)	U.S. Army Corps of Engineers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0107	0.0009	0.0032	0.0091	0.0000
Factor Payments												
(1)	Employee Compensation	0.0928	0.1155	0.3329	0.4662	0.5145	0.2917	0.0026	0.0001	0.0010	0.0008	0.0831
(2)	Proprietary Income	0.0701	0.1223	0.0184	0.0350	0.0351	0.0184	0.0002	0.0000	0.0001	0.0001	0.0050
(3)	Property Income	0.0550	0.2950	0.0911	0.1347	0.1228	0.2852	0.0020	0.0001	0.0008	0.0006	0.0546
(4)	Indirect Business Tax	0.0224	0.0675	0.0236	0.0388	0.1590	0.0647	0.0005	0.0000	0.0002	0.0001	0.0127
(5)	Broken Bow Lake	0.0011	0.0019	0.0022	0.0032	0.0035	0.0023	2.2403	0.0300	1.0001	0.0804	0.0006
Households												
(1)	Low Income	0.0476	0.0775	0.1014	0.1448	0.1579	0.0971	0.0089	0.0001	0.0039	0.0006	0.0266
(2)	Medium Income	0.0775	0.1397	0.1634	0.2337	0.2532	0.1694	0.0149	0.0002	0.0066	0.0009	0.0448
(3)	High Income	0.0257	0.0546	0.0531	0.0761	0.0815	0.0631	0.0050	0.0001	0.0022	0.0003	0.0158

TABLE III (Continued)

	Accounts	Commodities (1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Activity												
(1)	Agriculture	1.0713	0.0063	0.0771	0.0040	0.0039	0.0158	0.0003	0.0000	0.0001	0.0001	0.0112
(2)	Forestry	0.0002	1.0000	0.0170	0.0003	0.0003	0.0007	0.0000	0.0000	0.0000	0.0000	0.0020
(3)	Min. & Manuf.	0.0105	0.0333	1.1522	0.0197	0.0159	0.0424	0.0022	0.0001	0.0008	0.0013	0.1356
(4)	Transportation	0.0073	0.0050	0.0096	1.0012	0.0053	0.0071	0.0002	0.0000	0.0001	0.0000	0.0022
(5)	Trade	0.0025	0.0013	0.0105	0.0063	0.9438	0.0025	0.0000	0.0000	0.0000	0.0000	0.0016
(6)	Services	0.0997	0.1302	0.1029	0.1784	0.1590	1.0706	0.0075	0.0002	0.0031	0.0019	0.1854
(7)	Recreation	0.0000	0.0001	0.0001	0.0001	0.0001	0.0001	1.0000	0.0000	0.0000	0.0000	0.0000
(8)	Hydroelectric Power	0.0053	0.0097	0.0113	0.0159	0.0165	0.0114	0.0010	1.0000	0.0005	0.0001	0.0031
(9)	Flood Control	0.0008	0.0014	0.0017	0.0023	0.0024	0.0017	0.0002	0.0000	1.0001	0.0000	0.0005
(10)	Municipal and Ind. Water	0.0006	0.0011	0.0013	0.0018	0.0019	0.0013	0.0001	0.0000	0.0001	1.0000	0.0004
(11)	U.S. Army Corps of Engineers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0107	0.0009	0.0032	0.0091	1.0000
Commodities												
(1)	Agriculture	1.0763	0.0032	0.0758	0.0026	0.0024	0.0055	0.0002	0.0000	0.0001	0.0001	0.0094
(2)	Forestry	0.0002	1.0026	0.0170	0.0003	0.0003	0.0007	0.0000	0.0000	0.0000	0.0000	0.0020
(3)	Min. & Manuf.	0.0083	0.0319	1.1569	0.0183	0.0141	0.0298	0.0021	0.0001	0.0007	0.0012	0.1340
(4)	Transportation	0.0075	0.0051	0.0100	1.0563	0.0054	0.0062	0.0002	0.0000	0.0001	0.0000	0.0021
(5)	Trade	0.0027	0.0014	0.0111	0.0067	1.0019	0.0027	0.0000	0.0000	0.0000	0.0000	0.0017
(6)	Services	0.1041	0.1361	0.1067	0.1324	0.1635	1.1215	0.0079	0.0003	0.0032	0.0020	0.1941
(7)	Recreation	0.0000	0.0001	0.0001	0.0001	0.0001	0.0001	1.0000	0.0000	0.0000	0.0000	0.0000
(8)	Hydroelectric Power	0.0053	0.0097	0.0113	0.0159	0.0165	0.0114	0.0010	1.0000	0.0005	0.0001	0.0031
(9)	Flood Control	0.0008	0.0014	0.0017	0.0023	0.0024	0.0017	0.0002	0.0000	1.0001	0.0000	0.0005
(10)	Municipal and Ind. Water	0.0006	0.0011	0.0013	0.0018	0.0019	0.0013	0.0001	0.0000	0.0001	1.0000	0.0004
(11)	U.S. Army Corps of Engineers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0107	0.0009	0.0032	0.0091	1.0000
Factor Payments												
(1)	Employee Compensation	0.0926	0.1154	0.3314	0.4562	0.4855	0.2835	0.0026	0.0001	0.0010	0.0008	0.0831
(2)	Proprietary Income	0.0697	0.1221	0.0183	0.0341	0.0331	0.0185	0.0002	0.0000	0.0001	0.0001	0.0050
(3)	Property Income	0.0548	0.2943	0.0909	0.1417	0.1165	0.2739	0.0020	0.0001	0.0008	0.0006	0.0546
(4)	Indirect Business Tax	0.0233	0.0674	0.0235	0.0400	0.1500	0.0622	0.0005	0.0000	0.0002	0.0001	0.0127
(5)	Broken Bow Lake	0.0011	0.0019	0.0022	0.0032	0.0033	0.0023	2.2403	0.0300	1.0001	0.0804	0.0006
Households												
(1)	Low Income	0.0474	0.0774	0.1009	0.1420	0.1490	0.0944	0.0089	0.0001	0.0039	0.0006	0.0266
(2)	Medium Income	0.0773	0.1395	0.1627	0.2298	0.2390	0.1645	0.0149	0.0002	0.0066	0.0009	0.0449
(3)	High Income	0.0256	0.0545	0.0529	0.0753	0.0770	0.0612	0.0050	0.0001	0.0022	0.0003	0.0158

TABLE III (Continued)

	Accounts	Factor Payments (1)	(2)	(3)	(4)	(5)	Households (1)	(2)	(3)
Activity									
(1)	Agriculture	0.0057	0.0057	0.0016	0.0000	0.0001	0.0070	0.0067	0.0066
(2)	Forestry	0.0004	0.0004	0.0001	0.0000	0.0000	0.0005	0.0005	0.0005
(3)	Min. & Manuf.	0.0235	0.0237	0.0067	0.0000	0.0003	0.0279	0.0277	0.0290
(4)	Transportation	0.0052	0.0052	0.0014	0.0000	0.0001	0.0071	0.0055	0.0062
(5)	Trade	0.0006	0.0007	0.0002	0.0000	0.0000	0.0008	0.0008	0.0008
(6)	Services	0.1792	0.1807	0.0518	0.0000	0.0025	0.2073	0.2118	0.2278
(7)	Recreation	0.0002	0.0002	0.0001	0.0000	0.0000	0.0002	0.0002	0.0002
(8)	Hydroelectric Power	0.0321	0.0324	0.0091	0.0000	0.0004	0.0381	0.0381	0.0384
(9)	Flood Control	0.0047	0.0047	0.0014	0.0000	0.0001	0.0046	0.0057	0.0072
(10)	Municipal and Ind. Water	0.0037	0.0037	0.0011	0.0000	0.0001	0.0044	0.0044	0.0044
(11)	U.S. Army Corps of Engineers	0.0001	0.0001	0.0000	0.0000	0.0000	0.0001	0.0001	0.0001
Commodities									
(1)	Agriculture	0.0040	0.0040	0.0011	0.0000	0.0001	0.0050	0.0046	0.0044
(2)	Forestry	0.0004	0.0004	0.0001	0.0000	0.0000	0.0005	0.0005	0.0005
(3)	Min. & Manuf.	0.0215	0.0217	0.0061	0.0000	0.0003	0.0256	0.0253	0.0264
(4)	Transportation	0.0053	0.0053	0.0015	0.0000	0.0001	0.0072	0.0056	0.0063
(5)	Trade	0.0007	0.0007	0.0002	0.0000	0.0000	0.0008	0.0008	0.0009
(6)	Services	0.1875	0.1891	0.0542	0.0000	0.0026	0.2168	0.2216	0.2384
(7)	Recreation	0.0002	0.0002	0.0001	0.0000	0.0000	0.0002	0.0002	0.0002
(8)	Hydroelectric Power	0.0321	0.0324	0.0091	0.0000	0.0004	0.0381	0.0381	0.0384
(9)	Flood Control	0.0047	0.0047	0.0014	0.0000	0.0001	0.0046	0.0057	0.0072
(10)	Municipal and Ind. Water	0.0037	0.0037	0.0011	0.0000	0.0001	0.0044	0.0044	0.0044
(11)	U.S. Army Corps of Engineers	0.0001	0.0001	0.0000	0.0000	0.0000	0.0001	0.0001	0.0001
Factor Payments									
(1)	Employee Compensation	1.0553	0.0557	0.0162	0.0000	0.0008	0.0625	0.0647	0.0753
(2)	Proprietary Income	0.0036	1.0036	0.0010	0.0000	0.0000	0.0042	0.0042	0.0045
(3)	Property Income	0.0472	0.0476	1.0136	0.0000	0.0007	0.0548	0.0557	0.0599
(4)	Indirect Business Tax	0.0108	0.0109	0.0031	1.0000	0.0001	0.0126	0.0128	0.0137
(5)	Broken Bow Lake	0.0064	0.0064	0.0019	0.0000	1.0001	0.0066	0.0077	0.0091
Households									
(1)	Low Income	0.2970	0.2995	0.0423	0.0000	0.0039	1.0207	0.0213	0.0245
(2)	Medium Income	0.4642	0.4681	0.1323	0.0000	0.0064	0.0357	1.0368	0.0420
(3)	High Income	0.1420	0.1432	0.0826	0.0000	0.0022	0.0131	0.0134	1.0152

TABLE IV

IMPACT OF BROKEN BOW LAKE EXOGENOUS COMMODITY ACCOUNT ON MCCURTAIN COUNTY HOUSEHOLD INCOME BY INCOME CLASS SIZE, 1982

	Commodity	Exogenous Commodity Level	Household Income Impact ($1,000) Low Income	Medium Income	High Income	Total
(1)	Agriculture ($)	96,959	5	7	2	14
(2)	Forestry ($)	62,681	5	9	3	17
(3)	Mining & Manuf. ($)	3,076,256	310	501	163	974
(4)	Transportation ($)	131,238	19	30	10	59
(5)	Trade ($)	2,298,622	342	549	177	1,068
(6)	Services ($)	840,314	79	138	51	258
(7)	Recreation (VD)	981,000	9	15	5	29
(8)	Hydroelectric Power (kwh)	181,030,000	18	36	18	72
(9)	Flood Control ($)	467,500	2	3	1	6
Total Income Impact			789	1,288	430	2,507

TABLE V

IMPACT OF BROKEN BOW LAKE EXOGENOUS COMMODITY ACCOUNT ON FACTOR PAYMENTS TO BROKEN BOW LAKE PROJECT, 1982

Commodity	Exogenous Commodity Level	Broken Bow Lake Factor Payments	
		Interdependence Coefficient	Payments ($1,000)
(1) Agriculture ($)	96,959	0.0011	*
(2) Forestry ($)	62,681	0.0019	*
(3) Mining & Manuf.($)	3,076,256	0.0022	7
(4) Transportation ($)	131,238	0.0032	*
(5) Trade ($)	2,298,622	0.0033	8
(6) Services ($)	840,314	0.0023	2
(7) Recreation (VD)	981,000	2.2403	2,198
(8) Hydroelectric Power (kwh)	181,030,000	0.0300	5,431
(9) Flood Control ($)	467,500	1.0001	468
Total Factor Payment Impact			8,114

* Less than $1,000.

TABLE VI

IMPACT OF BROKEN BOW LAKE ENDOGENOUS COMMODITY AND HOUSEHOLD ACCOUNTS ON MCCURTAIN COUNTY HOUSEHOLD INCOME BY INCOME CLASS SIZE, 1982

Account	Endogenous Account Level	Household Income Impact ($1,000) Low Income	Medium Income	High Income	Total
Commodity					
(1) Agriculture ($)	5,103	*	*	*	*
(2) Forestry ($)	3,300	*	*	*	*
(3) Mining & Manuf. ($)	161,908	16	26	9	51
(4) Transportation ($)	6,907	1	2	1	4
(5) Trade ($)	120,980	18	29	9	56
(6) Services ($)	44,227	4	7	3	14
(7) Recreation (VD)	52,000	1	1	*	1
(8) Hydroelectric Power (kwh)	9,528,000	1	2	1	4
(9) Flood Control ($)	1,402,501	5	9	3	17
(10) Mun. & Indus. Water (mg)	1,095	*	*	*	*
Households					
(1) Low Income ($)	357,638	365	13	5	383
(2) Medium Income ($)	732,105	16	759	10	785
(3) High Income ($)	312,758	8	13	318	339
Total Income Impact		434	861	359	1,654

* Less than $1,000.

TABLE VII

IMPACT OF BROKEN BOW LAKE ENDOGENOUS COMMODITY AND HOUSEHOLD ACCOUNTS ON FACTOR PAYMENTS TO BROKEN BOW LAKE PROJECT, 1982

Account	Endogenous Account Level	Broken Bow Lake Factor Payments	
		Interdependence Coefficient	Payments ($1,000)
Commodity			
(1) Agriculture ($)	5,103	0.0011	*
(2) Forestry ($)	3,300	0.0019	*
(3) Mining & Manuf. ($)	161,908	0.0022	*
(4) Transportation ($)	6,907	0.0032	*
(5) Trade ($)	120,980	0.0033	*
(6) Services ($)	44,227	0.0023	*
(7) Recreation (VD)	52,000	2.2403	116
(8) Hydroelectric Power (kwh)	9,528,000	0.0300	286
(9) Flood Control ($)	1,402,501	1.0001	1,403
(10) Mun. & Indus. Water (mg)	1,095	0.0804	88
Households			
(1) Low Income ($)	357,638	0.0066	2
(2) Medium Income ($)	732,105	0.0077	6
(3) High Income ($)	312,758	0.0091	3
Total Factor Payment Impact			1,904

TABLE VIII

INCOME IMPACT OF BROKEN BOW LAKE
LAKE PROJECT ON MCCURTAIN BY
INCOME CLASS SIZE, 1982

	Household Income Class Size			
	Low Income	Middle Income	High Income	Total
McCurtain County				
Income Impact				
Exogenous Account				
Effect ($1,000)	789	1,288	430	2,507
Endogenous Account				
Effect ($1,000)	434	861	359	1,654
Total ($1,000)	1,223	2,149	789	4,161
Percent of Total				
County Income	1.46	1.57	1.70	1.55

TABLE IX

DISTRIBUTION OF FACTOR PAYMENTS TO BROKEN BOW LAKE PROJECT BY PURPOSE AND BY EXOGENOUS AND ENDOGENOUS ACCOUNTS, 1982

Account	Recreation	Household Income Class Size: Hydroelectric Power	Flood Control	Mun. & Indus. Water	Total
Exogenous					
Account ($1,000)	2,198	5,431	468	--	8,097
(%)	27.1	67.1	5.8	--	81.1
Endogenous					
Account ($1,000)	116	286	1,403	88	1,893
(%)	6.1	15.1	74.1	4.7	18.9
Total					
($1,000)	2,314	5,717	1,871	88	9,990
(%)	23.2	57.2	18.7	0.9	100.0

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