THE ECONOMY OF MOFFAT, ROUTT, AND RIO BLANCO COUNTIES, COLORADO DESCRIPTION AND ANALYSIS

By

John R. McKean
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COLORADO WATER RESOURCES

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Colorado State University
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DESCRIPTION AND ANALYSIS

By

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Norman A. Evans, Director

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ERRATA

The following error should be corrected as follows:

Table B-1 marked "EMPLOYMENT" (at the bottom of the table):

The numbers in this line are in scientific notation beginning

.3332E 06 0.5210E 06 0.4011E 06, etc.

Each of these numbers is 1,000 times too large.

All exponents should be reduced by 3 - i.e.,

.332E 03 0.5210E 03 0.4011E 03, etc.

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CHAPTER 1

INTRODUCTION

INTRODUCTION

The purpose of this report is to provide a description and analysis of a regional economy within the state of Colorado. The intent of the researchers is to provide policy makers with specific information contributing to the decision-making and planning processes and to provide a planning tool having the capability of analyzing a number of alternative development scenarios in the study region.

The Region Under Study

Three counties in Northwestern Colorado make up the study area.[1] These counties comprise parts of Colorado State Planning Regions II and XII. The land area contained in the region consists of approximately 10,356 square miles and is some 9.93 percent of the state total. The Federal Government owns 6,025 square miles or 58.1 percent of the region's total land area.[2] Federal ownership is represented in a national monument, a national forest, and holdings of the Bureau of Land Management and the Bureau of Reclamation. Land holdings of the U. S. Forest Service and the Bureau of Land Management generated Federal income of 89.5 million in fiscal 1976.[3]

The region's 1976 population is estimated at 23,060 inhabitants with an adjusted gross income of some $118 million. As a percentage of the state totals in these categories, the region's population is approximately 0.88 percent of the total while personal adjusted gross income is some 0.93 percent.[4]

On balance, the region is a net exporting region (where exports are defined in terms of deliveries of goods and services outside the region's boundaries). Net exports are estimated at $91.8 million. The major exporting activities are the extractive industries and recreation-oriented activities. A significant percentage of the state's total production of extractive goods comes from the tri-county region of Northwest Colorado. Some 1.8 percent of the value of crop production in the state is produced in the region; 58.4 percent of the state's crude oil; and 24.7 percent of the state's natural gas production. The region's coal output is 64.1 percent of the total Colorado tonnage. Colorado's federal oil shale tracts C-a and C-b are in the study region.[5]

The relative abundance of amenity resources has encouraged outdoor recreation activities of all kinds. A major ski area is found in Steamboat Springs. Big game hunting is an important activity with 36.3 percent and 20.4 percent, respectively, of the state's 1977 total deer and elk harvest occurring in the region.[6]

The regional economy is also characterized by a small but continually expanding base in the "light" industries sector. Firms in this segment of the economy produce largely for export markets. Significant export activity also occurs in the transportation, electric power, trade and a number of service sectors. However, the economy imports nearly all finished consumer products, heavy industry products, and ingredient materials such as cement and lumber.

STATEMENT OF THE PROBLEM

The natural resource base in the region, while relatively abundant in terms of the capability to satisfy local demands, is nonetheless the focal point for regional and extra-regional economic conflict. Ownership of the large deposits of exploitable resources is vested largely with the Federal

Government and corporations headquartered out of state. Water use is governed by state water law, interstate compacts, and international treaty. Thus, from a regional perspective, policies affecting the disposition of the regional resource base are largely determined outside of the region. From this same perspective, there is a need to develop a detailed description of the economy as it presently exists and an analytical framework which is capable of assessing the direct and indirect consequences of alternative scenarios for resource exploitation proposed by the public and private sectors of the economy. This description and analysis contitutes the major thrust of the research reported here.

The Model Used

A tool particularly adapted to these questions is the comprehensive inter-industry production model developed by W. W. Leontief. The strength of this model (ofter termed the input-output model) lies in its capability not only to describe the interdependence existing among sectors of an economy but also in the capacity to demonstrate, sector by sector, the total consequences of any number of development scenarios. The model is thus both descriptive and analytical. The descriptive components are accommodated through the collection of extensive primary data, from firms within the region, and subsequent tabulation of the data in a form consistent with the interindustry framework. The analytical phase consists of the impact analysis, development of the various multipliers, and consistent forecasting under alternative resource development scenarios.

Outline of the Report

The remainder of the report consists of a description of the method of the study which is presented in Chapter 2; the analysis of the regional economy, which is the concern of Chapter 3; and an extension of the basic model to include an analysis of water use and employment induced population effects which is contained in Chapter 4.

In addition to the main text of the report, there are several appendices. These contain the input-output tables, the sector identification used in the analysis, and a detailed critique of the data sources used in constructing the model.

NOTES

1. Moffat, Rio Blanco and Routt counties.

2. Colorado State Planning Division, Colorado Year Book, 1962-64, pp. 492-509.

3. In house reports of the U.S. Forest Service and U.S. Bureau of Land Management. Some 50 percent or $45 million were returned to the state. Federal income fell from 89.5 million in 1976, to about 27.2 million in 1977, and 24.4 million in 1978. The difference is due mainly to the lack of oil shale bonus payments in the later years.

4. Colorado State Planning Office and Colorado Department of Revenue, Annual Report, Fiscal Year Ending June 30, 1977.

5. Colorado Department of Agriculture, Colorado Crop and Livestock Reporting Service, Colorado Agricultural Statistics - 1978, July, 1978. Colorado Department of Natural Resources, Division of Mines, A Summary of Mineral Industry Activities in Colorado - 1976, June, 1977. Colorado Department of Natural Resources, Division of Mines, Coal - 1976, April, 1977.

6. Colorado Department of Natural Resources, Division of Wildlife, 1977 Colorado Big Game Harvest.

CHAPTER 2

THE METHODOLOGY OF THE STUDY

INTRODUCTION

The national energy situation has focused an increasing attention on the coal, oil shale, and oil and gas reserves in the Tri-County Region of Northwestern Colorado. As evidence of this fact are the prototype leases of federal oil shale lands. Additional evidence is found in the increased production of coal from existing operations, proposals for additional leases on federal coal lands, the two Hayden power plants on line, and increases in crude petroleum and natural gas production.[1]

These activities have generally been viewed as isolated from, or independent of, the remainder of the economic environment. In those cases where an impact statement has been filed[2] more concern has been given to physical impacts than to social and economic impacts.[3] As a result the total consequences of such developments have not been thoroughly analyzed.[4] While we do not propose to perform an ex-post evaluation of the impacts of existing developments, a major product of this research is the provision of the analytical capability for assessing the regional impacts of continued developments.

The interindustry model identifies the interdependent structure of an economy. No producing sector is autonomous (independent of the other sectors); rather, each sector interacts with other sectors (industrial, commercial, labor, government) through the purchase of goods and services and the sale of

outputs. Structural interdependence means, quite simply, that the activities in one sector have impacts on others. The identification of the nature and magnitude of this interdependence is one of the most useful results of the interindustry model.

The model is driven by what are termed final demands.[5] Final demands (as opposed to intermediate demands) reflect the demand for goods and services in final form. Thus, final demand sectors use or consume a finished good. Intermediate demands, on the other hand, reflect the demand for goods and services which are processed before becoming available for final consumption. Thus, changes in final demands result in changes in the processing (or intermediate) sectors of the economy. The primary purpose of the interindustry model is to trace these impacts throughout the economy. Tracing these direct and indirect impacts allows the derivation of the multiplier effects on production, income, employment, or water use, and also allows the use of the model in providing consistent forecasts of economic activity.[6]

PROCEDURES FOLLOWED

The discussion of procedures followed in conducting the research may be conveniently condensed into several categories including: the definition of the region; delineation of economic sectors; the data collection effort; selection of the base year; and data processing. Each is discussed, as briefly as possible, in the following pages.

THE DEFINITION OF THE REGION

The Tri-County Region of Northwestern Colorado, for purposes of this study, was defined as Moffat, Rio Blanco, and Routt Counties. This regional definition allows for an analysis of the area most immediately impacted by potential coal and oil shale development.

THE SECTOR DELINEATIONS

The interindustry model requires the separation of the economy into various economic entities or "sectors." Total output, by interindustry accounting procedures, is the aggregate value of all sales or purchases that take place, i.e., the total sales or purchases during a year. This total output must be divided up into sectors in order to assess the interindustry structural dependence that prevails. The model structures economic activity into two major components, suppliers (or sellers) and purchasers (or users). Each of these is further subdivided according to the following scheme: Suppliers include: 1) intermediate or processing suppliers who are producers who must purchase inputs to be processed into output which they sell to final users or as inputs to other processors; and 2) primary suppliers whose output is not directly dependent on purchased inputs. This latter category includes non-local suppliers (or imports). Purchasers include: 1) intermediate or processing purchasers who buy the outputs of suppliers for use as inputs for further processing; and 2) final purchasers who buy the outputs of suppliers in their final form and for final use. This latter category includes purchases by non-local users (or sales to exports). The level of demand by final purchasers, and its composition, are determined outside the processing sector. Production to meet the exogenously determined final demands generates intermediate purchases and sales. Primary suppliers and final purchasers may or may not be one and the same. However, in the interindustry model, their activities are treated as if they were completely independent of one another.

In summary, the two major divisions of suppliers are the intermediate suppliers, which we call the processing sector, and the primary suppliers,

which we call the final payments sector. (The suppliers are conventionally shown along the lefthand border of an interindustry table.) The two major divisions of the purchasers are the intermediate purchasers, which we label as the processing sector (just as with the intermediate suppliers) and the final purchasers which we label final demand. (The purchasers are conventionally shown along the top of an interindustry or input-output table.) It is within this general framework that a further sector disaggregation must be accomplished.

The ideal sector delineation would allow unique recognition of industries or producer groups which provide a homogenous good or service. This ideal is very difficult to achieve because of the large amounts of time and finances required for detailed disaggregation, disclosure problems, and lack of data. Any of these factors or a combination of them lead to a violation of the homogenous product ideal.[8]

Sector selection, in addition to dependence upon financing, time, and data availability, is determined to a large extent by the objectives of the study. Research objectives can often be achieved without detailed disaggregation in all sectors. Since our purpose here is largely to determine the impacts of coal and oil shale development and other sectors such as agriculture and local government, economic sectors such as trade and services do not require detailed disaggregation. The final delineation of the sectoring plan adopted for this study is shown in Table 2-1. A discussion of the two non-conventional accounting device sectors and how they are used follows. These sectors are the local and county taxes account and the transfer account. There is also an explanation of the profit and depreciation sectors.

TABLE 2-1

SECTOR IDENTIFICATION, TRI-COUNTY REGION OF NORTHWESTERN COLORADO, 1976

Sector Number	Sector Description	1972 SIC Codes
Processing Sectors		
1.	Ag/Livestock	01, 02, 07
2.	Coal Mines	12
3.	Oil/Gas Production	13
4.	Construction	14, 15, 16, 17
5.	All Manufacturing	20, 24, 25, 27 28, 32, 35, 38, 39
6.	Transportation/Communication	40, 41, 42, 45 47, 48
7.	Electricity; Gas Utilities	491, 492
8.	Wholesale Trade	50, 51
9.	Retail Trade	52, 53, 54, 55, 56, 57, 58, 59
10.	Finance, Insurance, Real Estate	60, 61, 62, 63, 64, 65, 66
11.	Services	70, 72, 73, 75, 76, 78, 79, 81, 86, 89
12.	Medical Services	80
13.	Education	82
14.	Water, Sewerage, Trash Removal Services	494, 495
15.	Local and County Roads	-
16.	Local and County Government	91, 92, 93, 94, 95, 96

TABLE 2-1 (Continued)

Sector Number	Sector Description	1972 SIC Codes
17.	Local and County Tax Accounts	-
18.	Subtotals	
Final Demand Sectors		
19.	Households	-
20.	State of Colorado	91, 92, 93, 94 95, 96, 97
21.	Federal Government	91, 92, 93, 94, 95, 96, 97
22.	Transfer Account	-
23.	Economic Investment	-
24.	Shale Oil	-
25.	Exports to Colorado Other Than the Tri-County Region	-
26.	Exports to the Rest of the World	-
27.	Totals	

The local and county government tax sector is employed as an accounting device. With the exception of building permit fees, franchise taxes, local and county liquor license fees, charges for services, intergovernmental transfers, and fines and forfeitures, all revenues (basically property and sales taxes, though also general occupation license fees) accruing to local and county government entities are shown as being paid to this account (sector). In turn the account distributes the tax monies to the appropriate agencies.

Thus the entries in the row for the local and county government tax sector show the amounts of local sales and property taxes paid by each respective sector in the Northwestern Colorado economy. In turn, the entries in the local and county government tax column show the relative distribution of local sales and property taxes for health, education, social services, roads and bridges operation and maintenance, other general government activities, and otherwise unallocated bond indenture sinking funds.

Another accounting device employed in the Northwestern Colorado inter-industry model is the transfer sector. This accounting device allows for two unique and distinctive characteristics that are not usually found in other regional interindustry studies. First, the assumption that transfer payments cancel in the net is dropped. Second, the model handles financial balances in such a manner as to give rise to a definition of regional income more analogous to the definition of national income. There are several reasons for this. (The reader is referred to the gross flows in the appendix for the positioning of the transfer sector and the relative magnitudes of its row and column values.) A schedule explaining the components of various cells row and column also appears in the appendix.

First, insurance premiums were divided so that a value equal to loss experiences ($5,932,125) was separated from other revenues ($5,769,012). This value equal to loss experiences was then prorated among the various sectors in accordance with their premium payments and directly charged into the transfer row. Thus, the $5,932,125 loss experience is not part of the total gross output of the finance, insurance, and real estate sector. The transfer column in turn is shown as making the claim payments to the various sectors, construction ($278,671), retail trade ($266,543), insurance and real estate ($28,099), health medical care services ($1,055,685), services n.e.c. ($1,475,378), households ($1,178,500), imports from Colorado other than the Tri-County Region ($1,015,132), and imports from the rest of the world ($645,833).

Second, the State of Colorado and the Federal Government both generated revenues in the Tri-County Region of Northwestern Colorado that exceeded the value of their expenditures in the region. These financial surpluses are shown as outlays by the respective state and federal sectors to the transfer account row. The transfer column then shows the State of Colorado's financial surplus ($16,121,328) as an import from Colorado other than the Tri-County Region; the Federal Government surplus ($75,631,866) is shown as an import from the rest of the world.

Third, transfer payments to households are handled through the transfer account.[9] Taxes collected in the region are always shown as being paid to the respective government accounts, i.e., local and county tax accounts, state of Colorado, or Federal Government. Any inter-governmental transfer is shown as a sale by the recipient and a purchase by the grantor. In turn, the account that grants the transfer payment(s) to the household sector is shown as making a purchase from the transfer account row in the amount of the

transfer payment(s).[10] The transfer account column then makes the payment to the household account.

Fourth, financial capital finds its way into the Tri-County Region by means other than local financial institutions.[11] When interest payments are made on this outside finance, the dollars involved leave the region; a lower bound estimate for this phenomenon was $2,817,486 for interest paid to private accounts and $3,473,114 paid to the federal government. To account for this, the total gross output of the regional financial institutions was increased by $6,290,600 so that all interest payments in the region could be shown as being made to the finance sector. The finance sector then charged the transfer row with the amount of the increase and the transfer column charged the same to the imports from Colorado other than the Tri-County Region and federal government account.

Fifth, interest paid by local financial institutions ($4,157,176) on savings accounts and certificates of deposit were charged against the transfer account row. The transfer account distributed this interest among various row entries with a prorated estimate of regional interest income.

Finally, the transfer account was used to close profits, interest, rents, and the like into the household sector and to expatriated profits. To accomplish this, the transfer account column shows a $96,864,880 credit at the intersection with the profit sector while $36,293,952 is charged at the intersection with the household row.

Where enterprise accounting was employed, the profit sector includes after tax profits, charges to reserves for bad debts, capital loss amortization, and outlays for rents and royalties.[12] Where government fund accounting was employed, the profit sector includes surplus of current revenues over

current[13] expenditures,[14] the value of capital expenditures appropriated out of current revenues, contributions to bond indenture sinking funds out of current revenues, net charges out of current revenues to any other reserve fund (.e.g, contingency funds), and rent payments. The profit sector is shown exporting $5,258,253. Of this amount, $1,520,838 represents what investors had to pay in local property taxes and a power plant under construction; $1,365,549 is interest income from front range financial institutions, and $2,371,866 represents the estimate of dividend income flowing into the region from the outside world.

The depreciation sector includes both depreciation and net inventory depletions. Inventory depletions are, relatively speaking, insignificant and are placed with depreciation charges. Similarly, the net inventory accumulation values were incorporated in the investment sector.

With the exception of the intersection of the household row and the transfer column and the household on household cell, the household row represents wages and salaries paid subject to withholding. In the absence of an adequate source for domestic employment earnings, 67 employees[15] are assumed to be full time equivalents at $2.50 an hour for 2,000 hours.

QUESTIONNAIRE DESIGN AND USE

Previous experience with questionnaires employed to obtain primary information for interindustry models suggested that a questionnaire, as such, should not be used in the pursuit of the primary data. The reason behind this is that no firm accounts for expenditure and revenue patterns on an SIC basis, the language ultimately employed in an interindustry model. Rather, a firm's books are designed around process or product activities. The use of a questionnaire, either by mail or by interview, presupposes adequate

translation from a firm's accounting language into SIC codes. The typical entrepreneur or manager does not ordinarily work with SIC descriptions, a rather precise and technical language.

Accordingly, a determination was made to conduct all interviews in a basic accounting language tailored to the individual firms involved and for the researcher to make the translation to SIC classification. Thus, the questionnaire form which appears in the appendix represents the format for the final translation by the researcher. A large majority of the primary data were originally collected in field notes that described the detail behind profit and loss statements for the firms interviewed.

Not all interviews could, however, be conducted as planned. It was found, for example, that some firms would have to refer for legal advice while others did not want to reveal information in the form desired. Even though it was established that the research should not solicit primary data through the mail, it was necessary to design a questionnaire for use both as an interview focal point and as an item that could be left with an interviewed firm.

The questionnaire was designed to fit three sheets of paper. A cover sheet was used to briefly explain the nature of the research and to solicit information on the nature of the firm's product lines, the number of employees, water use, and level of capacity utilization. Outlay patterns, both of a cash flow and a non-cash flow nature, were the concern of the second sheet; information on sales distribution was solicited on the third. Both sales and outlay patterns were disaggregated by Northwestern Colorado interindustry study sector descriptions and regionalized according to (a) Northwestern Colorado, (b) Colorado other than the Northwestern region, and (c) activity

outside Colorado. A question on water use was included to provide information on sector-by-sector water withdrawals. The level of production capacity utilization question was used to provide general background information.

SELECTION OF THE BASE YEAR

Other than a consumer price index for the Denver metropolitan area[16] there is no price index constructed specifically for Colorado. This effectively removes one criterion (relatively stable prices) from consideration when selecting a base year for Colorado economic studies. The 1974 base was selected for the following two reasons.

Interviewing for the Northwestern Colorado interindustry study commenced in February 1975. Calendar 1974 was the most recently completed accounting cycle for most firms; it was anticipated that the information from this cycle would be qualitatively speaking, foremost in the command of the interviewees. Also, activities of relatively new firms were automatically incorporated in the primary data base by soliciting what was then the most current information.

CONDUCT OF THE SURVEY

Interview schedules were arranged by telephone beween three days and a week in advance. Every effort was made to gain an interview with the person who would have immediate authority to release information. The length of time spent on an individual interview varied from firm to firm: several were conducted in less than an hour; some took place over several days. The interviews were conducted over a fifteen month period.

PROCESSING THE DATA

Information gathered on the outlay and sales patterns for any given enterprise was tabulated to conform to the sector delineations and regional descriptions as defined in Table 2-1. Care was exercised at this step to assure a balance between outlays and sales. Any anomalies were checked and corrected before proceeding further.

The next step was to aggregate questionnaire forms within a sector and to expand the information to represent gross flows. An iterative process was used to accomplish this so that the relative composition of a given sector delineated for the Tri-County interindustry model would be more truly reflected.[17] The final iteration produced gross flow patterns for the respective sectors delineated in the model.[18] The gross flows identified in this manner provide the border totals for the initial transactions statement.

Reconciling discrepancies in any given transaction cell is to be expected; only if the research yielded perfect knowledge about outlays and sales would this be avoided. A discrepancy can emanate from one of several sources or a combination thereof. The sales or purchases of one industry to or from another industry can be misrepresented, or the total gross output value for individual sectors can be in error. In the former case other rows and columns are affected by the error. In the latter, there is an aggregate distribution error in both outlays and sales for that sector. Each discrepancy is examined individually and reconciled on a case-by-case basis. Fortunately, the sources of relatively large discrepancies could be isolated and remedied through additional examination. Small discrepancies were reconciled by using imports from and exports to the world other than Colorado as residual accounts.

DATA SOURCES BY SECTOR

(1) Agricultural Production SIC 01, 02, 07

Colorado. Department of Agriculture. Colorado Crop and Livestock Reporting Service. Colorado Agricultural Statistics. Annual.

Colorado State University. Cooperative Extension Service Data. Department of Economics.

Industry survey data.

U.S. Department of Commerce. Bureau of the Census. Census of Agriculture: 1969. Volume 1, Area Reports, part 41, Colorado, Section 2, County Data. Washington, D. C.: Government Printing Office, 1972.

Colorado Agricultural Statistics reports crops on a production and market value basis. By contrast the total gross output in the interindustry model is reported on a market receipts basis. The implication of this difference is not too critical when virtually all production is marketed; this is not the case with hay, however, the major crop of the three counties. Thus to obtain an estimate of the market receipts from hay the ratio of hay marketings reported in the 1969 Federal Census of Agriculture to the 1969 market value of hay reported in Colorado Agriculture Statistics was applied to the latter's 1976 report.

Data on the value of marketings of livestock are not published on a county basis in Colorado. Thus, the value of the total gross output of the livestock sector in the three counties was determined from information secured from the Cooperative Extension Service. The value of output by agricultural services was estimated by using information gained in surveys conducted during 1975.

(2) Coal Production SIC 12

Colorado. Department of Natural Resources. Division of Mines. A Summary of Mineral Industry Activities in Colorado. Part I: Coal. Annual.

Colorado. Public Utilities Commission. Files.

Hebb, D. H., and Curtin, M. S. "Colorado Coal: A Production and Shipment Directory." (U. S. Department of Interior, Bureau of Mines.) Golden, Colorado: Colorado School of Mines Mineral Economics Institute, 1977. (Xerox reproduction.)

Industry survey data.

Data on tonnage and labor days are available in the Division of Mines publication on a mine by mine basis. The PUC files, the Hebb-Curtin study, and survey information provided the data used in estimating price. Observe that the sale by coal production to the investment component of the region's economy is an inventory accumulation figure that in due time will be influenced by electric power generation.

(3) Oil and Natural Gas Production SIC 13

Colorado. Department of Natural Resources. Division of Mines. A Summary of Mineral Industry Activities in Colorado. Part II. Metal-Nonmetal Annual.

Colorado. Department of Natural Resources. Oil and Gas Conservation Commission. Oil and Gas Statistics. Annual.

Industry survey data.

Pederson, John A., and Rudawsky, Oded. "The Role of Minerals and Energy in the Colorado Economy." (U. S. Bureau of Mines Grant No. G-0122090.) Golden, Colorado: Department of Mineral Economics, Colorado School of Mines, 1974. (Xerox reproduction.)

Total gross output values for oil and natural gas production were taken from the State of Colorado publications. Interindustry flows were estimated by using the Pederson-Rudawsky study adjusted and updated with information gained in independent surveys and using both Nelson and Wholesale Price Indices. It should be noted that the intrasector transaction estimate (essentially operators purchasing from field services) causes the total gross output value of the sector to be greater than the output value of crude and natural gas.

Also, the market value of stripper wells and natural gas production increased at a greater rate than did input prices from the time of the Pederson-Rudawsky study to 1976. After accounting for increased royalty values (an estimate based on the United States Government's royalty revenues) and increased input prices there was still a considerable portion of the regional oil and gas dollar that was unaccounted for. That residual was charged to profits and the imputed federal and state corporate income taxes.

(4) Construction SIC 14, 15, 16, 17

Colorado. Department of Labor and Employment. Files. Industry survey data.

Information gained by interviews with contractors was used to calculate a ratio between contract value and outlay for labor on a two-digit SIC level. This ratio was then applied to the

annualized employment and wage data for 1976 provided by the Colorado Department of Labor and Employment to estimate total gross output.

Note is made of the inclusion of SIC 14, nonmetalic mining, in the construction sector of the model. This was necessary to avoid disclosing information peculiar to a limited number of operators.

(5) Manufacturing SIC 20, 24, 25, 27, 28, 32, 35, 38, 39

Colorado. Department of Labor and Employment. Colorado Manpower Review. Monthly.

Colorado. Department of Labor and Employment. Files. Industry survey data.

Information gained by interviews, conducted for the year 1974 in northwestern Colorado, was used to calculate a ratio between total gross output value and outlay for labor on a two digit SIC level. This ratio was then applied to the 1974 annualized employment and wage data provided for the three study counties by the Colorado Department of Labor and Employment to estimate total gross output at the two digit level. The change in wages per employee per two digit SIC classification in the State of Colorado, as reported in the Colorado Manpower Review, from 1974 to 1976 was used as a proxy to initially boost the 1974 output values to 1976 dollars. Select manufacturers were contacted to gain information necessary for further refinement of changes in both real and dollar values.

About half of the manufacturers in the three county region were included in the initial surveys; these were originally part of another study concerning nine counties in northwestern Colorado. For those firms not directly surveyed in the three counties the survey results from the nine county study were used as a proxy. It is unlikely that this method seriously biases the results as the firms involved rely on rather standardized technology, e.g., dairy manufacturing.

(6) Transportation and Communication SIC 40, 41, 42, 45, 47, 48

Colorado. Department of Labor and Employment. Files.

Colorado. Public Utilities Commission. Files.

Colorado. State Auditor. Files.

Industry survey data.

Information pertinent to railroad and telephone communications was gained from filed PUC reports and survey. Because of the nature of the accounting systems employed by the firms involved, a significant amount of prorating was required to scale the data to approximate the three county conditions. The methods of prorating, originally developed for 1974 conditions in nine northwestern Colorado counties* were applied to reported 1976 data.

Where the airports are operated by local public authorities the relevant information was obtained from reports filed with the Colorado State Auditor.

*The Economy of Northwestern Colorado: Description and Analysis, Contract Report, Bureau of Land Management, March 1977, S. L. Gray, J. R. McKean and J. Weber.

Data on employment and earnings for components other than rail and air transportation sectors were obtained for the year 1974 from the Colorado Department of Labor and Employment and the 1974 nine county survey provided an estimation for the output level. For a first approximation of 1976 conditions the output index value of the trade sectors (for the index method see the section on trade) was used as a proxy for real growth. A tarrif increase of fifteen percent was used to represent price changes.

(7) Electric and Natural Gas Utilities SIC 491, 492

Colorado. Department of Labor and Employment. Files.

Colorado. Public Utilities Commission. Files.

Colorado. State Auditor. Files.

Industry survey data.

A certain amount of prorating and imputation was involved in this sector because of geographic location of activity. For example, power is generated at the Hayden power plants (in the three county region) and transmission of that power takes place both within and outside of the region. Thus using the 1976 PUC report for Colorado Ute Electric Association, the direct cost of power generation at the Hayden sites was accounted for in the three county output value. Power deliveries to White River and Yampa Valley Electric Associations were treated as regional uses of Hayden power; the balance of Hayden power was treated as an export. The transmission expense incurred by Colorado Ute were prorated over the miles of line in the three county region and miles of line outside the region with the former

being imputed to three county output value. Depreciation charges, interest, property taxes, general overhead, and profits were each directly charged to regional output or prorated depending on the case at hand and the information available. Note is made here that property taxes on plant under construction are shown in the transaction table as being charged to the investment column.

Similar techniques were used to impute regional output values to the activities of firms such as Moon Lake Electric Association, West Slope Gas Company, Greeley Gas Company, and so forth. Electric and gas activities under the control of local public authorities were identified by examining 1976 reports filed with the State Auditor. Finally, information gained from the Colorado Department of Labor and Employment and from interviews provided cross checks throughout the estimation of the activities of this sector.

(8) Wholesale Trade SIC 50, 51; also

(9) Retail Trade SIC 52, 53, 54, 55, 56, 57, 58, 59

Colorado. Department of Labor and Employment. Colorado Manpower Review. Monthly.

Colorado. Department of Labor and Employment. Files.

Colorado. Department of Revenue. Annual Report. Annual.

Industry survey data.

Interviews conducted for the nine county study in northwestern Colorado with a 1974 base year were used to determine the basic outlay patterns for the trade sectors for the 1976 three county

model. Modifications from the 1974 data file were made as follows: sales data, as reported in the Colorado Department of Revenue's Annual Report were annualized and extrapolated to cover the six months beyond the published fiscal 1976 information. By using information reported in the Colorado Manpower Review with respect to state wide employment and earnings in the trade sectors and the Department of Revenue's state wide information on trade sector sales an index was constructed to facilitate establishing the dichotomy between output changes and price level changes in Colorado between 1974 and 1976. The output change ratio was used to boost the 1974 employment as determined from data provided by the Colorado Department of Labor and Employment. Finally, the 1974 survey information was modified to allow for relative price changes in select inputs, specifically newspaper advertising, transportation, communications, electric and gas utilities, payrolls, and local taxes.

Mention is made here of the practice of "margining" the trade account sectors. With rare exception, convention dictates that the trade sectors are entered in the interindustry model at the level of gross margins. The reasoning behind this is to facilitate showing the direct economic links between producers and users. The absence of margining would interject the huge trade sector dollar turnover between producers and consumers. The three county regional model was margined. The output of local producers was distributed to the various sectors in accordance with survey findings. Where the output,

e.g., milk products, ordinarily goes first to a trade sector, e.g., grocery stores, before going to a regional user, e.g., households in the model, the sale was made directly. A margin on the sale is attributed to the trade sector. Merchandise imports by the trade sectors were prorated and assigned to the various regional sectors based on the relative volumes of purchases from the trade sectors.

(10) Finance, Insurance, and Real Estate SIC 60, 61, 62, 63, 64, 65, 66

Colorado. Department of Labor and Employment. Colorado Manpower Review. Monthly.

Colorado. Department of Labor and Employment. Files.

Colorado. Department of Regulatory Agencies. Division of Insurance. Insurance Industry in Colorado: Statistical Report. Annual.

Colorado. Department of Revenue. Annual Report. Annual.

County Clerk Offices, respective counties. Files.

Federal Credit Banks of Wichita. Files.

Federal Home Loan Bank Board. Combined Financial Statements - Member Savings and Loan Associations of the Federal Home Loan Bank System. Annual.

Industry survey data.

Sheshunoff & Company, Inc. The Banks of Colorado. (A private publication.) Annual.

The output value of the finance sector was entered in the three county interindustry model as the estimated value of interest charges incurred within the region. Interest earnings by commercial banks were readily identified in the Sheshunoff publication; likewise, the

Federal Credit Banks of Wichita provided data relevant to the operations of the Production Credit Association and Federal Land Bank Association. Regional information on the activities of savings and loan associations is not readily available so the data published for Colorado in the Federal Home Loan Bank Board's Combined Financial Statements was prorated by a wage and salary formula for the three county region. Survey data was used both as a cross check to published data and to estimate financing from outside the region, e.g., certain school bonds, Rural Electrification Association loans, insurance company loans, and so forth.

Information gained in interviews with several major insurance companies in the 1974 nine county interindustry study suggested that a precise accounting for insurance premiums paid on per county basis was a near impossibility. Another difficulty observed was with respect to loss claims; specifically, in a small region the losses incurred by any one economic sector cannot be predicted with any certainty. Thus, for the three county interindustry model the insurance sector was handled as follows.

Gross insurance premiums paid in the three county region were approximated by prorating premiums paid in the State of Colorado by a personal adjusted gross income figure. Premiums paid in Colorado are reported in the State Division of Insurance's Statistical Report; personal income is reported in the Department of Revenue's Annual Report. The state loss experience ratio was then used to split gross premiums paid; the loss portion was charged to the transfer account in

the three county interindustry model and the balance was charged as gross output of the insurance sector. Accordingly, the transfer row collects the portion of premiums paid that subsequently reimburses for losses and the transfer account column distributes the same to contractors, auto dealers, health practitioners, and so forth. (The reader is alerted to the fact that the transfer account is also used for other purposes in the model; see the section on transfer account.)

Information on documentary fees paid for real estate transactions was secured from the county clerks in the respective counties. The fee information was used to estimate the gross value of transactions and survey information provided a means to estimate the commissions which make up the gross output of the real estate sector.

Survey information collected for the 1974 nine counties in northwestern Colorado provided the means to make a first approximation distribution of the total gross outlays in the finance, insurance, and real estate sector. Select adjustments were then made to accomodate certain relative price changes such as for utilities, taxes, and wages.

(11) Services SIC 70, 72, 73, 75, 76, 78, 79, 81, 86, 89

Colorado. Department of Labor and Employment. Colorado Manpower Review. Monthly.

Colorado. Department of Labor and Employment. Files.

Colorado. Department of Revenue. Annual Report. Annual.

Industry survey data.

U. S. Department of Commerce. Bureau of the Census. Census of Selected Service Industries, 1972: Area Series, Colorado, 72-A-6. Washington, D. C.: Government Printing Office, 1974.

Sales by the hotels and other lodging facilities sector were estimated by annualizing the pertinent information reported in the Department of Revenue's Annual Report; as with the trade sectors, an extrapolation factor was used to cover the last six months of 1976. Also analogous to the treatment of the trade sectors, an index was built to separate real from money growth in this sector in the State of Colorado. Employment from 1974 to 1976 was allowed to grow in accordance with the real growth index as applied to the three county region's situation. Wage rates in the lodging sector were allowed to rise in accordance with the Colorado experience as determined from the Manpower Review. Survey information from the 1974 interviews was further modified to account for relative price changes.

Estimation of the output value of the other service sectors was accomplished as follows. The Census of Selected Service Industries provided certain information on output and employment in the study counties and the entire state for 1972. Census disclosure requirements cause a considerable amount of data aggregation to take place at the county level. Thus by using Department of Labor and Employment data for the respective counties in 1972 and Colorado productivity ratios, calculated from the Census, the reported county output data was disaggregated on a three digit SIC basis.

Real output changes from 1972 to 1974 were then accounted for by using employment and earnings data provided by the Department of Labor and Employment. Output changes from 1974 to 1976 and price changes from 1972 to 1976 were approximated by utilizing an index analogous to

the index described in the trade sectors. Outlay distributions were estimated from information gained by interview, and select adjustments were made to accomodate relative price changes.

(12) Health SIC 80

Colorado. Department of Labor and Employment. Files.

Colorado. Department of Revenue. Annual Report. Annual.

Colorado. State Auditor. Files.

Industry survey data.

Health facilities owned by local public authorities had current financial statements on file with the State Auditor. The delivery of services in nursing home situations were used as they appeared in the 1974 nine county study. Other components of the health medical care sector were increased from the estimated 1974 conditions in accordance with population increases as reported in the Department of Revenue's Annual Reports. Further adjustments were made for relative price changes. Information was not available to estimate changes in wage rates from 1974 to 1976 for this sector so the state change in the retail trade sectors was arbitrarily used as a proxy.

(13) Education SIC 82

Colorado. Department of Education. Files.

Colorado. Department of Education. Revenues and Expenditures: Colorado School Districts. Annual.

Industry survey data.

Information on public school districts is published on a school year basis in Revenues and Expenditures. The 1976-77 data had yet to

be published so the Department of Education's files were used to secure information pertinent to the latter part of 1976. Information on the Rangeley Junior College District and the Colorado State Extension Service was secured directly. All data were annualized and distributed on the basis of survey information.

(14) Water, Sewer, and Trash SIC 494, 495; also

(15) Local and County Roads; also

(16) Local and County Government; also

(17) Local and County Taxes

Colorado. State Auditor. Files.

Industry survey data.

The 1976 audit reports for all local and county government authorities were examined and the data contained therein were aggregated. Information gained in select interviews facilitated the distribution of the various sectors' outlays.

Mention is made of an accounting device in the three county model, namely the tax account. Conventional interindustry transactions tables charge the local and county government cells in respective columns with the value of taxes paid. The subtle assumption in such a procedure is to the effect that respective sectors "buy" a service from the local and county government authorities. The disaggregation of the local and county government functions in the three county model, if convention were followed, would have required prorating taxes paid by any one economic sector. The procedure

would produce rather untenable results, e.g., the agriculture sector would be shown as purchasing from health medical care, education, and so forth. To avoid this dilemma, the tax account row collects all local and county property, specific ownership, and sales taxes and the tax account column distributes these monies to the various agencies.

(19) Households

Colorado. Department of Labor and Employment. Files.

Colorado. Department of Revenue. Annual Report. Annual.

Colorado. Public Employees Retirement Association. Files.

Colorado State University. Cooperative Extension Service. Trade Areas Study: Northwest Colorado Area. Fort Collins, Colorado, May 1966.

Community Services Administration. Federal Outlays in Colorado. Annual. (Prior to fiscal 1975 published by Office of Economic Opportunity.)

Industry survey data.

U. S. Department of Commerce. Bureau of the Census. Census of Population, 1970: General Social and Economic Characteristics, Final Report, Colorado, PC (1)-C7. Washington, D. C.: Government Printing Office, 1972.

U. S. Department of the Treasury. Internal Revenue Service. Statistics of Income 1969, ZIP Code Area Data from Individual Income Tax Returns. Washington, D. C.: Government Printing Office, 1972.

Household income in the three county interindustry model is shown as emanating from wages and salaries subject to withholding, proprietorship, partnership, and Sub-Chapter S Corporation income, interest, rent, and dividend income, and transfer payments.

The Department of Revenue's Annual Report publishes, on a county basis, personal adjusted gross income figures. Because the latest published Annual Report covered through fiscal 1976 (largely covering calendar 1975 returns), the first approximation of the 1976 personal adjusted gross income was made by extrapolating from the previous several years' trend. The Statistics of Income publication of the IRS was set against the Department of Revenue's report for the corresponding year and the ratio used to approximate what federal adjusted gross income was for 1976. Likewise the ratios of dividends and interest to adjusted gross income as reported in Statistics of Income were used. A word of caution is exercised on two accounts: first, the IRS publication was 1969; and second, the ZIP Code areas on the Western Slope do not fit county lines. It is not felt that either of these seriously affect the estimations because the relative amounts involved are rather small.

Audit reports for the respective countries provided information on the level of payments made to households by the three counties' departments of social services. An estimate of payments by the Colorado Public Employees Retirement Association was made based on information provided by the Association. The value of transfer payments made by the U. S. Government was approximated by annualizing the reported information in Federal Outlays. Life insurance distributions were estimated in accordance with the procedure described in the insurance section of this writing.

Payments made to the household account by the respective regional economic sectors reflect an estimate of wages paid subject to withholding. For most of the private enterprise portion of the economy, this estimate reflects the place of work data base provided by the Colorado Department of Labor and Employment files. Estimates on the earnings of agricultural, railroad, and government employees reflect the information sources peculiar to those sectors. The household on household cell was imputed by taking the domestic employment figure from the Census of Population and annualizing a $2.50 wage rate. The transfer column entry for households is a closing entry that is described in detail in the transfer account section. Essentially it is an entry that brings non-wage and salary income to the household sector.

Households were not surveyed to gain information on their outlay patterns. Rather there was a reliance on the sales information provided by regional producers. Accordingly, the import figure, aside from the post marginal trade sector merchandise, for households is largely a residual value. Examination of the data in the Extension Service's Trade Areas Study suggested that this was not an unreasonable procedure. The reason the Trade Areas Study was not used directly was because of its dated findings.

(20) State Government; also

(21) Federal Government

Colorado. Department of Education. Revenues and Expenditures: Colorado School Districts. Annual.

Colorado. Department of Highways. Colorado's Annual Highway Report. Annual.

Colorado. Department of Natural Resources. Division of Wildlife. Colorado Big Game Harvest. Annual.

Colorado. Department of Natural Resources. State Board of Land Commissioners. Summary of Transactions. Annual.

Colorado. Department of Planning and Budget. Files.

Colorado. Department of Revenue. Annual Report. Annual.

Colorado. State Auditor. Files.

Colorado. Public Employees Retirement Association. Files.

Colorado. Public Utilities Commission. Files.

Community Services Administration. Federal Outlays in Colorado. Annual. (Prior to fiscal 1975 published by Office of Economic Opportunity.)

Industry survey data.

Sheshunoff & Company, Inc. The Banks of Colorado. (A private publication.) Annual.

U. S. Department of the Treasury. Bureau of Government Financial Operations. Combined Statement of Receipts, Expenditures and Balances of the United States Government. Washington, D. C.: Government Printing Office. Annual.

U. S. Department of the Treasury. Internal Revenue Service. Statistics of Income 1969, ZIP Code Area Data from Individual Income Tax Returns. Washington, D. C.: Government Printing Office, 1972.

Total gross output for the government sectors is defined in terms of the estimate of revenues from all sources. For private enterprise in the endogeneous portion of the model an estimate was made of income and payroll tax liabilities and fees and royalties paid by each respective sector. There is no real cross check against these estimates because neither Colorado nor the U. S. Government report business tax liabilities

on a county basis. Further, previous research experience has demonstrated that prorating the reported state level of collections (reported in the Treasury's Combined Statement of Receipts Expenditures and Balances and the Department of Revenue's Annual Report) by such factors as population or personal income produces questionable results.

Personal tax and fee liabilities were much more readily estimated by using such publications as the Department of Revenue's Annual Report, the Division of Wildlife's Big Game Harvest, and the IRS's ZIP Code Area Data. The exports by the State of Colorado include estimates of sales taxes and non-resident hunting fees collected from tourists in the three county region.

All estimates of government revenues were annualized and put on a 1976 basis. Expenditures were likewise adjusted.

For the U. S. Government, the publication Federal Outlays was used as a first approximation of expenditures. Select interviews with the larger agencies, such as the U. S. Forest Service, Bureau of Land Management, and U. S. Postal Service, provided the information to estimate agency operating expenditure patterns. Information on direct payments for such things as schools, interest on government securities held by commercial banks, highways, and local government activities was taken from the Colorado Department of Education's Revenues and Expenditures, Sheshunoff's The Banks of Colorado, Colorado's Annual Highway Report, and files in the Colorado State Auditor's Office.

State of Colorado Expenditures were first approximated by information contained in regionalized budgets provided by the Department of Planning and Budget. This information was on a state planning region basis and was designed for State analysis for the fiscal 1976 budget so modification was necessary on an agency by agency basis. Contacts were made with the larger agencies such as the Division of Wildlife and the State Department of Highways to accomodate this requirement.

The estimates for revenues for both the State of Colorado and the U. S. Government exceeded the estimates of their outlays. This difference was charged to the transfer account and the transfer account treats them as an import to the three county region.

(22) Transfer Account

The transfer account is an accounting device that allows for two unique and distinctive characteristics that are not found in conventional regional interindustry studies. First, the assumption that transfer payments cancel in the net is dropped. Second, the model handles financial balances in such a manner as to give rise to a definition of regional income more analogous to the definition of national income. A schedule of the transfer account as it appears in the initial transaction table is shown in the appendix.

Entrepreneurial earnings and rents were charged to the profit row. The profit row entries for the various local and county government columns account for funds set aside for capital expenditures and bond principal repayments and the surplus of revenues over commitments. The profit row entry for the household column largely represents the estimate of household saving. The profit row also "exports" household dividend income to the world, a portion of household interest income to Colorado outside the three county region, and the property taxes paid on electric plant under construction to the greater part of Colorado.

Many organizations and business firms have funds in interest earning deposits. No satisfactory method was discovered to assign these interest earnings to the various sectors. Thus, after assigning estimated interest income to households and the various government sectors, the transfer column charges the profit row with the undistributed residual.

Survey information was used to estimate the investment column. The value of investment was then set against the value of the profit and depreciation rows. Out of the net difference, the estimate of entrepreneurial income was taken and closed to households; the residual after accounting for entrepreneurial income was treated as expatriated profits.

The oil shale column in the basic transaction table was designed to block out space in the computer program for projection of the industry at a latter time.

(25) Imports - Colorado; also

(25) Exports - Colorado; also

(26) Imports - World; also

(26) Exports - World

Imports and exports in the three county interindustry model were estimated by using survey information. Also, in the process of reconciling and balancing the transactions table, the entries in these rows and columns were used as the adjustment mechanism.

(28) Labor

Colorado. Department of Labor and Employment. Colorado Manpower Review. Monthly.

Colorado. Department of Labor and Employment. Files.

Industry survey data.

U. S. Department of Commerce. Bureau of the Census. Census of Population, 1970: General Social and Economic Characteristics, Final Report, Colorado, PC (1) - C7. Washington, D. C.: Government Printing Office, 1972.

The labor estimates are annualized full time equivalents of wage and salaried employees. Further, the estimates refer to work performed within the three county region. The private sector of the economy, with the exception of agriculture, was estimated by using the quarterly report information by place of work submitted to the Colorado Department of Labor and Employment. This information was secured for 1972, 1973, and 1974 on a four-digit SIC basis. With the exception of the construction sectors, these data points were adjusted on a sector by sector basis to approximate 1976 conditions. The securing of useable data from the 1976 quarterly reports would have been an extremely expensive and time consuming process which could not be justified for the three county study. Because of the volatile nature of the construction sectors an exception was made and the information was secured directly.

No single source or agency seems to be able to provide an adequate estimate of annualized full time equivalent employment in agriculture. Consequently, the published estimate of farm labor in the 1970 Census of Population was used as a proxy. Employment by government agencies was estimated by using survey information.

Caution is exercised to the fact that employment levels as defined in the three county interindustry model do not approximate employment levels as defined in some commonly distributed publications. The Colorado Manpower Review, for example, publishes county estimates on the resident adjusted labor force. Aside from the definitional difference, and the fact that employment by industry is not reported for low population counties, the current method used to estimate the resident adjusted labor force is extremely questionable. The reader is referred to the January 1977 Manpower Review for a complete discussion on this matter. (excerpts are attached)

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COLORADO TRENDS

Colorado labor force estimates have recently been benchmarked to the 1976 national Current Population Survey on a state-wide basis. This benchmarking process has introduced substantial adjustments to previously published employment and unemployment estimates for the State as far back as January 1970. Consult the article beginning on page 3 of this edition for a discussion of this development and its effect on future data presented in the Manpower Review.

On a seasonally adjusted basis the Colorado unemployment rate dropped to 5.2 percent in January, an improvement over the 5.5 percent registered during December 1976 and the lowest level achieved since December 1974. The State unemployment rate last year at this time was 6.0 percent.

The number of Colorado jobless dipped to 63,800 in January after seasonal adjustment -- down 3,900 from December and 7,800 from a year ago. The level of unemployment in the State has been declining since November 1976, according to the seasonally adjusted series, indicating a definite trend toward improvement in Colorado labor market conditions during this period.

Seasonally adjusted January employment showed a growth of 14,600, rising to 1,170,800. This is 56,200 above the year ago figure of 1,114,400 and the highest level reached to date in this series. Colorado employment has registered steady monthly growth since August 1976.

The unadjusted unemployment rate for January in Colorado was 5.9 percent, up from December's 5.7. Unadjusted employment dropped 21,600 and unemployment rose 900 from December. The relative movements in the seasonally adjusted and unadjusted Colorado labor force series indicate that historically January has generally been a month of rising unemployment and falling employment. (For a discussion of seasonal adjustment see "Seasonally Adjusted Labor Force Data Introduced," in the November 1976 issue of the Manpower Review.) The magnitudes (continued on page 2)

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COLORADO LABOR FORCE ESTIMATES BENCHMARKED TO CURRENT POPULATION SURVEY

Introduction of Statewide Survey:

Due to an overall expansion in coverage the national Current Population Survey (CPS) is now being used as an annual benchmark for all Colorado labor force estimates. The revisions in the originally published data series caused by this benchmarking process will affect estimates back to January 1970 for every Colorado area except the Denver-Boulder LMA. The Denver area has been benchmarked to the CPS for the past several years and thus revisions prior to 1974 are minimal.

Since 1940 the household survey procedure known as the CPS has been utilized to compile labor force statistics on the national level. At the present time some 55,000 housing units around the country are assigned for interview each month in this survey. In contrast, labor force data on the local level is derived through a federally developed procedure involving the use of locally available information from administrative data systems and derived statistical relationships. It is widely believed that the household survey technique utilized at the national level is much more consistent and reliable than the mathematical building block approach used locally.

In 1974 the federal Bureau of Labor Statistics (BLS) made provisions for the benchmarking of local labor force data to the CPS in those areas in which the CPS sample was of sufficient size to produce a locally valid annual average. In Colorado this meant that employment and unemployment estimates for the Denver-Boulder LMA began to be benchmarked annually to the CPS, while figures for the balance of the State area were computed in the historical manner without benchmarking.

State Methodology and BLS Methodology:

At the time of the 1975 CPS benchmark for the Denver-Boulder LMA, which occurred in early 1976, the BLS also instituted a program of adjusting labor force data in non-CPS areas of the country to broad national CPS totals. This had the net affect of lowering unemployment rates in all Colorado areas outside Metropolitan Denver for 1975 and 1976 at the same time that the regular CPS benchmarking process in the Denver-Boulder LMA drastically raised the area's unemployment. (For a more in-depth discussion of these events, see the April 1976 issue of the "Colorado Manpower Review.")

During this period the Research and Analysis (R & A) unit of the Colorado Division of Employment and Training, after much study, felt that the BLS mandated adjustments to the Colorado labor force series did not take into account Colorado's unique situation of being partially a CPS area and partially a non-CPS area. R & A decided to produce, in addition to the data calculated utilizing all the BLS mandated adjustment for federal program purposes, another labor force series for all Colorado areas which could be used for economic analysis. Thus came about the division of "State methodology" and "BLS methodology." In the State methodology series for economic analysis, the BLS method of extrapolating the 1975 CPS level into 1976 for the Denver area was modified to allow for changing economic conditions. The result of utilizing this variable extrapolator was an overall lowering of the unemployment rate in the Denver Metropolitan area during 1976, as compared to the rate calculated under strict BLS methodology. For areas

outside the Denver-Boulder LMS, the State methodology series disregarded the procedure of adjusting employment and unemployment data in non-CPS areas to meet broad national CPS levels. The result was a higher unemployment rate for these "balance of the State" areas than that recorded by the BLS methodology. It should be re-emphasized that the distribution of federal monies to high unemployment areas was based on the federally mandated BLS series of labor force data.

The recent release of 1976 CPS data for both the Denver-Boulder LMA and the State of Colorado as a whole indicates that the position adopted by the R & A staff during 1976 was justified. Revisions introduced from the 1976 CPS benchmark have substantially lowered the estimated unemployment rate in the Denver metropolitan area even below the level produced by the State methodology. In areas outside Denver, the expanded 1976 CPS indicates that unemployment was being significantly underestimated by the strict BLS methodology and also to a lesser extent by State methodology. The net result of the 1976 CPS benchmark is statewide 1976 unemployment rates that are very similar to the ones originally published under both State and BLS methodologies. Large adjustments, however, are made from the BLS methodology in the distribution of unemployment between the Denver-Boulder LMA and the balance of the State.

According to the current CPS benchmark, the annual average unemployment rate for the State of Colorado was 5.9 percent in 1976. Both State and BLS methodologies indicated a 1976 Colorado unemployment rate of 6.0 In the Denver-Boulder LMA, however, the 1976 CPS derived unemployment rate was 6.1 percent, compared to 6.6 under State methodology and 6.8 percent under the BLS mandated procedure. In the balance of the State, CPS figures showed a 1976 annual average unemployment rate of 5.6 percent, while computed under State methodology the 1976 rate was 5.2 percent and under BLS methodology it was 4.8 percent.

State Methodology Series Discontinued:

As previously indicated, the adjustment in Colorado unemployment rates which have come about as a result of expanded CPS measurements are in line with the anticipations of the Research and Analysis staff. They indicate that the variations from the strict BLS procedures which were encompassed in the State methodology series of labor force calculation were, indeed, a step in the right direction. However, with the introduction of statewide CPS benchmarking, the contradictory treatment of labor force computations in Colorado's non-CPS areas which occurred under mandated BLS procedures has been abolished. It is now felt that the State methodology concept of labor force calculation has served its purpose and the primary cause of its inception has disappeared. Since all Colorado labor areas are now benchmarked directly to the CPS, there will no longer be published separate labor force estimates computed under State and BLS methodologies. Labor force statistics computed under BLS/CPS methodology will be put forth as both a tool for economic analysis and a requirement for federal program eligibility purposes. Hopefully, this approach will also result in less confusion concerning employment and unemployment data.

This is not to say that R & A analysis of the computational processes and the validity of Colorado labor force estimates will cease. Even under the current system of statewide benchmarking to CPS levels, there is room for questioning and discussion.

Reliability of Current CPS Data:

In the past, the unemployment side of labor force estimating has usually received the most emphasis. The level of unemployment and the unemployment rate has tended to be the overriding concern of people interested in the validity of statistics for Colorado or any other area. It should be realized, however, that the calculation of employment is also important and changes in the rate of job growth can be very meaningful in the analysis of economic trends.

According to CPS figures, in 1976 Colorado showed a gain of some 72,000 jobs over the prior year. That would be the second highest annual employment growth for the State since the compilation of labor force data began--in the only higher instance employment grew by 93,000 during the 1972-73 period according to the CPS. 1976 was definitely a year of recovery for the Colorado economy, but an expansion of 72,000 people on the employment side does not appear to be justified at this point.

This magnitude of job growth has, so far, not materialized in any other data systems which reflect on the total employment level. The Current Employment Statistics (CES) program data on nonagricultural wage and salary employment by place of work, which is derived from a monthly mail sample survey of employers and appears regularly in the Manpower Review, indicates job growth between 1975 and 1976 in Colorado of just over 27,000. Admittedly, this series is not equivalent to the total employment calculation, and due to the benchmark timing of the CES program, some growth occurring in employment is not registered. The currently published CES data on place of work, nonagricultural wage and salary employment is based on a March 1974 benchmark primarily with an Employment Service report known as the ES-202. The ES-202 is a compilation of confidential reports on employment and earnings which each eligible employer is required to file with the Colorado Division of Employment and Training under the State's Employment Security Act. Employment attributed to firms which have come into being during the 1976 period of economic growth in Colorado would be unrepresented in CES data based on the March 1974 benchmark.

Preliminary data from the ES-202 through the third quarter of 1976 registers approximately 37,000 new jobs in Colorado over the same period in 1975. There are certain portions of nonagricultural wage and salary employment that are not included in this report--primarily related to government--but that still leaves a good deal of CPS registered growth unaccounted for.

Neither of the two above-mentioned series on employment (the CES program or the ES-202) can be utilized as a direct substitute for a total employment estimate. Both are based on the measurement of jobs by place of work, rather than the employment of people by place of residence definition, which determines total area employment. Conceptually, however, the number of jobs by place of work should tend to be higher than the number of people employed by residence, and that would serve to widen the gap between the CPS employment growth rate and that indicated by these data series. On the whole, when allowances are made for the employment areas not covered and the conceptual differences, the CES program and the ES-202 do not support the growth of 72,000 new jobs in Colorado indicated by the 1976 Current Population Survey.

Questions on the reliability of the CPS to serve as a benchmark for local labor force estimates are not unique to the Colorado situation. Nationally 23 states were benchmarked to the CPS for the first time this year. A preliminary review

of the 1976 data for these areas indicates significant revisions from originally calculated data in many states. In some cases, the number of unemployed, as measured by payments for unemployment compensation, actually exceeded the CPS estimate of total unemployment. This state of affairs prompted the Research and Statistics Committee of the Interstate Conference of Employment Security Agencies to express "strong misgivings and serious doubts concerning the 1976 revisions proposed by BLS to state and local area unemployment statistics necessitated by adjustments to the Current Population Survey" in their December 1976 meeting.

The R & A staff will continue to monitor and analyze the concepts utilized in the calculation of Colorado labor force statistics. For at least the immediate future, however, all Colorado area unemployment rates utilized by this publication for economic analysis will be based on methodology which strictly follows the guidelines established by the federal Bureau of Labor Statistics.

Publication of Series Revisions:

Colorado and Denver-Boulder LMA monthly and annual average labor force data incorporating all recent revisions for the 1970 through 1976 period are included on pages 7 to 11 of this issue. On pages 12 and 13 are revised Colorado county labor force estimates for annual average 1976 and January 1977. Monthly 1976 data is available for all Colorado counties in this format upon request to the Research and Analysis Unit of the Colorado Division of Employment and Training. Revised county labor force figures are not yet available for periods prior to January 1976. When these historical revisions are completed, they will be announed in the Manpower Review. A monthly summary of current Colorado county labor force estimates similar to that on page 13 will be a regular feature in upcoming issues of the Review.

Revisions to previously published Colorado and the Denver-Boulder LMA seasonally adjusted labor force estimates for 1970 through 1976 appear on pages 14, 15, and 16 of this issue. Revised 1976 seasonally adjusted data for the Colorado Springs, Pueblo, Fort Collins, and Greeley SMSA's is included on page 14. Previously published data for periods prior to 1976 have not yet been revised for these areas and are not comparable to the current series.

NOTES

1. Colorado Department of Natural Resources, Division of Mines, A Summary of Mineral Industry Activities in Colorado - 1976 (June 1977); and Colorado Department of Natural Resources, Division of Mines, Coal 1976 (April 1977); and Colorado Department of Natural Resources, Division of Mines, State Coal Mine Inspection, Monthly Report; and Colorado Department of Natural Resources, Oil and Gas Conservation Commission, Oil and Gas Statistics 1976 (1976); and Colorado-Ute Electric Association, Inc., Annual Report to the Colorado Public Utilities Commission - 1976; and Colorado School of Mines Mineral Industries Bulletin, March 1975; and U. S. Department of the Interior, Bureau of Mines, Subcommittee to Expedite Energy Development. Also, U. S. Environmental Protection Agency, Socio-economic Impacts of Natural Resource Development Committee, "A Listing of Proposed, Planned, or Under Construction Energy Projects in Federal Region VIII" (a joint report prepared for the Committee on Energy and Environment of the Denver Federal Executive Board and the Mountain Plains Federal Regional Council, August 1975), (Xerox reproduction.)

2. Ute Electric Association, Inc., Basalt-Aspen 115 KV Transmission Line: Applicant's Environmental Analysis (Montrose, Colorado: June 1974); and U. S. Department of Agriculture, Rural Electrification Administration, Final Environmental Statement - Hayden Station Unit 2 (Washington, D.C.: January 1972); and U. S. Department of Agriculture, Rural Electrification Administration, Final Environmental Statement - 230 KV Transmission Tap Line to Steamboat Springs and Substation (Washington, D.C.: October 1973); and U. S. Department of Agriculture, Rural Electrification Administration, Final Environmental Statement - Yampa Project (Washington, D.C.: July 1974); and U. S. Department of the Interior, Bureau of Land Management, Draft Northwest Colorado Coal Environmental Statement, 4 volumes and 4 appendices (June 1976); and U. S. Department of the Interior, Bureau of Land Management, Final Environmental Impact Statement, Proposed Federal Coal Leasing Programs (Washington, D.C.: Government Printing Office, 1975); and U. S. Department of the Interior, Office of the Secretary, Final Environmental Statement for the Prototype Oil Shale Leasing Program, 6 volumes (Washington, D.C.: Government Printing Office, 1973); and VTN Colorado, Inc., Environmental Impact Assessment for the Proposed Colowyo Mine, Colowyo Coal Company (Denver, Colorado, for W. R. Grace and Co., December 1975). (Commercial reproduction).

3. Environmental Impact Assessment Project of the Institute of Ecology, A Scientific and Policy Review of the Final Environmental Impact Statement for the Prototype Oil Shale Leasing Program of the Department of the Interior. Edited by Katherine Fletcher and Malcolm F. Baldwin (Washington, D.C.; Environmental Impact Assessment Project, 1973). Researcher's assessment.

4. Colorado General Assembly, Final Report of the Committee on Oil Shale, Coal, and Related Minerals, Legislative Council Research Publication No. 208, often referred to as the Michael L. Strang Committee Report (December 1974); and Colorado Office of the Governor, Oil Shale Planning and Coordination, Impact: An Assessment of the Impact of Oil Shale Development - Colorado Planning and Management Region 11, 5 volumes, often referred to as the Donald A. Rapp Report (December 1974); and U. S. Department of the Interior, Oil Shale Environmental Advisory Panel, First Annual Report (Denver, Colorado: U. S. Department of the Interior, June 1975).

5. See Technical Report for a solution to the interindustry equations.

6. The projections are consistent but the underlying assumption in the model of fixed production coefficients qualify the results unless some dynamic adjustment of technology is explicitly involved.

7. 1976 estimated population 23,060: Colorado State Planning Office.

8. Information obtained from the Colorado Department of Labor and Employment cannot be published unless there are at least three firms in a given sector and no two firms account for more than 80 percent of the total employment. Ethical considerations also dictate that the operations of any single enterprise can never be divulged.

9. At the county level these transfer payments are monies distributed by the various departments of social services. The state of Colorado transfer payments are confined largely to unemployment compensation insurance claims and distribution of funds from the Public Employees Retirement Association account. Federal Government transfer payments include bonus payments under the food stamp program, direct payments to households under the social security program, such as disability, retirement, and survivor benefits, railroad retirement benefits, black lung benefits, veterans and military pensions, federal employee retirement benefits, medicare payments, and payments to farm operators under the agricultural stabilization and conservation program and the sugar program.

10. Respectively for the accounts social services (in local and county government), State of Colorado, and Federal Government these charges are $573,115, $758,811, and $14,342,000.

11. An example would be the sale of bonds in an open market by a school district.

12. Except in the case where rents (e.g., agricultural land leases) and royalties (e.g., oil and gas) were paid to the Colorado and Federal Governments. In these instances the amounts are shown as being paid directly to the respective governments.

13. Current in the sense that it occurred in 1974.

14. An exception to this is in the Colorado and Federal Government sectors; see the explanation of the transfer section in the appendix.

15. U. S. Department of Commerce, Bureau of the Census, Census of Population, 1970: General Social and Economic Characteristics, Final Report, Colorado, PC(1)-C7, Washington, D.C.: Government Printing Office, Table 123.

16. Denver Metropolitan Area Consumer Price Index, Denver, Colorado: University of Denver, College of Business Administration, Quarterly.

17. For example: There were three two-digit SIC classifications incorporated in the sector delineation for construction. Accordingly the questionnaire forms were first aggregated on the basis of the two-digit categories. Regional payroll data from the Colorado Department of Labor and Employment was then aggregated on the same basis. The payroll values on the aggregated questionnaire forms represented a given proportion of the regional payroll in each respective SIC classification; based on this ratio the information on the aggregated two-digit level questionnaire sheets was blown up to represent the total pattern for the two-digit delineation. Subsequently the computed totals at the two-digit level were aggregated to represent the construction sector in the Northwestern Colorado interindustry model.

18. The gross flow patterns were arrived at in either one of two ways. First there was a method that used payroll data (described in the preceeding footnote) when an adequate total gross output value had not been identified. The second method distributed gross flows within the bounds of a total gross output value based on the relative allocation of the flows identified on initially aggregated questionnaire forms.

CHAPTER 3

ANALYSIS OF THE TRI-COUNTY REGION OF NORTHWESTERN COLORADO

INTRODUCTION

The results of the descriptive analysis of the tri-county economy are presented in this chapter. The discussion contained in the chapter includes: the description of the economy; an analysis of the nature and magnitude of economic interdependence among processing sectors; the various business activity and income multipliers; and an analysis of employment in the region.

The description and analysis of the economy hinges on three major components of the interindustry model. These are: the gross flows or transactions table; the table of direct production requirements; and the table of direct plus indirect production requirements. These tables are discussed and interpreted in turn. Because of the size of the tables, they are presented in the appendix.

THE TRANSACTION TABLE

The first essential component of any interindustry study is the collection and tabulation of data which serve to describe the flows of commodities from each supplying sector to each purchasing sector. These flows are typically expressed in terms of the dollar value of transactions occurring in a specific period of time, normally one year. The information is arrayed in tabular form with the suppliers (selling sectors) listed at the left of the table and the purchasing sectors listed at the top. The information in this table, termed

the transactions table, does two things simultaneously: it identifies the estimated dollar value of sales by each sector to each of the other sectors, (thus, the distribution of each sector's output) and it identifies the purchases of ingredients of production by each sector from each of the other sectors (the distribution of purchases). In essence, the material contained in the transactions table represents a double-entry system of bookkeeping in which every sale is simultaneously described as a purchase. Thus, the system deliberately double counts. The transactions table for the Northwestern Economy is found in the appendix. A description of the sector identification labels used throughout the appendix and in the tables of this chapter is also shown in the appendix.

The rows and columns of Table B-1 which are numbered 1-16, identify the processing, or intermediate demand, sectors. Row and column 18 represent subtotals of activities within the processing sector. This portion of the table describes, in dollar terms, the flow of goods and services necessary to satisfy intermediate demands. Final demands, i.e., demands for goods and services that will not be further processed within the region, are identified in columns 19-21 and 23-26. Rows 19-21 and 23-26 identify the final payments sector. Final payments include, then, federal and state taxes, wages, profits, rents, losses, net inventory depletions, and payments for goods and services imported from outside the region. The rows and columns numbered 17 and 22 (the local and county government tax account and the transfer account) are accounting devices as described previously. The last row and column of Table B-1 contain, respectively, total outlay (purchases) and total output (sales) for each sector of the regional economy.

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 Table B-1. 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 by cost component.

For example, consider section 2, coal mines. Reading across row 2 of Table B-1 shows that the total output of coal mines was distributed in the following way: $3,914,407 worth of output was sold to electric and natural gas utilities and $3,852,564 to coal mines. Total sales by coal mines to the processing sector of the economy thus amounted to $7,766,971. The remaining sales were to the final demand sectors consisting of net inventory accumulation, $3,626,276; exports to Colorado $32,122,131; and exports to the rest of the world, $14,116,556. Total sales to final demand thus amounted to $49,864,963. The total gross output of the coal mines sector is the sum of these individual sales or $57,631,934.

The distribution of purchases by coal mines, by cost category, are shown in column 2 of Table B-1. Purchases by coal mines from coal mines were estimated at $3,852,564; from repair and maintenance construction, $547,339; from all manufacturing, $1,072,656; from transportation and communication, $980,942; from electricity and natural gas utilities, $1,522,887; from wholesale trade, $170,074; from retail trade, $53,666; from finance, insurance and real estate, $456,706; from services, $91,882; from medical, $26,167; and from water and sanitation, $24,112. Coal mining paid local property and sales taxes amounting to $565,942. The total purchases by coal mines from the processing sector are thus estimated at $9,364,997 for 1976. Final payments made by coal mines were estimated at $48,266,937. These payments were distributed

as follows: wages subject to withholding, $9,503,565; taxes and charges of the State of Colorado, $864,421; taxes and charges of the Federal Government, $8,526,328; profits, royalties, and rents, $7,497,316; depreciation, $2,792,735; insurance loss pool (transfer account), $366,994; imports from Colorado, $10,235,400; imports from the rest of the world, $8,498,178. Total purchases thus amount to $57,631,934 and, as required by the accounting format, equal the value of output.

Other information can be obtained directly from the transactions table. The houshold row, with the exception of the sale by households to the transfer account represents wages paid subject to withholding. This row shows household income. The leading contributors to household income are: construction, with payments to labor of $15.1 million; coal mines, $9.5 million; oil and natural gas production, $8.6 million; retail trade, $8.8 million; and education, $8.3 million. Similarly, sector by sector contributions to taxes may be directly obtained from Table B-1. The five sectors showing the greatest dollar outlay for local and county taxes are: oil and natural gas, $4.8 million; households, $3.7 million; investment, $2.0 million; retail trade, $1.7 million; and agriculture, $1.4 million.

Estimates of gross regional income and gross regional product may be obtained from the final payments and final demands portion of the table. Gross regional product is defined as the sum of deliveries to final demand, net of imports. Traditionally, local and county government activities are included as part of final demand. Because this model treats these accounts as part of the processing sector, an adjustment is required. Also, the transfer and tax accounts cannot be counted in final demand, for to do so

would be double counting. Thus the sum of education; water, sewerage, and sanitation; local roads; local government; households; state government; federal government; investment and inventory accumulation; and exports from the tri-county region, less regional imports, yields the estimated gross regional product of $374.6 million. Gross regional income (which must equal gross regional product) is computed as the sum of final payments less imports. Again, the local and county tax account and the transfer account must be excluded to avoid double counting.

While these items, obtained directly from the transactions table, are useful as initial indicators of the relative importance of each sector in the regional economy, the important question of interdependence is not addressed. In order to do so, it is first necessary to isolate the direct production relationships existing in the economy.

DIRECT PRODUCTION REQUIREMENTS

The direct production requirements, or coefficients, represent the second major component of the interindustry analysis. These direct requirements are presented in the appendix. Computation of the direct production requirements is quite simple, given the transactions table and requires only that each column entry of the transactions table be divided by the respective column total. The resulting coefficients describe the direct purchases necessary from each supplier (at the left of the table) in order for the purchasing sector (at the head of the column) to produce one dollar's worth of output. The coefficients, then, are interpreted as the direct requirements per dollar of output produced by each sector.

As an example consider the coal mining sector, sector 2 (column 2 of the direct requirements table). For every dollar's worth of output produced by

coal mines in the region, $.0668 worth of inputs are required from the coal mining and related services sector; $.0095 from construction; $.0186 from regional manufacturing; $.0170 from transportation and communication; and so on down the column. It is obvious from the table that far and away the largest direct purchases made by the coal mining sector are those for labor services, with a direct outlay of over 16 cents per each dollar of output produced, and imports from outside the region, with a coefficient of .3251 for all imports. This says that a dollar's worth of production in surface coal requires imports valued at 32½ cents. Each column of the direct requirements table is interpreted in this manner.

These direct impacts identify only a portion of the total economic impacts that would accompany a change in final demands for the output of a given sector. There are additional, or indirect, impacts which can be quite important. Assessment of all direct and indirect impacts of these exogenous (final demand) changes is made possible through the third analytical component of interindustry analysis. This component is the table of direct plus indirect production requirements.

DIRECT PLUS INDIRECT IMPACTS

The concept of interdependence can be fairly easily established with a brief example. Suppose that the export demand for coal production increases. There will be immediate, or direct, responses of the following type. Coal production will have to increase. In order for coal production to increase, inputs must be obtained from sectors such as transportation, utilities for power, and labor. These are direct impacts. As transportation and utilities increase their output to meet the increasing requirements in the coal sector, their own requirements for productive ingredients increase, e.g., services,

labor, petroleum and natural gas, and coal. The chain of events goes on. The total impacts are readily estimated through the input-output framework and are presented in the appendix.

Before proceeding to a discussion of the table, a few comments regarding the treatment of households are in order. Households may be treated as either a part of the processing sector of the economy or as a part of the final demand component. In the first instance, households are treated in precisely the same manner as any other production sector. The estimate of the direct and indirect production impacts of a change in final demand include the induced production impacts which derive from increased household incomes and increased consumption. In the latter, with households a component in final demand, the induced impacts of successive rounds of consumer spending are omitted. For purposes of this report, the discussion of economic interdependencies and the subsequent business and income multiplier analysis is based upon the model which includes households both as a member of the processing sector of the economy and as a final demand sector.

The direct plus indirect coefficients are interpreted as the production required or generated in all sectors of the economy in order to sustain the delivery of one dollar's worth of output to final demand by any single sector. It should be carefully noted that these coefficients reflect production generated per dollar of final demand as opposed to requirements per dollar of output. This, of course, reflects the fact that the model is driven by changes in final demand.

For purposes of interpretation, consider the coal mining sector. Suppose that the export demand for surface mined coal increases by $1 million.

What is the estimated impact that this increase will have on the entire tri-county region of the Northwestern Colorado economy? The answer to this question may be obtained directly by reading down column two of the table and summing the individual sector impacts. Thus, the increase of $1 million in the final demand for coal generates a total direct plus indirect production valued at $3,300 in agriculture ($1 million x .0033); $1,074 million in coal mining and related services; $20,500 in oil and gas production; $14,500 in construction; $22,250 in regional manufacturing; and so on down the column. Any column of this table is interpreted in this same manner. The sum of the entries in column 2 show the total production generated locally as a result of the increase in fixed demands for surface mined coal. Thus, the total business activity generated per dollar increase in final demand for coal is $1.596 or, in our example assuming a $1 million increase, $1.6 million worth of business activity results. These column sums are one of the various multipliers concepts which are derived from input-output analysis.

BUSINESS MULTIPLIERS

The column sums of the direct plus indirect requirements table are termed business activity (or production) multipliers. They identify the total value of production in the region which results from a dollar's worth of output delivered to final demand. Table 3-1 presents the business multipliers. These estimates indicate that the greatest business activity generated per dollar of delivery to final demand is in the local tax account. The business multiplier for this sector is 2.156 which indicates that, as the "final demand" for local sales and property taxes increases by $1, a

total production of $2.16 is generated in the tri-county economy. Other sectors of the economy which have relatively large business multipliers are: electricity and natural gas utilities, 1.891; agriculture, 1.576; construction, 1.360; and regional manufacturing 1.347. These sectors show the greatest degree of interdependence with other sectors of the regional economy. At the margin, these sectors generate the greatest business activity per dollar of output delivered to final demand. The phrase, "at the margin," is important as a qualification in the use of these multipliers. It implies a word of caution concerning the implications of the multipliers. The electricity and natural gas sector in 1976 had total final demand deliveries of $46,828,421. Thus a 10 percent increase in final demand, i.e., an increase of $4,682,842, would result in a total business activity of $8,855,254 in the regional economy. This same 10 percent increase in the final demand for the output of oil and natural gas production, an increase of $21,852,289, yields a total business activity of $26,484,974 in the regional economy. This is, of course, because of the absolute magnitude of final demands for the oil and natural gas sector's output. In using the business multipliers, the argument thus should be stated in terms of the impacts of an equal dollar increase in final demands. That is, for an equal increase (in dollar terms) in final demands, electricity and natural gas utilities will generate more business activity in the local economy than will any other private sector. The first column of Table 3-1 shows the business multipliers with households in final demand; the second column shows the business multipliers with households endogenous (part of the processing sector).

TABLE 3-1

BUSINESS ACTIVITY MULTIPLIERS
TRI-COUNTY REGION OF N.W. COLORADO
BY SECTOR, 1976

(In dollars of business activity generated in the tri-county region of N.W. Colorado per dollar delivered to final demand)

	Sector	Business Multiplier I	Business Multiplier II
1.	Ag/Livestock	1.576	1.833
2.	Coal Mines	1.229	1.596
3.	Oil/Gas PR	1.212	1.325
4.	Construct	1.360	2.004
5.	All Mfg	1.347	1.816
6.	Trans/Comm	1.200	1.896
7.	Elec/Gs Ut	1.891	2.107
8.	Wholesale	1.298	1.709
9.	Retail	1.361	1.966
10.	Fin/Ins/Re	1.112	1.367
11.	Services	1.271	1.823
12.	Medical	1.090	1.627
13.	Education	1.095	2.244
14.	Wat/San	1.184	1.569
15.	Loc Roads	1.213	2.065
16.	Loc Gov	1.251	1.993
17.	Loc Taxes	2.156	3.088
18.	Households	-	1.797

TABLE 3-2

INCOME MULTIPLIERS
TRI-COUNTY REGION OF N.W. COLORADO
BY SECTOR, 1976

(In dollars of income generated per dollar of direct income paid to households)

	Sector	Income Multipliers Type I	Type II
1.	Ag/Livestock	2.283	2.611
2.	Coal Mines	1.240	1.418
3.	Oil/Gas Pr	1.928	2.205
4.	Construct	1.331	1.522
5.	All Mfg	1.228	1.405
6.	Trans/Comm	1.127	1.289
7.	Elec/Gs Ut	2.293	2.633
8.	Wholesale	1.487	1.700
9.	Retail	1.323	1.513
10.	Fin/Ins/Re	1.200	1.372
11.	Services	1.206	1.379
12.	Medical	1.067	1.220
13.	Education	1.020	1.166
14.	Wat/San	1.119	1.280
15.	Loc Roads	1.100	1.258
16.	Loc Gov	1.180	1.350
17.	Loc Taxes	-	-

INCOME MULTIPLIERS

Other multiplier effects can also be estimated from the interindustry model. For example, there are income multipliers which relate to changes in income paid to the household sector. The following discussion presents what are termed the Type I and Type II income multipliers.

The Type I and Type II income multipliers are estimated ratios: Type I is the ratio of direct plus indirect income to the direct income paid households; Type II is the ratio of direct plus indirect plus induced income to direct income. Thus, while the business activity multipliers are related to changes in sales to final demand, the income multipliers are related to changes in income paid to the household sector. The Type I multiplier describes the direct plus indirect income increases emanating from an additional dollar of direct income paid to households. The Type II multiplier takes into account not only the direct plus indirect changes in income, but also the induced income increases generated by additional consumer spending. Accordingly, the Type II income multiplier identifies the direct plus indirect plus induced income generated by an additional dollar of income paid directly to households.

Attention is drawn to the comparatively higher income multiplier value estimates for the agriculture and livestock sector. The reasons for this relatively high value is straightforward. The tri-county interindustry study allocated proprietorship and partnership net incomes to the profit account. As a result, labor inputs (household account) for agriculture and livestock, are somewhat understated because this sector is characterized by a relatively high incidence of proprietorship and partnership enterprises with relatively little hired help. By understating the value (contribution) of labor inputs for this sector, the value (contribution) of other inputs,

relative to labor, became larger. And with direct income being the denominator of the Type I and Type II income multiplier ratios, the multiplier estimate for this sector is of the relatively high magnitude observed. By contrast, the relatively high multiplier values for electricity and natural gas utilities, oil and gas production, and wholesale trade exist because these sectors exhibit greater interdependence in the tri-county economy.

EMPLOYMENT ANALYSIS

Direct employment requirements as is the case with direct business activity and direct income payments, are, by themselves, of limited use for assessing the impacts of various changes in economic activity in the tri-county region. This limitation arises because direct requirements differ from total requirements, the difference being indirect requirements that emanate from sectoral interdependence. The interindustry model provides a framework within which both direct and indirect employment requirements can be addressed. Basic to the analysis are data on employment levels in the respective sectors and the table of direct plus indirect requirements per dollar of output delivered to final demand.

Before proceeding with the analysis some discussion on the table of direct and indirect requirements per dollar of delivery to final demand is warranted. When the household sector is included as a processing sector in the interindustry model it becomes simply another producer. To treat households in this manner is consistent within the interindustry framework, but it imposes a critical assumption on household purchase patterns. Specifically, household purchases are expressed as a linear function of income; the marginal and the average propensities to consume are assumed to be one and the same. To change this limiting assumption, the household

sector has to be treated as a part of final demand.

Treating the household sector in this manner removes the assumption that household purchases are a linear function of income. Specifically, because the interindustry model is a final demand drive model, treating the household sector as any other producing sector implies the level of employment was dependent only on the level of state and federal government expenditures, investment expenditures, inventory accumulation, and exports. By treating households exogenously this assumption is expanded to include a dependency on the level of household expenditures. Direct and indirect requirements per dollar of delivery to final demand, households exogenous, which are used in the employment analysis for the tri-county region of Northwestern Colorado are shown in the appendix. The estimated employment levels and corresponding employment coefficients (expressed as the number of employees per dollar of total gross output) used in the analysis are presented in Table 3-3.

To assess the total employment impacts of exogenous changes in final demand, the respective tables of direct and indirect requirements per dollar of delivery to final demand, households exogenous, was pre-multiplied by a diagonal matrix of direct labor use requirements (where the elements of the diagonal were the employment coefficients shown in Table 3-3). Summing down the respective columns of the resulting matrix yielded the estimates of the direct and indirect labor requirements per dollar delivered to final demand. Table 3-4 presents the estimates.

The interpretation of the entries in Table 3-4 is demonstrated by an example from the coal mining sector. As the final demand for the output of coal expands by $1, there will be a direct expansion of employment in that

TABLE 3-3

TOTAL EMPLOYMENT AND EMPLOYMENT COEFFICIENTS
TRI-COUNTY REGION OF N.W. COLORADO
BY SECTOR, 1976

(In number of workers in the tri-county region of N.W. Colorado and workers per thousand dollars of output)

	Sector	Total Employment	Workers Per Thousand $ Total Output
1.	Ag/Livestk	333	.00805
2.	Coal Mines	521	.00904
3.	Oil/Gas Pr	402	.00152
4.	Construct	1,084	.01925
5.	All Mfg	307	.02316
6.	Trans/Comm	436	.02935
7.	Elec/Gs Ut	237	.00390
8.	Wholesale	159	.01460
9.	Retail	1,521	.04421
10.	Fin/Ins/Re	372	.01306
11.	Services	1,031	.04152
12.	Medical	307	.05495
13.	Education	859	.06499
14.	Wat/San	55	.02213
15.	Loc Roads	213	.04842
16.	Loc Gov	395	.04598
17.	Loc Taxes	-	-
18.	Households	67	-
19.	State Gov	231	-
20.	Fed Gov	205	-

TABLE 3-4

DIRECT PLUS INDIRECT LABOR REQUIREMENTS PER THOUSAND DOLLARS
DELIVERED TO FINAL DEMAND AND PER ADDED WORKER HIRED
TRI-COUNTY REGION OF N.W. COLORADO
BY SECTOR, 1976

	Sector	Direct + Indirect Labor Requirement Per Thousand $ of Final Demand	Direct + Indirect Labor Requirement Per Added Worker Hired
1.	Ag/Livestok	.01751	2.1752
2.	Coal Mines	.01245	1.3772
3.	Oil/Gas Pr	.00466	3.0658
4.	Construct	.02854	1.4826
5.	All Mfg	.02886	1.2461
6.	Trans/Comm	.03465	1.1806
7.	Elec.Gs Ut	.00945	2.4231
8.	Wholesale	.02218	1.5192
9.	Retail	.05312	1.2015
10.	Rin/Ins/Re	.01606	1.2297
11.	Services	.04739	1.1414
12.	Medical	.05718	1.0406
13.	Education	.06639	1.0215
14.	Wat/San	.02482	1.1216
15.	Loc Roads	.05335	1.1018
16.	Loc Gov.	.05366	1.1670
17.	Loc Taxes	-	-

sector as well as those sectors responsible for supplying production ingredients to the surface mining of coal sector. The sectors supplying ingredients to the surface mining of coal sector will in turn require production ingredients from others and this will further expand indirect employment impacts; and so forth. The magnitude of the direct and indirect employment impacts, .01245, shows the total employment generated in the entire Northwestern Colorado economy as this single sector, surface mining of coal, increases by $1,000, its deliveries to final demand. That is to say that an increase of $1 million in the final demands, e.g., exports to the Front Range or out of state, for coal would result in an estimated additional employment of 12½ persons in the tri-county region. All remaining entries in Table 3-4 have analogous interpretations for their respective sectors. Thus, the leading sectors in terms of direct and indirect employment generation in the tri-county economy are education, medical, local government, local roads, retail, and services. Table 3-4 also shows the total employment impact of exogenous changes in workers hired. This information is found simply by dividing the direct plus indirect labor requirements per thousand dollars of final demand (in Table 3-4) by the workers per thousand dollars of final demand shown in Table 3-3. The workers added per worker hired column shows that for each worker hired by coal mines, 0.3772 workers are hired throughout the region's economy. Thus the multiplier for exogenous changes in coal mine employment is 1.3772.

CHAPTER 4

EXTENSIONS OF THE BASIC ANALYSIS: REGIONAL WATER REQUIREMENTS AND ANALYSIS OF EMPLOYMENT RELATED POPULATION EFFECTS

INTRODUCTION

The previous chapter presented what may be appropriately called the results of traditional applications of the Leontief interindustry model. In addition to the descriptive analysis and the attendant development of various multipliers, application of the model can be extended to other questions. The I-O technique, because of the detailed analysis of interdependence among economic sectors, is readily adaptable to an examination of, for example, resource use associated with economic activity in the region. We proceed, first, with an examination of water withdrawal and consumptive use in the regional economy. Subsequent to the water use analysis, we apply the model to the analysis of population change related to the regional economy through the sector-by-sector employment requirements. Other resource impacts, e.g., water and air quality impacts, land use, and growth of various types of energy consumption, could also be studied, providing adequate data are available.

WATER USE ANALYSIS

The water use analysis requires data pertaining to water withdrawals and consumptive use on a sector-by-sector basis. It is further required that these

data be related to economic activity on a per dollar sales basis. These data, particularly for consumptive use, are difficult to obtain on a sector-by-sector basis and for a rather small regional economy. The problem for the tri-county region of northwestern Colorado is narrowed somewhat simply because the most intensive water use is found in the agricultural sectors. Nonagricultural water use is quite small in relation to water use in agriculture.

Water withdrawal and consumption data for irrigated agriculture and fruit production were computed from several sources. The USDA-SCS, Special Projects Division, Denver, Colorado, has published Annual Irrigation Water Use Coefficients, 1975 National Water Assessment. This report provides, for each state, a subregional breakdown of gross diversion requirements and net depletions by crop. These estimates are in terms of acre-feet per acre of irrigated crop. We have used these requirements per acre and the estimated 1974 irrigated acreage for each crop as stated in the 1976 Colorado Agricultural Statistics[1] in order to obtain the total estimated withdrawal and consumptive use of water in irrigated agriculture. The totals were then divided by the estimated total value of output by sector in 1974 in order to obtain water use per dollar of output.

Water use in the manufacturing sectors was estimated from the four digit SIC water use data presented in the U. S. Census of Manufacturers, Water Use in Manufacturing, 1972. These data were weighted by employment share in the four digit SIC listings for the regional economy and then converted to withdrawal and consumptive use requirements per dollar output in each sector. Water use in the mining sectors was estimated from personal interview and questionnaire responses.

Table 4-1 presents the withdrawal and consumptive use coefficients per dollar of output for each of the processing sectors of the regional economy. These estimates may vary depending upon sources of information, particularly within certain manufacturing sectors. However, alternative water use estimates may be employed quickly and inexpensively within the analytical framework and thus disagreement with the coefficients does not pose a serious shortcoming of the analysis. In addition, water use in irrigated agriculture and related sectors constitutes far and away the greatest pressure on the region's water supply. The detailed estimates of diversion and consumption per crop and per irrigated acre appear to be as accurate as any estimates currently available. Thus, discrepancies in the minor water using sectors will have very little impact on aggregate water use in the region. Table 4-2 presents the estimated withdrawals and consumptive use for each of the processing sectors of the regional economy in acre-feet. The agricultural sector accounts for some 72 percent of total processing withdrawals and 91 percent of consumptive use in the region. For the region as a whole, consumptive use represents 32 percent of total withdrawals.

It should be noted that the estimates presented in Tables 4-1 and 4-2 do not include water use in the final demand/final payments sectors. In order to assess total water use, it is necessary to have some indication of requirements in the final demand sectors, e.g., households, governments, education, etc. Aggregated data generally show depletions for irrigation as a separate category of water use and a second category consisting of municipal and industrial and domestic water use. Since industrial (manufacturing) water use has been disaggregated above, as has agricultural use, the final demand use of water could be computed as a residual if estimates of total withdrawal and consumption were available.

TABLE 4-1

ESTIMATED WITHDRAWAL AND CONSUMPTIVE USE
REQUIREMENTS BY SECTOR, TRI-COUNTY REGION
OF NORTHWESTERN COLORADO
(In Gallons Per Dollar of Output)

Sector	Withdrawal	Consumptive Use
AG	1,535.0	620.0
COAL	9.9	0.9
OIL GAS	27.0	6.2
CONSTRUCT	4.0	0.4
MFG	21.6	4.8
TRANS COMM	2.1	0.1
ELEC/GS UT	267.0	13.4
WHOLESALE	2.3	0.2
RETAIL	3.9	0.6
FIRE	4.9	0.5
SERVICES	3.5	0.7
MEDICAL	5.1	0.5
ED	1.5	0.2
WAT SAN	-0-	-0-
LOC RD	-0-	-0-
LOC GV	-0-	-0-

TABLE 4-2

TOTAL WATER USE, BY PROCESSING SECTORS,
TRI-COUNTY REGION OF NORTHWESTERN COLORADO, 1976
(In Acre Feet)

	Sector	Withdrawal	Consumptive Use
1.	AG/LIVESTK	194,461	78,543
2.	COAL MINES	1,746	159
3.	OIL/GAS PR	21,806	5,007
4.	CONSTRUCT	689	69
5.	ALL MFG	876	195
6.	TRANS/COMM	95	5
7.	ELEC/GS UT	49,619	2,490
8.	WHOLESALE	77	7
9.	RETAIL	411	63
10.	FIN/INS/RE	427	44
11.	SERVICES	266	53
12.	MEDICAL	87	9
13.	EDUCATION	61	8
14.	WAT/SAN	-0-	-0-
15.	LOC ROADS	-0-	-0-
16.	LOC GOV	-0-	-0-

Estimates of total withdrawal and total consumptive use of water are useful from a purely descriptive point of view. However, the model allows also the analysis of direct and indirect water use which parallels the previous discussion of direct and indirect production. The purpose of such analysis is to isolate the effect of economic interdependence on water requirements. The specific question to be addressed is that of determining the likely impact of expanding final demand in any or all processing sectors on the regional water requirements. The key element in the assessment is the derivation of the direct plus indirect water requirements per dollar of output delivered to final demand.

The procedure is really quite simple once the direct water requirements and the table of direct plus indirect production requirements have been obtained. The matrix of direct and indirect production coefficients is pre-multiplied by a diagonal matrix consisting of the direct water requirements along the diagonal and zeros elsewhere. The columns of the resulting matrix are summed in order to obtain the direct plus indirect water requirements per dollar of output delivered to final demand by each sector. These requirements for the tri-county economy are shown in Table 4-3. The importance of considering indirect as well as direct water requirements in the planning perspective can be readily seen by comparing Table 4-1 and Table 4-3. Consider, for example, the direct withdrawal and consumptive use requirements for Coal in Table 4-1. The direct requirements are 9.9 and 0.9 gallons for each dollar of output. However, as the final demand for the output of the Coal sector expands by one dollar, there is a total direct plus indirect water requirement of 24.9 gallons (withdrawal) and 3.5 gallons (consumptive) generated throughout the economy. The indirect impacts, because of the significant interdependencies within and between coal and other sectors, are far

TABLE 4-3

DIRECT PLUS INDIRECT WATER REQUIREMENTS,
TRI-COUNTY REGION OF NORTHWESTERN COLORADO, 1976
(In Gallons Per Dollar of Output Delivered to Final Demand)

	Sector	Withdrawal	Consumptive Use
1.	AG/LIVESTK	1821.6	732.7
2.	COAL MINES	24.9	3.5
3.	OIL/GAS PR	37.2	8.0
4.	CONSTRUCT	13.0	3.2
5.	ALL MFG	247.9	94.0
6.	TRANS/COMM	4.8	.5
7.	ELEC/GS UT	313.2	19.1
8.	WHOLESALE	8.8	1.2
9.	RETAIL	16.1	3.0
10.	FIN/INS/RE	8.6	1.2
11.	SERVICES	13.9	1.9
12.	MEDICAL	7.4	.9
13.	EDUCATION	9.3	.7
14.	WAT/SAN	16.0	1.0
15.	LOC ROADS	10.2	.9
16.	LOC GOV	9.9	2.2

more important than the direct requirements. Applying only the direct water requirements to assumed increases in deliveries to final demand can obviously result in an understatement of water use.

POPULATION ANALYSIS

A procedure to estimate population effects which accompany projections of economic growth is developed below. The essence of the method is to utilize the employment projections and/or employment multipliers discussed earlier to forecast employment change. The employment change is first converted into an age-sex distribution of immigrant workers. A labor force participation rate schedule is then used to convert the immigrant employment distribution into an immigrant employment induced population distribution. Several rather severe assumptions are required in order to make use of available historical data. First, it is assumed that unemployment in the region is initially small so that all of the employment effect is attributed to immigrant labor and population change. Second, the estimates of the labor force participation rates for the state from the 1970 Census (as reported by the Colorado Division of Planning) are assumed to apply to the immigrant population entering the region. Third, the distribution of employment related immigrants to counties averaged across counties, as estimated by Monarchi for the Colorado Division of Planning, is assumed to apply to immigrants to the region. For lack of alternative information, it is also assumed that these distributions remain constant over time. Additionally, the relative expansion among industries is assumed to have no effect on the age-sex distribution of employment generated.

The practical application of the technique is as follows: Assume, for expository purposes, that an employment change of 1,000 added workers has been

projected for the region at a certain point in time. The distribution labeled S_{ij} is used to allocate this added labor force to age and sex classifications. For example, the number of added workers in the male age 15 to 19 classification would be 43.3 while 158.4 workers would be added to the male age 20 to 24 classification and so on. Once the entire distribution of the 1,000 immigrant workers among the various age classes for both male and female workers is accomplished, this employment distribution can be converted into an employment-related immigrant population distribution. Each cell entry in this employment distribution can be converted into an induced population change by dividing it by the corresponding entry in the P_{ij} distribution. Thus, the entry for male age 15 to 19 classification which contains 43.3 workers would be divided by .436 to obtain 99.3 additional males of age 15 to 19 as part of the population change accompanying the 1,000 worker increase projected by the input-output model. Similar calculations would result in a complete distribution of the added population by sex and age classification.

The rationale for the calculations presented below is based upon data estimated in Colorado Population Estimates--1970 to 1980: Methods and Results for the Colorado Division of Planning and the Business Research Division of the Graduate School of Business Administration, University of Colorado by David E. Monarchi. Essentially, one critical distribution is used from the Monarchi study. This is the distribution of employment-related migrants for 1970-1980. These data are estimated by utilizing a county-by-county cohort-survival model to separate population changes into natural change and change due to migration. Migration of those over 65 years of age is assumed to be unrelated to employment. (See page 25 and appendix A of the Monarchi study.) The migration distribution is labeled M_{ij} for purposes of this discussion.

TABLE 4-4

ASSUMED DISTRIBUTION OF EMPLOYMENT-RELATED MIGRANTS
(White Migrants) AND LABOR FORCE PARTICIPATION RATES

Age	M_{ij} Male	M_{ij} Female	P_{ij} Male	P_{ij} Female
0-4	.0124	.0129	-0-	-0-
5-9	.0348	.0349	-0-	-0-
10-14	.0568	.0523	-0-	-0-
15-19	.0533	.0539	.436	.496
20-24	.0943	.0948	.900	.544
25-29	.0577	.0851	.940	.451
30-34	.0597	.0602	.940	.451
35-39	.0455	.0398	.957	.511
40-44	.0320	.0316	.957	.511
45-49	.0187	.0187	.935	.530
50-54	.0172	.0111	.935	.530
55-59	.0060	.0063	.880	.482
60-64	.0050	.0050	.700	.368
65 +	-0-	-0-	-0-	-0-
	0.4934	0.5066		

Source: Colorado County Population Estimates -- 1970 to 1980: Methods and Results, David E. Monarchi, Business Research Division, Graduate School of Business Administration, University of Colorado, Boulder, Colorado; and Colorado Division of Planning, 617 State Services Bldg., Denver, Colorado.

TABLE 4-5

DISTRIBUTION OF EMPLOYED MIGRANTS AS A PERCENT OF TOTAL MIGRANTS AND AS A PERCENT OF EMPLOYED MIGRANTS

Age	R_{ij} Male	R_{ij} Female	S_{ij} Male	S_{ij} Female
0-4	-0-	-0-	-0-	-0-
5-9	-0-	-0-	-0-	-0-
10-14	-0-	-0-	-0-	-0-
15-19	.0232	.0267	.0433	.0498
20-24	.0849	.0516	.1584	.0963
25-29	.0542	.0384	.1012	.0717
30-34	.0561	.0272	.1047	.0508
35-39	.0435	.0203	.0812	.0379
40-44	.0306	.0161	.0571	.0300
45-49	.0175	.0099	.0327	.0185
50-54	.0161	.0059	.0300	.0110
55-59	.0053	.0030	.0099	.0056
60-64	.0035	.0018	.0065	.0034
65 +	-0-	-0-	-0-	-0-
	.3349	.2009	.6250	.3750

Source: See text.

Labor force participation rates are also taken from the Monarchi study, but they are essentially the same as could be found by manipulating data presented in the Census publication "Detailed Characteristics for Colorado, 1970." Three of the rates have been adjusted by Monarchi to account for declining college enrollments, the discharge of men from the military, and the assumption of increasingly early retirement age. The labor force participation rates are labeled P_{ij} in this discussion. Both the R_{ij} and the S_{ij} distributions are derived from the M_{ij} and P_{ij} distributions. The R_{ij} distribution is found by simply multiplying cells of the M_{ij} distribution times the corresponding cells of the P_{ij} distribution. M_{ij} is the migrant population of age i and sex j divided by the total migrant population, while P_{ij} is the number of workers of age i and sex j divided by the population of age i and sex j. The product $R_{ij} = M_{ij} P_{ij}$ is the number of workers of age i and sex j divided by the total population of migrants. The R_{ij} distribution is then converted into the S_{ij} population by defining $\Sigma\Sigma S_{ij} = 1.0$ and noting that the number of immigrant workers is equal to (k)x(immigrant population) where $k < 1$. By summing all the entries in the $R_{i,j}$ distribution, we obtain $k = .5358$. Each entry in the R_{ij} distribution is now divided by .5358 so that the distribution is adjusted to sum to one. This implies that the original distribution of employment by age and sex as a percent of the migrant population has been converted into a distribution of workers by age and sex as a percent of migrant employment. Thus, the S_{ij} distribution is a distribution of migrant workers by age and sex as a percent of the total migrant work force.

The technique presented earlier to estimate the employment-related population change required first converting the input-output projection of

total employment change into a distribution of migrant workers by age and sex. The previous discussion shows that S_{ij} is the appropriate prorating distribution to allocate migrant employment by age and sex. Once we have calculated the number of workers by age and sex (information which by itself may be useful) this distribution is converted into a population distribution by dividing each element by the corresponding element of the P_{ij} distribution, the labor force participation rates. The result is a population distribution of employment-induced migrants.

One essential element of the population is not included in the projections discussed above; that is the age brackets too young to work, ages 1-14. These latter elements of the population of migrants can now be estimated making use of the estimated work-age population of migrants and data from table M_{ij}. Total migrant population (TMP) can be defined as TMP = work age migrants + young migrants. Work-age migrants have been estimated and can be defined as $\sum_{ij}\sum E_{ij} / P_{ij}$ where E_{ij} is the estimated workers by age and sex distribution and the P_{ij} is the labor force participation rates. The M_{ij} data shows the percentage of the TMP in each age sex classification. The M_{ij} data for young migrants multiplied times TMP will provide the actual numbers of young migrants. We then have $TMP = \sum\sum E_{ij} / P_{ij} + (TMP)(.0124 + .0348 + .0568 + .0129 + .0349 + .0523)$, where the numbers multiplied times TMP are the percentages for young migrants ages 1-14 from the M_{ij} distribution. Solving for TMP, we have

$$TMP = \frac{\sum\sum(E_{ij} / P_{ij})}{1 - .2041} = \frac{\text{(work age migrant population)}}{0.7959},$$

and once the total migrant population (TMP) is calculated, each of the age-sex entries for young migrants can be found by multiplying the appropriate M_{ij} times TMP. For example, males age 0-4 would be (.0124)(TMP) and so forth.

NOTES

1. The exceptions are fruit agriculture and irrigated pasture. Data on acreages in fruit production and irrigated pasture were obtained from 1974 Census of Agriculture Preliminary Reports and from unpublished sources.

2. C. Richard Murray and E. Bodette Reeves, U.S. Geological Survey, Circular 676, Estimated Use of Water in the United States in 1970, Washington, D.C., 1972.

3. Excludes withdrawals for mining activities, electric power generation, and agriculture.

4. Murray and Reeves, op. cit.

APPENDICES

Appendix:

APPENDIX A

SECTOR IDENTIFICATION, TRI-COUNTY REGION OF NORTHWESTERN COLORADO, 1976

Sector Number	Sector Description	1972 SIC Codes
Processing Sectors		
1.	Ag/Livestock	01, 02, 07
2.	Coal Mines	12
3.	Oil/Gas Production	13
4.	Construction	14, 15, 16, 17
5.	All Manufacturing	20, 24, 25, 27 28, 32, 35, 38, 39
6.	Transportation/Communication	40, 41, 42, 45 47, 48
7.	Electricity; Gas Utilities	491, 492
8.	Wholesale Trade	50, 51
9.	Retail Trade	52, 53, 54, 55, 56, 57, 58, 59
10.	Finance, Insurance, Real Estate	60, 61, 62, 63, 64, 65, 66
11.	Services	70, 72, 73, 75, 76, 78, 79, 81, 86, 89
12.	Medical Services	80
13.	Education	82
14.	Water, Sewerage, Trash Removal Services	494, 495
15.	Local and County Roads	-
16.	Local and County Government	91, 92, 93, 94, 95, 96

APPENDIX A (Continued)

Sector Number	Sector Description	1972 SIC Codes
17.	Local and County Tax Accounts	-
18.	Subtotals	
Final Demand Sectors		
19.	Households	-
20.	State of Colorado	91, 92, 93, 94 95, 96, 97
21.	Federal Government	91, 92, 93, 94, 95, 96, 97
22.	Transfer Account	-
23.	Economic Investment	-
24.	Shale Oil	-
25.	Exports to Colorado Other Than the Tri-County Region	-
26.	Exports to the Rest of the World	-
27.	Totals	

APPENDIX B

INPUT-OUTPUT TABLES FOR THE TRI-COUNTY REGION OF N.W. COLORADO, 1976

APPENDIX B-1

TRI-COUNTY REGION OF N.W. COLORADO, GROSS FLOWS TABLE
(1976 Dollars)

		1	2	3	4	5	6	7	8	9	10
		ag/livestk	coal-mines	oil/gas/pr	construct	all/mfg	trans/comm	elec/gs/ut	wholesale	retail	fin/ins/re
1	ag/livestk	6326108.	0.	0.	0.	1595907.	0.	0.	0.	0.	0.
2	coal-mines	0.	3852564.	0.	0.	0.	0.	3914407.	0.	0.	0.
3	oil/gas/pr	0.	0.	17681458.	0.	0.	0.	27646014.	0.	0.	0.
4	construct	221551.	547399.	1275518.	7262875.	188909.	5869.	0.	207520.	189972.	50345.
5	all-mfg	15629.	1072656.	2613057.	1270617.	79623.	20091.	30188.	69233.	663430.	157851.
6	trans/comm	209572.	980942.	3673102.	681722.	178734.	274433.	19336.	1189729.	2569611.	263375.
7	elec/gs/ut	775289.	1522887.	3955494.	63113.	188428.	43864.	5211242.	113443.	610452.	140642.
8	wholesale	1456680.	170074.	928151.	737229.	86569.	31945.	22152.	18078.	67902.	73074.
9	retail	463925.	53666.	738836.	2682201.	161108.	212904.	51387.	120488.	249759.	207949.
10	fin/ins/re	4328712.	456706.	1997371.	781617.	282023.	667317.	3757881.	372067.	1376604.	518602.
11	services	988062.	91882.	1921631.	970290.	262408.	386883.	50134.	198861.	916204.	797286.
12	medical	499.	26167.	0.	11181.	109.	390.	0.	0.	0.	0.
13	education	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
14	wat/san	224356.	24112.	60932.	6663.	4211.	1960.	1102.	3500.	64289.	11204.
15	loc-roads	0.	0.	0.	335055.	0.	2801.	0.	0.	0.	0.
16	loc-gov	0.	0.	0.	102332.	0.	38536.	69901.	0.	81180.	0.
17	loc-taxes	1378488.	565942.	4840012.	231076.	74731.	421465.	656124.	170736.	1727389.	164731.
18	subtotal	16388871.	9364997.	39685562.	15135971.	3102760.	2108458.	41429868.	2463655.	8516792.	2385059.
19	households	2596305.	9503565.	8630966.	15157555.	2818985.	5103086.	3189824.	1673739.	8763203.	3358613.
20	state-gov	272009.	864421.	7841834.	280579.	83058.	451142.	109165.	251348.	285324.	83680.
21	fed-gov	634886.	8526328.	72640840.	2893652.	596932.	776665.	965718.	2071200.	3180777.	1046097.
22	transfers	230204.	366994.	182573.	413934.	56031.	191936.	92691.	57842.	513221.	10485502.
23	profits	8258906.	7479316.	78717444.	2704630.	875956.	1315496.	1648618.	3598313.	10841386.	3869927.
24	deprec	4251120.	2792735.	7289691.	1924912.	602590.	1050442.	3195173.	371704.	1311569.	300700.
25	imp-colo	3954525.	10235400.	37766689.	8428742.	2431172.	3516576.	7916080.	181903.	485591.	5597220.
26	imp-world	4801101.	8498178.	11094768.	9368346.	2688119.	339608.	2166160.	221031.	509605.	1347942.
27	total	41387927.	57631934.	263850370.	56308321.	13255603.	14853409.	60713297.	10890735.	34407468.	28474740.

1	EMPLOYMENT	0.3332E 06	0.5210E 06	0.4011E 06	0.1084E 07	0.3070E 06	0.4359E 06	0.2368E 06	0.1590E 06	0.1521E 07	0.3719E 06
2	WITHDRAWAL	0.6353E 11	0.5706E 09	0.7124E 10	0.2252E 09	0.2863E 09	0.3119E 08	0.1621E 11	0.2505E 08	0.1342E 09	0.1395E 09
3	CONSUMP.	0.2566E 11	0.5187E 08	0.1636E 10	0.2252E 08	0.6363E 08	0.1485E 07	0.8136E 09	0.2178E 07	0.2064E 08	0.1424E 08

GROSS FLOWS TABLE (last rows show resource inputs)

		11 services	12 medical	13 education	14 wat/san	15 loc-roads	16 loc-gov	17 loc-taxes	18 subtotal	19 households	20 state-gov
1	ag/livestk	0.	0.	0.	0.	0.	13300.	0.	7935315.	22363.	791.
2	coal-mines	0.	0.	0.	0.	0.	0.	0.	7766971.	0.	0.
3	oil/gas/pr	0.	0.	0.	0.	0.	0.	0.	45327472.	0.	0.
4	construct	326429.	1528.	1118.	5188.	106942.	64254.	0.	10455417.	633024.	3337099.
5	all-mfg	128954.	16622.	3221.	28.	6054.	58456.	0.	6205710.	332947.	5518.
6	trans/comm	463402.	49727.	66572.	3083.	9295.	133084.	0.	10765719.	3761082.	45854.
7	elec/gs/ut	598770.	17046.	310685.	119878.	117083.	96560.	0.	13884876.	3863117.	61308.
8	wholesale	248504.	30493.	23711.	9203.	109456.	24610.	0.	4037831.	2757214.	27911.
9	retail	268771.	24533.	62184.	27144.	102884.	101419.	0.	5529158.	18376153.	97301.
10	fin/ins/re	1111326.	101458.	317108.	105872.	55406.	362094.	0.	16592164.	8573428.	51468.
11	services	467961.	49316.	73809.	38916.	82757.	231082.	0.	7527482.	4755146.	160394.
12	medical	0.	12017.	4895.	0.	0.	108056.	492112.	655426.	3875712.	0.
13	education	0.	0.	0.	0.	0.	0.	8994826.	8994826.	313010.	3166590.
14	wat/san	37763.	3810.	17973.	3636.	7393.	16681.	934747.	1424332.	846191.	2976.
15	loc-roads	0.	0.	0.	0.	77335.	455731.	920616.	1791538.	0.	2043978.
16	loc-gov	500.	1000.	0.	127.	262.	57853.	5947168.	6298859.	357706.	804464.
17	loc-taxes	856095.	55312.	0.	0.	0.	0.	0.	11142101.	3721434.	0.
18	subtotal	4508475.	362862.	881276.	313075.	674867.	1723180.	17289469.	166335200.	52188527.	9805652.
19	households	6326694.	1565867.	8285404.	475326.	1896550.	3002972.	0.	82348654.	335000.	2987259.
20	state-gov	90233.	445.	898556.	668.	0.	114302.	0.	11626764.	7220234.	336380.
21	fed-gov	1097971.	128967.	23594.	33193.	110573.	221751.	0.	94949144.	17296152.	97361.
22	transfers	249716.	79049.	159942.	3957.	43490.	661736.	0.	13788818.	3123301.	16932752.
23	profits	3533081.	2577220.	1806386.	1274855.	869485.	2389037.	0.	131760056.	6223373.	522631.
24	deprec	1393468.	107623.	0.	216245.	0.	0.	0.	24807972.	0.	0.
25	imp-colo	2535274.	490903.	566311.	95337.	424714.	166379.	53712.	84846528.	11937261.	668478.
26	imp-world	5093730.	273887.	596635.	72727.	379326.	311746.	0.	47762909.	26537052.	375155.
27	total	24828642.	5586823.	13218104.	2485383.	4399005.	8591103.	17343181.	658226056.	124860900.	31725668.

1	EMPLOYMENT	0.1031E 07	0.3070E 06	0.8590E 06	0.5500E 05	0.2130E 06	0.3950E 06	0.	0.	0.	0.
2	WITHDRAWAL	0.8690E 08	0.2849E 08	0.1983E 08	0.	0.	0.	0.	0.	0.	0.
3	CONSUMP.	0.1738E 08	0.2793E 07	0.2644E 07	0.	0.	0.	0.	0.	0.	0.

GROSS FLOWS TABLE (last rows show resource inputs)

GROSS FLOWS TABLE (last rows show resource inputs)

		21 fed-gov	22 transfers	23 investment	24 shale-oil	25 exp-colo	26 exp-world	27 total
1	ag/livestk	0.	0.	0.	0.	23660678.	9768780.	41387927.
2	coal-mines	0.	0.	3626276.	0.	32122131.	14116556.	57631934.
3	oil/gas/pr	0.	0.	0.	0.	0.	218522896.	263850368.
4	construct	6464371.	278671.	35139739.	0.	0.	0.	56308321.
5	all-mfg	212091.	0.	0.	0.	3638022.	2861315.	13255603.
6	trans/comm	280754.	0.	0.	0.	0.	0.	14853409.
7	elec/gs/ut	78575.	0.	0.	0.	19654669.	23170752.	60713297.
8	wholesale	25410.	13511.	3417823.	0.	327792.	283243.	10890735.
9	retail	96995.	90045.	6145416.	0.	2184654.	1887746.	34407468.
10	fin/ins/re	502650.	28099.	2726931.	0.	0.	0.	28474740.
11	services	166922.	1475378.	0.	0.	6601758.	4141562.	24828642.
12	medical	0.	1055685.	0.	0.	0.	0.	5586823.
13	education	301977.	137561.	0.	0.	150357.	153783.	13218104.
14	wat/san	16822.	88214.	106848.	0.	0.	0.	2485383.
15	loc-roads	561036.	2453.	0.	0.	0.	0.	4399005.
16	loc-gov	559027.	571047.	0.	0.	0.	0.	8591103.
17	loc-taxes	0.	0.	2009348.	0.	318747.	151551.	17343181.
18	subtotal	9266630.	3740664.	53172381.	0.	88658808.	275058192.	658226056.
19	households	2896035.	36293952.	0.	0.	0.	0.	124860900.
20	state-gov	9970595.	158290.	822722.	0.	278447.	1312236.	31725668.
21	fed-gov	351041.	3963114.	0.	0.	0.	0.	116656812.
22	transfers	89973866.	0.	0.	0.	0.	0.	123818737.
23	profits	978858.	-96864880.	0.	0.	2886387.	2371866.	47878293.
24	deprec	16032.	0.	0.	0.	0.	0.	24824004.
25	imp-colo	2743707.	100126051.	4462834.	0.	949607.	820549.	206555018.
26	imp-world	460048.	76401546.	14244358.	10.	3004793.	2596421.	171382294.
27	total	116656812.	123818737.	72702295.	10.	95778042.	282159264.	1505927808.
1	EMPLOYMENT	0.	0.	0.	0.	0.	0.	0.
2	WITHDRAWAL	0.	0.	0.	0.	0.	0.	0.
3	CONSUMP.	0.	0.	0.	0.	0.	0.	0.

APPENDIX B-2

TRI-COUNTY REGION OF N.W. COLORADO

Direct Requirements Per Dollar of Output, 1976

		1	2	3	4	5	6	7	8	9	10
		ag/livestk	coal-mines	oil/gas/pr	construct	all/mfg	trans/comm	elec/gs/ut	wholesale	retail	fin/ins/re
1	ag/livestk	0.152849	0.	0.	0.	0.120395	0.	0.	0.	0.	0.
2	coal-mines	0.	0.066848	0.	0.	0.	0.	0.064474	0.	0.	0.
3	oil/gas/pr	0.	0.	0.067013	0.	0.	0.	0.455354	0.	0.	0.
4	construct	0.005353	0.009498	0.004834	0.128984	0.014251	0.000395	0.	0.019055	0.005521	0.001768
5	all-mfg	0.000378	0.018612	0.009904	0.022565	0.006007	0.001353	0.000497	0.006357	0.019282	0.005544
6	trans/comm	0.005064	0.017021	0.013921	0.012107	0.013484	0.018476	0.000318	0.109242	0.074682	0.009249
7	elec/gs/ut	0.018732	0.026424	0.014991	0.001121	0.014215	0.002953	0.085834	0.010416	0.017742	0.004939
8	wholesale	0.035196	0.002951	0.003518	0.013093	0.006531	0.002151	0.000365	0.001660	0.001973	0.002566
9	retail	0.011209	0.000931	0.002800	0.047634	0.012154	0.014334	0.000846	0.011063	0.007259	0.007303
10	fin/ins/re	0.104589	0.007925	0.007570	0.013881	0.021276	0.044927	0.061896	0.034164	0.040009	0.018213
11	services	0.023873	0.001594	0.007283	0.017232	0.019796	0.026047	0.000826	0.018260	0.026628	0.028000
12	medical	0.000012	0.000454	0.	0.000199	0.000008	0.000026	0.	0.	0.	0.
13	education	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
14	wat/san	0.005421	0.000418	0.000231	0.000118	0.000318	0.000132	0.000018	0.000321	0.001868	0.000393
15	loc-roads	0.	0.	0.	0.005950	0.	0.000189	0.	0.	0.	0.
16	loc-gov	0.	0.	0.	0.001817	0.	0.002594	0.001151	0.	0.002359	0.
17	loc-taxes	0.033307	0.009820	0.018344	0.004104	0.005638	0.028375	0.010807	0.015677	0.050204	0.005785
18	households	0.062731	0.164901	0.032712	0.269189	0.212664	0.343563	0.052539	0.153685	0.254689	0.117951
19	state-gov	0.006572	0.014999	0.029721	0.004983	0.006266	0.030373	0.001798	0.023079	0.008293	0.002939
20	fed-gov	0.015340	0.147945	0.275311	0.051389	0.045032	0.052289	0.015906	0.190180	0.092444	0.036738
21	transfers	0.005562	0.006368	0.000692	0.007351	0.004227	0.012922	0.001527	0.005311	0.014916	0.368239
22	profits	0.199549	0.129777	0.298341	0.048033	0.066082	0.088565	0.027154	0.330401	0.315088	0.135907
23	deprec	0.102714	0.048458	0.027628	0.034185	0.045459	0.070721	0.052627	0.034130	0.038119	0.010560
24	imp-colo	0.095548	0.177599	0.143137	0.149689	0.183407	0.236752	0.130385	0.016703	0.014113	0.196568
25	imp-world	0.116002	0.147456	0.042049	0.166376	0.202791	0.022864	0.035679	0.020295	0.014811	0.047338

Direct Requirements Per Dollar of Output, 1976

		11 services	12 medical	13 education	14 wat/san	15 loc-roads	16 loc-gov	17 loc-taxes	18 households	19 state-gov	20 fed-gov
1	ag/livestk	0.	0.	0.	0.	0.	0.001548	0.	0.000179	0.000025	0.
2	coal-mines	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3	oil/gas/pr	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
4	construct	0.013147	0.000274	0.000085	0.002087	0.024310	0.007479	0.	0.005070	0.105186	0.055414
5	all-mfg	0.005194	0.002975	0.000244	0.000011	0.001376	0.006804	0.	0.002667	0.000174	0.001818
6	trans/comm	0.018664	0.008901	0.005036	0.001240	0.002113	0.015491	0.	0.030122	0.001445	0.002407
7	elec/gs/ut	0.024116	0.003051	0.023505	0.048233	0.026616	0.011240	0.	0.030939	0.001932	0.000674
8	wholesale	0.010009	0.005458	0.001794	0.003703	0.024882	0.002865	0.	0.022082	0.000880	0.000218
9	retail	0.010825	0.004391	0.004704	0.010921	0.023388	0.011805	0.	0.147173	0.003067	0.000831
10	fin/ins/re	0.044760	0.018160	0.023990	0.042598	0.012595	0.042148	0.	0.068664	0.001622	0.004309
11	services	0.018848	0.008827	0.005584	0.015658	0.018813	0.026898	0.	0.038084	0.005056	0.001431
12	medical	0.	0.002151	0.000370	0.	0.	0.012578	0.028375	0.031040	0.	0.
13	education	0.	0.	0.	0.	0.	0.	0.518638	0.002507	0.099812	0.002589
14	wat/san	0.001521	0.000682	0.001360	0.001463	0.001681	0.001942	0.053897	0.006777	0.000094	0.000144
15	loc-roads	0.	0.	0.	0.	0.017580	0.053047	0.053082	0.	0.064427	0.004809
16	loc-gov	0.000020	0.000179	0.	0.000051	0.000060	0.006734	0.342911	0.002865	0.025357	0.004792
17	loc-taxes	0.034480	0.009900	0.	0.	0.	0.	0.	0.029805	0.	0.
18	households	0.254814	0.280279	0.626822	0.191249	0.431132	0.349544	0.	0.002683	0.094159	0.024825
19	state-gov	0.003634	0.000080	0.067979	0.000269	0.	0.013305	0.	0.057826	0.010603	0.085469
20	fed-gov	0.044222	0.023084	0.001785	0.013355	0.025136	0.025812	0.	0.138523	0.003069	0.003009
21	transfers	0.010058	0.014149	0.012100	0.001592	0.009886	0.077026	0.	0.025014	0.533724	0.771270
22	profits	0.142299	0.461303	0.136660	0.512941	0.197655	0.278083	0.	0.049842	0.016473	0.008391
23	deprec	0.056123	0.019264	0.	0.087007	0.	0.	0.	0.	0.	0.000137
24	imp-colo	0.102111	0.087868	0.042844	0.038359	0.096548	0.019366	0.003097	0.095604	0.021071	0.023519
25	imp-world	0.205155	0.049024	0.045138	0.029262	0.086230	0.036287	0.	0.212533	0.011825	0.003944

Direct Requirements Per Dollar of Output, 1976

		21 transfers	22 investment	23 shale-oil	24 exp-colo	25 exp-world
1	ag/livestk	0.	0.	0.	0.247037	0.034622
2	coal-mines	0.	0.049878	0.	0.335381	0.050030
3	oil/gas/pr	0.	0.	0.	0.	0.774466
4	construct	0.002251	0.483337	0.	0.	0.
5	all-mfg	0.	0.	0.	0.037984	0.010141
6	trans/comm	0.	0.	0.	0.	0.
7	elec/gs/ut	0.	0.	0.	0.205211	0.082119
8	wholesale	0.000109	0.047011	0.	0.003422	0.001004
9	retail	0.000727	0.084529	0.	0.022810	0.006690
10	fin/ins/re	0.000227	0.037508	0.	0.	0.
11	services	0.011916	0.	0.	0.068928	0.014678
12	medical	0.008526	0.	0.	0.	0.
13	education	0.001111	0.	0.	0.001570	0.000545
14	wat/san	0.000712	0.001470	0.	0.	0.
15	loc-roads	0.000020	0.	0.	0.	0.
16	loc-gov	0.004612	0.	0.	0.	0.
17	loc-taxes	0.	0.027638	0.	0.003328	0.000537
18	households	0.293122	0.	0.	0.	0.
19	state-gov	0.001278	0.011316	0.	0.002907	0.004651
20	fed-gov	0.032007	0.	0.	0.	0.
21	transfers	0.	0.	0.	0.	0.
22	profits	-0.782312	0.	0.	0.030136	0.008406
23	deprec	0.	0.	0.	0.	0.
24	imp-colo	0.808650	0.061385	0.	0.009915	0.002908
25	imp-world	0.617043	0.195927	1.000000	0.031372	0.009202

APPENDIX B-3

TRI-COUNTY REGION OF N.W. COLORADO

Direct and Indirect Requirements Per Dollar Delivered to Final Demand (1976)
(Households in Processing Sector)

		1	2	3	4	5	6	7	8	9	10
		ag/livestk	coal-mines	oil/gas/pr	construct	all/mfg	trans/comm	elec/gs/ut	wholesale	retail	fin/ins/re
1	ag/livestk	1.1810	0.0033	0.0017	0.0045	0.1436	0.0009	0.0013	0.0015	0.0035	0.0011
2	coal-mines	0.0024	1.0745	0.0015	0.0015	0.0023	0.0016	0.0768	0.0017	0.0027	0.0009
3	oil/gas/pr	0.0171	0.0205	1.0825	0.0104	0.0161	0.0116	0.5428	0.0120	0.0190	0.0066
4	construct	0.0109	0.0145	0.0073	1.1536	0.0210	0.0053	0.0057	0.0251	0.0113	0.0043
5	all-mfg	0.0037	0.0225	0.0118	0.0307	1.0097	0.0056	0.0091	0.0098	0.0235	0.0074
6	trans/comm	0.0227	0.0315	0.0204	0.0412	0.0329	1.0430	0.0179	0.1268	0.0979	0.0192
7	elec/gs/ut	0.0351	0.0420	0.0220	0.0214	0.0329	0.0238	1.1121	0.0245	0.0389	0.0136
8	wholesale	0.0467	0.0094	0.0060	0.0259	0.0196	0.0135	0.0064	1.0091	0.0125	0.0070
9	retail	0.0413	0.0380	0.0152	0.1189	0.0613	0.0831	0.0249	0.0545	1.0689	0.0329
10	fin/ins/re	0.1483	0.0339	0.0186	0.0587	0.0684	0.0890	0.0889	0.0668	0.0843	1.0360
11	services	0.0433	0.0153	0.0133	0.0443	0.0414	0.0513	0.0151	0.0371	0.0515	0.0380
12	medical	0.0068	0.0085	0.0031	0.0139	0.0102	0.0155	0.0053	0.0092	0.0144	0.0055
13	education	0.0268	0.0122	0.0129	0.0152	0.0144	0.0271	0.0159	0.0175	0.0381	0.0081
14	wat/san	0.0106	0.0034	0.0022	0.0048	0.0048	0.0062	0.0029	0.0041	0.0088	0.0025
15	loc-roads	0.0038	0.0018	0.0018	0.0092	0.0021	0.0041	0.0023	0.0026	0.0055	0.0011
16	loc-gov	0.0183	0.0087	0.0088	0.0131	0.0103	0.0216	0.0121	0.0125	0.0287	0.0058
17	loc-taxes	0.0509	0.0224	0.0244	0.0273	0.0264	0.0502	0.0299	0.0324	0.0716	0.0149
18	households	0.1638	0.2339	0.0721	0.4096	0.2987	0.4428	0.1378	0.2613	0.3853	0.1618

Direct and Indirect Requirements Per Dollar Delivered to Finald Demand (1976)
(Households in Processing Sector)

		11 services	12 medical	13 education	14 wat/san	15 loc-roads	16 loc-gov	17 loc-taxes	18 households
1	ag/livestk	0.0014	0.0009	0.0010	0.0005	0.0012	0.0036	0.0019	0.0015
2	coal-mines	0.0030	0.0013	0.0039	0.0045	0.0037	0.0025	0.0033	0.0032
3	oil/gas/pr	0.0213	0.0090	0.0276	0.0315	0.0264	0.0173	0.0236	0.0229
4	construct	0.0194	0.0038	0.0069	0.0053	0.0345	0.0153	0.0111	0.0101
5	all-mfg	0.0092	0.0059	0.0061	0.0029	0.0072	0.0116	0.0078	0.0083
6	trans/comm	0.0399	0.0271	0.0414	0.0157	0.0344	0.0420	0.0393	0.0548
7	elec/gs/ut	0.0436	0.0184	0.0566	0.0646	0.0541	0.0355	0.0484	0.0470
8	wholesale	0.0194	0.0140	0.0195	0.0101	0.0392	0.0165	0.0188	0.0274
9	retail	0.0666	0.0570	0.1161	0.0491	0.1086	0.0867	0.1000	0.1734
10	fin/ins/re	0.0829	0.0505	0.0909	0.0703	0.0665	0.0903	0.0868	0.0995
11	services	1.0402	0.0271	0.0427	0.0302	0.0488	0.0548	0.0459	0.0558
12	medical	0.0127	1.0137	0.0242	0.0081	0.0178	0.0282	0.0524	0.0372
13	education	0.0283	0.0142	1.0187	0.0075	0.0152	0.0134	0.5346	0.0281
14	wat/san	0.0071	0.0046	0.0085	1.0041	0.0072	0.0069	0.0614	0.0110
15	loc-roads	0.0040	0.0020	0.0026	0.0011	1.0202	0.0563	0.0749	0.0038
16	loc-gov	0.0196	0.0103	0.0138	0.0056	0.0113	1.0167	0.3570	0.0208
17	loc-taxes	0.0528	0.0258	0.0326	0.0133	0.0268	0.0235	1.0278	0.0487
18	households	0.3514	0.3419	0.7310	0.2447	0.5422	0.4718	0.5926	1.1437

APPENDIX B-4

TRI-COUNTY REGION OF N.W. COLORADO

Direct and Indirect Requirements Per Dollar Delivered to Final Demand (1976)
(Households in Final Demand)

		1	2	3	4	5	6	7	8	9	10
		ag/livestk	coal-mines	oil/gas/pr	construct	all/mfg	trans/comm	elec/gs/ut	wholesale	retail	fin/ins/re
1	ag/livestk	1.1808	0.0030	0.0016	0.0039	0.1432	0.0004	0.0012	0.0011	0.0030	0.0009
2	coal-mines	0.0020	1.0739	0.0013	0.0003	0.0014	0.0004	0.0764	0.0010	0.0016	0.0005
3	oil/gas/pr	0.0139	0.0158	1.0811	0.0022	0.0101	0.0027	0.5400	0.0067	0.0113	0.0034
4	construct	0.0095	0.0124	0.0066	1.1500	0.0184	0.0014	0.0045	0.0228	0.0079	0.0028
5	all-mfg	0.0025	0.0208	0.0113	0.0277	1.0075	0.0023	0.0081	0.0079	0.0207	0.0062
6	trans/comm	0.0148	0.0202	0.0169	0.0216	0.0186	1.0218	0.0113	0.1143	0.0795	0.0114
7	elec/gs/ut	0.0284	0.0323	0.0190	0.0046	0.0207	0.0056	1.1065	0.0138	0.0231	0.0069
8	wholesale	0.0428	0.0038	0.0043	0.0161	0.0124	0.0029	0.0031	1.0028	0.0033	0.0031
9	retail	0.0164	0.0026	0.0042	0.0568	0.0160	0.0159	0.0040	0.0149	1.0105	0.0084
10	fin/ins/re	0.1340	0.0135	0.0123	0.0231	0.0424	0.0505	0.0769	0.0441	0.0508	1.0219
11	services	0.0353	0.0039	0.0097	0.0243	0.0268	0.0297	0.0084	0.0244	0.0327	0.0301
12	medical	0.0015	0.0009	0.0007	0.0006	0.0005	0.0011	0.0008	0.0007	0.0019	0.0003
13	education	0.0228	0.0064	0.0111	0.0051	0.0071	0.0162	0.0125	0.0110	0.0286	0.0041
14	wat/san	0.0090	0.0012	0.0015	0.0009	0.0020	0.0020	0.0016	0.0016	0.0051	0.0009
15	loc-roads	0.0033	0.0010	0.0016	0.0078	0.0011	0.0026	0.0018	0.0017	0.0042	0.0006
16	loc-gov	0.0153	0.0044	0.0075	0.0057	0.0049	0.0135	0.0096	0.0077	0.0217	0.0028
17	loc-taxes	0.0439	0.0124	0.0214	0.0098	0.0136	0.0313	0.0240	0.0213	0.0552	0.0080

Direct and Indirect Requirements Per Dollar Delivered to Final Demand (1976)
(Households in Final Demand)

		11 services	12 medical	13 education	14 wat/san	15 loc-roads	16 loc-gov	17 loc-taxes
1	ag/livestk	0.0010	0.0005	0.0001	0.0002	0.0005	0.0030	0.0011
2	coal-mines	0.0020	0.0003	0.0018	0.0038	0.0022	0.0011	0.0017
3	oil/gas/pr	0.0142	0.0021	0.0130	0.0266	0.0155	0.0078	0.0117
4	construct	0.0163	0.0008	0.0005	0.0032	0.0297	0.0112	0.0058
5	all-mfg	0.0067	0.0034	0.0008	0.0011	0.0032	0.0082	0.0035
6	trans/comm	0.0231	0.0107	0.0064	0.0040	0.0084	0.0194	0.0109
7	elec/gs/ut	0.0291	0.0043	0.0266	0.0545	0.0318	0.0161	0.0240
8	wholesale	0.0110	0.0058	0.0021	0.0042	0.0262	0.0052	0.0046
9	retail	0.0133	0.0051	0.0053	0.0120	0.0264	0.0151	0.0101
10	fin/ins/re	0.0523	0.0207	0.0273	0.0490	0.0193	0.0492	0.0353
11	services	1.0231	0.0104	0.0070	0.0183	0.0223	0.0318	0.0170
12	medical	0.0013	1.0025	0.0004	0.0001	0.0001	0.0128	0.0331
13	education	0.0196	0.0058	1.0007	0.0015	0.0019	0.0018	0.5200
14	wat/san	0.0037	0.0013	0.0015	1.0017	0.0020	0.0024	0.0557
15	loc-roads	0.0029	0.0008	0.0001	0.0002	1.0184	0.0547	0.0729
16	loc-gov	0.0132	0.0041	0.0006	0.0011	0.0015	1.0081	0.3462
17	loc-taxes	0.0378	0.0112	0.0014	0.0028	0.0037	0.0034	1.0026

APPENDIX C

CRITIQUE OF DATA SOURCES

Introduction

Data gathered for the tri-county interindsutry study were secured from a wide variety of primary and secondary sources. Data from secondary sources were basically used to provide preliminary estimates of total gross output levels for the respective sectors delineated in the study. As the study progressed, it was discovered that particular secondary sources could not be used for such estimation purposes. The reasons for this are quite specific and vary depending on the source. Primary data were used extensively to estimate the gross flows matrix; they were also used to estimate a level of total gross output for several of the sectors. Thus, the purpose of this section is to criticize the various data sources and sepcifically explain how the data and any attending problems were handled in the study. The discussion commences with an overview of the primary sources. Following this, the section is divided by SIC division descriptions with each containing an identification of relevant data sources, comment on the adequacy of the data for the tri-county Northwestern Colorado interindustry study, and mention of how the data were handled.

Following the discussion is a complete listing, in bibliographic form, of data sources cited. Reference numbers in the text of this section refer to the sequence numbers of this list, not the bibliography entries at the conclusion of the report. Following each entry is an abbreviated annotation in brackets. The SIC numbers in the annotation indicate that data pertinent

to that respective SIC classification are contained in the source cited; a verbal description is used when SIC numbers are not appropriate.

Primary Sources

Data from primary sources can be classified into two categories: first, information obtained directly from economic producers, and second, information obtained from the files of government agencies, trade associations, and others who receive report forms from economic producers. As indicated previously, data obtained directly from economic producers were secured through the interview process; a mail questionnaire was not employed in the study.

Data identifying gross flows for the agriculture and livestock sectors were largely secured from the Cooperative Extension Service, Department of Economics, Colorado State University. Specifically, the Extension Service data pertained to estimated costs of producing particular crops and animals, not the aggregate expense levels of individual farm operators.

John Peterson and Oded Rudawsky of the Colorado School of Mines had just completed a rather extensive study of minerals and energy in Colorado about the time the research for this inquiry was commencing. (40) Because 53 percent of Colorado's crude production and nearly 25 percent of the state's natural gas extraction occurs in Northwestern Colorado, the decision was made to use the basic findings of Pederson and Rudawsky and limit the interviewing for this sector. The limited interviewing that did occur was highly selective and for the express purpose of securing information necessary for the modification of published results of the Pederson and Rudawsky study.

Special comment on the data secured from the Colorado Department of Labor and Employment is warranted. (10) Employment and wage information contained in the reports of each employer in the state is placed on reels of computer

tape for processing by the Department. The Colorado Manpower Review(9) publishes a summary of this data for the state and the Denver-Boulder Labor Market Area; detailed information for individual counties does not ordinarily get published. Accordingly, the information pertinent to employment and earnings in the tri-county region of Northwestern Colorado had to be obtained directly from the Colorado Department of Labor and Employment. The computer tapes released for use in the tri-county study covered the reports of calendar years 1972 and 1973 and the first three quarters of 1974. This presented some difficulty because the study was designed to cover calendar year 1976. Further, the Colorado Department of Labor and Employment uses 1967 SIC descriptions at the four-digit level to classify firms, while the tri-county study used 1972 SIC codes. Still other difficulties were presented by what appeared to be obvious misclassification of firms (this is especially true at the four-digit level) and recording errors, not to mention a change in report procedures between 1973 and 1974. Considerable effort was required to modify Colorado Department of Labor and Employment data before it could be used. These adjustments were made on a case-by-case basis and did not follow a specific formula.

Serious difficulties were not encountered with the information secured from the files and inhouse reports of other government agencies, trade associations, and other organizations (5,7,19,22,23,24,25,29,31,38,44,68, and 77). The data were not always in the form requested but were sufficiently detailed so that, with slight modifications, they were quite useful. Specific comment on these data and others follow in the respective SIC division.

Agriculture and Forestry

Of all economic sectors in the model, agriculture has the most current and detailed secondary data. The most versatile document in terms of securing individual crop data on an individual county basis is the Colorado Agricultural Statistics publication (1). Issued annually by the Colorado Department of Agriculture, it publishes detail on major state crops, and identifies the production levels in respective counties. Specific limitations are nonetheless inherent in the tabular presentations. For example, crops are reported on a production and market value basis; and there is a difference between market value and market receipts. The implication of this is not too severe for crops when virtually all production is marketed; but this is not the case with crops such as hay. Total gross output in the model is defined in terms of market receipts; so an adjustment of the value of the hay crop, as reported in Colorado Agricultural Statistics, was made. Specifically, the ratio of hay marketings reported in the 1969 Federal Census of Agriculture to the 1969 market value of hay reported in Colorado Agricultural Statistics was applied to the latter's 1974 report.

The Colorado Agricultural Statistics also has a tendency to aggregate certain "minor" crops not only across crop lines but also county lines. For example, potatoes are identified for Morgan, Weld, and the respective counties in the San Luis Valley; one value is then reported for the rest of the state. Hence, while potatoe production is not important in the tri-county region of Northwestern Colorado, precise documentation of that fact is not possible because of aggregated reporting for crops.

Other particular adjustments were not attempted on the irrigated and dry agricultural output as reported by Colorado Agricultural Statistics.

The publication is not well enough documented to determine whether or not an adjustment is warranted. Further, all production indices availables are for the entire state and are highly aggregated (2).

Procedures employed to secure and report information are not documented in Colorado Agricultural Statistics. A regional analyst must be concerned with the quality of data but really has not basis for judgment without supporting documentation. For example, onion production is reported in Colorado Agricultural Statistics for the Western Slope (no county delineation); the Bureau of Reclamation also reports onion production in the annual publication of Water and Land Resource Accomplishments for farms served by the GrandValley and Uncompahgre projects (71) and (72). The Bureau's report suggests there is a definite element of randomness involved, i.e., both acreage planted and production yields vary over time. By contrast, the acreages reported by Colorado Agricultural Statistics are rather consistent. It should also be mentioned that in certain years the Bureau's publication reports considerably more acreage for farms served by the above two projects than the state publication does for the entire Western Slope; and for the counties involved, the authors suggest that it makes a considerable difference in the aggregate value of marketings.

Data on the value of marketings of livestock is reported in Colorado Agricultural Statistics for final marketings only. Further, the data are reported at the state level. Thus, not only are interfarm transactions not reported, but the relative value of individual county output cannot be directly determined. Thus, the value of the total gross output of the livestock sector in the tri-county interindustry study was determined from information secured from the Cooperative Extension Service, Department of Economics, Colorado State University.

Determination of the gross flows for agriculture and livestock production was highly dependent on information secured from the Cooperative Extension Service. This was supplemented with data published in Cost of Producing Crops in the Irrigated Southwest (82) and information supplied by the Northwest Colorado Agri-Business Association (38) and Tri River Agri-Business Farm Management Association (44). Government payments to the agricultural sectors were determined from the Agricultural Stabilization and Conservation Service, Annual Report - Colorado (45).

Data on the employment of labor in the agricultural sectors is not readily available from published sources. The estimate of the dollars paid for wages in each of the sectors was based on the Cooperative Extension Service information. The number of people employed in agriculture as identified in the 1970 Census of Population (59) was taken as a proxy value to obtain an employment coefficient. The aggregate value for agricultural services was estimated by using the Cooperative Extension Service information and checked for consistency by interview.

In summary, adequate data do appear to exist for the agricultural sectors of the tri-county economy. However, particular concern is noted for the high level of aggregation in some cases, a lack of published interfarm transaction values for livestock, and lack of good data on employment. Also, it appears that there is a general lack of documentation, a deficiency which must be overcome in order to judge the quality of the data.

Mining

Publications by the Federal Government were not considered for inclusion in the mining division of the model. At the national level, and sometimes

the state level, information pertaining to mining production quantities and values van be secured. Because of the characteristically small number of operators, information on specific minerals in specific counties is rarely published. Examples of Federal publications for which this is largely true are: Census of Minerals Industries (58); Minerals Yearbook (70); Statistical Data of the Uranium Industry (75); and Uranium Exploration Expenditures and Plans (76).

State of Colorado documents were relied upon quite extensively, but not without reservation. The most comprehensive, yet the most limiting, state document is A Summary of Mineral Industry Activities in Colorado (13). This publication lists production by mineral value and by county. Listing by mineral value has several very specific limitations. For some outputs the unit price is not always given; thus quantity calculation becomes difficult, if not nearly impossible. Where unit price is given it is always applied to all production; thus, for example, the market value for metallurgical coal is published as being equal to the market value for other types of coal. The unit price for ores refers to a refined market value; thus when ore is subject to reduction away from the county in which it was mined, the value accruing to the mining county is overstated. One last criticism is leveled at the practice in the publication of adding nearly $50 million to the value of state mineral production and footnoting it as minerals mined out of, but refined in, the state; no indication is given as to what the minerals are or where they are refined.

Data are available monthly in the Monthly Report (15) and annually in Coal (14) on the production of coal. Tonnage values, labor employed, and days worked are reported for every coal mine in the state. Barrels of oil pumped, cubic feet of gas produced, and the volume of injections are

published for every well in the state in Oil and Gas Statistics (17). Thus, the researcher is left with the task of determining a unit value when information on coal, oil, and gas is secured from these sources.

The Pederson and Rudawsky study, "The Role of Minerals and Energy in the Colorado Economy," was used as a data source in the mining division, especially as it related to oil and gas production. A publication that complemented Oil and Gas Statistics when identifying potential interviewees for the oil and gas sector was the Rocky Mountain Petroleum Directory (81).

In the final analysis, the total gross output values used in the mining division of the tri-county study were estimated based on information gained by interviewing. Federal publications fail to publish sufficient information at the county level and state publications leave much to be desired with respect to unit pricing. Furthermore, state documents do not necessarily identify the economic production that takes place in some counties.

Construction

Publications such as the Census of Construction Industries (50) and (51) and the Construction Review (65) aggregate on the state level and hence are inadequate for estimation of activities in individual counties. The publication, Construction Reports - Housing Authorized by Building Permits and Public Contracts (63), though county specific, fails to account for all construction. Further, the reference accounts for permits and contracts authorized during a given period. In a relatively small county there is not necessarily sufficient volume to either avoid "lumpy" reporting or maintenance of the assumption that level of work in a given period is equal to the dollar value of the authorizations. Finally, the Construction Reports do not suggest how much of the job is involved with various types of contractors so

that an estimation of value of intersector transactions can be made. In conclusion, the authors saw no alternative but to estimate total gross output for the construction sector from primary data.

Manufacturing

Both the 1972 Census of Manufacturers (57) and County Business Patterns is fairly complete in a broad sense but still quite limited in what detail is published. Disclosure requirements preclude publishing critical information and result in a high degree of aggregation. Even in those sectors where the data are published, restrictions are imposed because seasonal variations (e.g., as in food processing) are not reflected in the first quarter reporting. Finally, County Business Patterns still employs 1967 SIC code definitions. As a result, neither of these publications were of much use for the tri-county interindustry study. In fact, levels of output for the manufacturing sectors had to be estimated from primary data.

The Directory of Colorado Manufacturers (79), published annually by the Bureau of Economic and Business Research (University of Colorado), was used extensively in the determination of which manufacturers to interview. The publication identifies firms by four-digit SIC classification, location, and employment range. Key personalities are also identified. Some information in the Directory of Colorado Manufacturers is quite dated, but the document is nonetheless an invaluable reference.

Before interviewing a given owner or manager, an attempt was always made to gain a "feel" for the type of firm that was involved. For example, secondary research was done on what the output per worker might be and what might be expected in terms of value added. A publication quite often referred to for answers to these types of questions was the Annual Survey of

Manufacturers (48). Though the information contained therein was not directly used in the tri-county study, it did provide for an ongoing consistency check. Specifically, the document contains, on a four-digit SIC basis, ratios pertaining to inputs and outputs of the manufacturing sectors of the national economy.

In summary, detailed secondary data do not exist for manufacturing activities in the study region. Aggregate levels of economic activity for individual sectors must be determined from primary data and checked for consistency by observing secondary data.

Transportation, Communications, Electric, Gas, and Sanitary Services

Secondary data for the transportation, communications, electric, gas, and sanitary services sectors is quite available and generally speaking, of fairly good quality. Despite this, almost none of it was used in the tri-county study. The reasons for this are largely in the nature of the filing system at the Colorado Public Utilities Commission (PUC) (23) and methods employed prior to seeking an interview with any given firm. Specifically, before any single interview was conducted an attempt was made to learn as much as possible about the firm in question. This meant that for firms in the public utilities sectors, the research started with an examination of the reports filed with the PUC. The PUC reports were readily accessible so they were also used to estimate levels of total gross output where applicable. For those cases in which the PUC does not have jurisdiction, because municipal owned enterprises are involved, estimates were made based on information filed with the Colorado State Auditor (24). Bureau of Reclamation power activities were estimated based on interview. Despite the above

mentioned relatively high incidence of direct information, secondary data sources still merit comment.

The Interstate Commerce Commission publishes materials pertaining to various forms of transportation on a regional basis: examples are Transport Statistics in the United States: Pipelines (36) and Transport Statistics in the United States: Motor Carriers (37). These types of documents were not really helpful in the study because their use necessitate a significant amount of prorating. A similar argument holds for documents published by the Federal Aviation Administration. As a result, the best alternative was to estimate the level of economic activity in the transportation sector from PUC reports and information gained in interviews.

United States Postal Service (U.S.P.S.) revenues were determined by examining postal receipt schedules for each post office in the region. Since Congress created the independent U.S.P.S., postal receipts for individual post offices are no longer published. Accordingly, this information was obtained directly from the Sectional Center Facility (SCF) managers (77). The SCF manager in Grand Junction was interviewed to gain information on the expense patterns for the U.S.P.S. Despite the accuracy of this information, it is suggested that the regional accounting perspective can lead to an erronous conclusion about the U.S.P.S. This is because the postal sector's total gross output was defined in terms of an expense level rather than a revenue level. The reason for doing this is that the imputed postal revenue for the tri-county region of Northwestern Colorado is higher than the actual revenue but it is not known by how much higher. For example, Mountain Bell mails statements to local customers from Denver; the actual revenue for the U.S.P.S. is identified with the Denver Post Office, yet a portion

of the expenses connected with the handling of those statements is absorbed by the local Post Office. Thus, a portion of the actual Denver revenue imputes to the tri-county region.

Information on rural telephone systems can be obtained from the Annual Statistical Report: Rural Telephone Borrowers (47). Territorial integrity for rural systems in the region is such that the information is straightforward and does not have to be allocated. Mountain Bell's activities, on the other hand, had to be estimated by prorating the various revenues and charges identified in their annual report to the Colorado PUC. This was greatly facilitated by having additional information supplied directly by the company. Radio and television activities were estimated by prorating data contained in the Federal Communications Commission's Annual Report (30). Specifically, the data identified revenue for stations outside the metropolitan area. The basis for allocation was the volume of retail sales as identified in the Annual Report (21) of the Colorado Department of Revenue.

Published secondary data were of limited use for estimating electric and gas revenues. For example, examination of Annual Statistical Report: Rural Electric Borrowers (46) sometimes fails to include the operation of electric associations which are headquartered outside the tri-county region. Information contained in statistics of Publicly Owned Electric Utilities in the United States (34) is reported on a company basis and the tri-county is only part of the territory of the Public Servcie Company of Colorado. Statistics of Publicly Owned Electric Utilities in the United States (35) does not identify all the municipal operations in the tri-county region. Finally, the Bureau of Reclamation's power activities cannot be reasonably estimated by using the information contained in Water and Land Resource

Accomplishments: Summary Report (72). Thus, the estimation of total gross output for the electricity and natural gas sector was determined by the information obtained from PUC reports, the State Auditor, and interviews.

The water, sewerage, and sanitary services sector is characterized by a high incidence of special tax districts. Complete information on the activities of these districts is not published anywhere. Thus the audit reports filed with the Colorado State Auditor were examined in detail to secure information for this sector. For those instances where private enterprise is involved, the information was obtained at the PUC office.

In summary, though considerable information is published for the transportation, communications, electric, gas, and sanitary services sectors, problems associated with excessive aggregation, territorial integrity, and incomplete reporting precluded use of the information in the tri-county interindustry study.

Trade - Wholesale and Retail

Examination of Robert Morris Associates' Annual Statement Studies (42) suggested that to arrive at any meaningful coefficients for the trade sectors a rather exhaustive and detailed study of the trade sectors would have been warranted. Considering the time and financial constraint imposed on the research such a detailed study could not be justified. Accordingly, very little primary data were secured for the trade sectors in the tri-county interindustry study.

Secondary data sources used to estimated the levels of total gross output included the Census of Wholesale Trade (62), The Census of Retail Trade (60), and the Colorado Department of Revenue's Annual Report (21). Both Census publications referred to calendar year 1972, used 1972 SIC classifications,

and needed updating to reflect 1976 conditions. Difficulties encountered in this activity emanated from the Colorado Department of Labor and Employment data being classified by 1967 SIC codes and the lack of price indices for Colorado. The Department of Revenue report is classified by 1967 SIC descriptions and pertains to a fiscal year. Other problems associated with the use of the Department of Revenue report stem from the failure to identify the ratio of tax exempt sales at the county level and what appears to be a rather significant understatement of the volume of wholesale activities. The total gross output values were thus estimated as follows. Mean values were calculated for each trade sector using two annual reports of the Colorado Department of Revenue; the state exemption ratio for each respective sector was used to increase reported county retail sales; output values were shifted to conform to 1972 SIC descriptions by using ratios describing the relationship between Colorado labor data for 1972 and the wholesale and retail census for 1972.

Select interviews were used to gain information relative to what values would be used for regional flows and margining of the trade sectors. Further, information contained in publications such as "Economic Impact of Alternative Energy Supply Policies in Colorado" (26) and "An Interindustry Analysis of the Colorado River Basin in 1960 with Projections to 1980 and 2010" (78) was used to routinely check for consistency. Given these limitations, caution must be expressed in regard to the accuracy of the coefficients in the trade sector. It is recommended that an in-depth study of this sector, employing primary data collection techniques, be undertaken in the near future.

Finance, Insurance, and Real Estate

Secondary data on the activities of commercial banks is contained in Sheshunoff and Company's The Banks of Colorado (43). This is a privately-printed industry publication that shows the balance sheet and income statement for each bank in the state. A source such as Bank Operating Statistics (32), published by the Federal Deposit Insurance Corporation, aggregates information by region; none of these regions correspond to the geographic delineation of the tri-county study. Accordingly, the Sheshunoff data was used to identify the level of economic activity for commercial banks.

Savings and Loan Association data are published in Combined Financial Statements - Member Savings and Loan Association of the Federal Home Loan Bank System (33). Association activities are identified by state total, metropolitan area, and the area outside the metropolitan area. Thus, to estimate total gross output for savings and loan associations, the activity outside the metropolitan area was prorated to the tri-county region by using the personal adjusted gross income figures reported in the Colorado Department of Revenue's Annual Report (21). Information pertaining to the activities of the Federal Credit Banks' operations was gained from filed reports (31).

Insurance activities were estimated from information gained largely from interview. The Colorado Division of Insurance publishes the Insurance Industry in Colorado: Statistical Report (20). This document identifies, on a company basis and a line basis, premiums earned and losses incurred. As a first approximation the difference between premiums and losses was prorated by population to estimate tri-county insurance activity. This first approximation was then modified based on information gained in interviews.

Real estate activities were estimated by first obtaining the value of documentary fees paid in each of the three counties (29). From the

documentary fees paid an estimate was made of the transaction values involved and a six percent commission was allowed on the same. The estimated commissions were used in turn as the approximation for the total gross output of the real estate sector.

In summary, direct information pertaining to finance, insurance, and real estate does not exist in published form for the study region. Estimates must be made using a combination of published secondary data and information gained from primary sources.

Services

Data sources for services are grouped into three categories for discussion purposes. The first part of the discussion will focus on data sources pertinent to the health and medical care field; the second pertains to data sources for the education sector; and final portion comments on data sources for all other services.

Information pertaining to institutional health care was secured directly from the providers of the services. These providers include the Veterans Administration Hospital, the State Home, private and public hospitals, and nursing homes. Contact with the nursing homes was facilitated by an interview with the Colorado Health Care Association (25). A partial list of hospitals and nursing homes in the region is contained in the Directory - Medicare Providers and Suppliers of Services (66).

The value of services provided by physicians, dentists, optometrists, and others was estimated by using secondary information. For a first approximation, information contained in "National Health Expenditures" (28) was adjusted by using the index values published in Medicare: Health Insurance for the Aged - Geographical Index of Reimbursement by State and County (67).

The resulting figure was then adjusted based on information gained in interviews and secured from the Colorado State Department of Health (7), the Colorado Department of Social Services (22), and the Social Security Administration (68).

Data are readily available for education activities in the tri-county region. Data pertaining to colleges were secured directly from the respective institutions. The Colorado Commission on Higher Education (CCHE) (5) also provided information on other institutions of higher education. Revenues and Expenditures: Colorado School Districts (6), published annually by the Colorado Department of Education, was used to identify the level of total gross output for public schools. This document is rather comprehensive and identifies revenues and expenditures for each school district in the state. Data secured from the CCHE and the Department of Education's revenue and expenditure report were supplemented with information gained in interviews. Because of the high quality data described above, the Bureau of the Census data contained in Finances of School Districts (55) were not used in the tri-county interindustry study.

The information contained in Census of Selected Service Industries (61) was used as a first approximation of the total gross output for all other services. Colorado Department of Labor and Employment data were used to update the census data to an approximation of 1976 conditions. Concomitantly, the data that pertained to dental laboratories in this publication were removed to the health and medical care sector.

As with the trade sectors, very little primary information was collected for the services not elsewhere classified sector. Accordingly, given this limitation, caution is expressed with regard to the accuracy of the coefficients

in this sector in the tri-county interindustry study. Further, it is recommended that an in-depth study of the sector be conducted employing primary data collection techniques.

Public Administration

Rather extensive information on local and county government activities is contained in the Bureau of Census publications, Compendium of Government Finances (52), Finances of County Governments (53), Finances of Municipalities and Township Governments (54), and Compendium of Public Employment (56). Two considerations precluded the use of these documents in the tri-county interindustry study. First, the desire to have even more detailed data to facilitate the separation of local and county government enterprises. Second, preliminary investigation suggested that the dollar increase in a number of local and county government budgets was rather significant between 1972 and 1974.

Secondary data published by the state were used extensively during the preliminary stages of the research but were later replaced with primary data. The Local Government Financial Compendium (11) does not list expenditures and revenues for communities under 1,000 people. Further, the publication does not account for special tax districts. The Division of Property Taxation's Annual Report to the Governor and the Legislature (12) identifies valuations, levies, and property tax revenues for every local tax authority. The Colorado Department of Revenue's Annual Report (21) contains information sufficient to estimate local sales tax collections. Though each publication contains good quality data, the tri-county study eventually used the files of the State Auditor. The audit reports filed here are more complete, more detailed, and more extensive in coverage than than the state publications.

Data pertaining to the total expenditures of the State of Colorado were secured directly from the Colorado Department of Planning and Budget (19). A recent executive order had caused all state budgets to be regionalized according to the various planning regions in the state. Though the planning regions do not conform to the delineation of the tri-county interindustry study, the budget regionalization greatly facilitated the search for data on state expenditures. Information on tax payments to the State of Colorado is contained in the Department of Revenue's Annual Report (21). An estimation of revenues from hunting and fishing licenses was made based on information in Coloado Big Game Harvest (16). Revenue generated because of activites on state lands was estimated by using the State Board of Land Commissioners' Summary of Transactions (18).

Following the collection of the above data, interviews were arranged with the agencies that made significant expenditures in behalf of the State of Colorado. Scheduling the expense patterns of the Colorado Department of Highways was greatly facilitated by the use of Colorado's Annual Highway Report (8). In summary, the data secured on the State of Colorado pecuniary activities were not difficult to obtain and are rather comprehensive.

Revenues accruing to the Federal Government account were largely estimated by prorating from a Colorado base. The Treasury publication, Combined Statement of Receipts, Expenditures, and Balances of the United States Government for the Fiscal Year Ended June 30, 1975 (73), identified revenue by state and by category. Thus the figure published for Colorado was adjusted by using information in the Colorado Department of Revenues' Annual Report (21) and the Treasury's Statistics of Income 1969, Zip Code Area Data From Individual Income Tax Returns (74). This first approximation was then adjusted by using information gained from the Forest Service, the

Bureau of Land Management, the Bureau of Reclamation, and the publication Public Land Statistics (69).

For a first approximation of Federal expenditures, data were secured from Federal Outlays in Colorado (39). This publication shows estimates for Federal outlays by agency and by county. Many of the estimates are prorated by using standardized criteria. Thus, the research for the tri-county interindustry study sought to estimate Federal expenditures independently. Some documents, such as the Veterans Administration's Annual Report (80) and the Railroad Retirement Board's Annual Report (41), were examined and the data so secured prorated to the tri-county region of Northwestern Colorado. This practice was too limiting so more direct information was obtained. Specifically, the major agencies were contacted: these include the Social Security Administration, the Bureau of Reclamation, the Bureau of Land Management, the Geological Survey, the Forest Service, the U. S. Postal Service, and the Energy Research and Development Administration.

In summary, the data on Federal Government revenues are approximations derived largely from state totals. The data pertaining to Federal expenditures are largely estimations based on information gained in interviews.

Households were not interviewed for the tri-county study. Further, the data pertaining to household income and expenses are a direct result of the estimations made for the income and expenses of the other sectors in the study.

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[01, 02, 07]

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[13]

18. Colorado. Department of Natural Resources. State Board of Land Commissioners. Summary of Transactions. Annual.
[public land administration]

19. Colorado. Department of Planning and Budget. Files.
[state government]

20. Colorado. Department of Regulatory Agencies. Division of Insurance. Insurance Industry in Colorado: Statistical Report. Annual.
[63, 64]

21. Colorado. Department of Revenue. Annual Report. Annual
[population, income, state tax revenues, motor vehicle registrations]

22. Colorado. Department of Social Services. Files.
[80, 83, households]

23. Colorado. Public Utilities Commission. Files.
[40-42, 45-49]

24. Colorado. State Auditor. Files.
[local and county governments, special tax districts]

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APPENDIX D

COMPONENTS OF TRANSFER, DEPRECIATION, AND INVESTMENT ACCOUNTS

D-1
COMPONENTS OF TRANSFER ACCOUNT ROW

Column Headed	Dollars Charged Transfer Account	Explanation
1. Ag/Livestock	230,204	insurance loss pool
2. Coal Mines	366,994	insurance loss pool
3. Oil/Gas Pr	182,573	insurance loss pool
4. Construct	413,934	insurance loss pool
5. All Mfg.	56,031	insurance loss pool
6. Trans/Comm	191,936	insurance loss pool
7. Elec/GS UT	92,691	insurance loss pool
8. Wholesale	57,842	insurance loss pool
9. Retail	513,221	insurance loss pool
10. Fin/Ins/Re	37,726	insurance loss pool
	4,157,176	interest payments
	6,290,600	outside finance
11. Services	249,716	insurance loss pool
12. Medical	79,049	insurance loss pool
13. Education	159,942	insurance loss pool
14. Wat/San	3,957	insurance loss pool
15. Loc Roads	43,490	insurance loss pool
16. Loc Gov	88,621	insurance loss pool
	573,115	transfer payments
19. Households	3,123,301	insurance loss pool
20. State Gov	52,613	insurance loss pool
	758,811	transfer payments
	16,121,328	state financial surplus

D-3

Column Headed	Dollars Charged Transfer Account	Explanation
21. Fed Gov	14,342,000	transfer payments
	75,631,866	Federal financial surplus

D-2
COMPONENTS OF TRANSFER ACCOUNT COLUMN

Row Headed	Dollars from Transfer Account	Explanation
4. Construct	278,671	insurance loss pool
9. Retail	266,543	insurance loss pool
10. Fin/Ins/Re	28,099	insurance loss pool
11. Services	1,475,378	insurance loss pool
12. Medical	1,055,685	insurance loss pool
13. Education	137,561	interest income
14. Wat/San	88,214	interest income
15. Loc Roads	2,453	interest income
16. Loc Gov	571,047	interest income
19. Households	1,178,500	insurance loss pool
	2,371,866	dividend income
	4,075,160	interest income
	12,994,500	entrepreneurial income
	573,115	local government transfer
	758,811	state government transfer
	14,342,000	Federal government transfer
20. State Gov	158,290	interest income

Row Headed	Dollars from Transfer Account	Explanation
21. Fed Gov	3,473,114	outside finance
	490,000	other interest income
23. Proftis	2,709,611	interest income
	-19,441,526	close dividends, interest, and profit to households
	-80,132,965	expatriate profits
25. Imp-Colo.	1,015,132	insurance loss pool
	2,817,486	outside finance
	80,132,965	expatriate profits
	16,121,328	state financial surplus
26. Imp-World	645,833	insurance loss pool
	75,631,866	Federal financial surplus

(23) Profits, rents, interest; also

(23) Investment; also

(24) Depreciation; also

(24) Oil Shale

APPENDIX E

SURVEY FORM USED FOR THE INTERINDUSTRY STUDY

COLORADO STATE UNIVERSITY
department of economics
FORT COLLINS
COLORADO
80521

QUESTIONNAIRE

COLORADO INTER-INDUSTRY ANALYSIS

This questionnaire is designed to enable you to provide us, in as simple a form as possible, a detailed account of your firm's purchases and sales in 1974. The specific focus of the analysis is the component of that activity occurring in the nine county N.W. Colorado region comprised of Delta, Eagle, Garfield, Mesa, Moffat, Montrose, Pitkin, Rio Blanco and Routt counties.

This information will be handled in strictest confidence. Your responses will be aggregated with those of other firms in your sector, eliminating the possibility that any single firm's responses will be identifiable.

Please note:

1. We are particularly interested in obtaining data which are a reasonable representation of your firm's current operation. Data for a fiscal or calendar year 1974 or later are preferred. In the event that data are not available in this form, please use any consecutive twelve months since 1973 (please indicate).

2. You may indicate sales and purchases in dollar amounts or percentages.

3. When exact data are not available, please use estimates. If it is not possible to provide information for certain questions, please indicate.

Name of Firm: _____

What is your major product(s) or service(s)? If convenient, list the appropriate SIC classification(s). _____

_____

What was the total number of employees you had at any one time in 1974?

Full Time: _____ Part Time: _____

Please indicate the value of your establishment's sales in 1974. TOTAL SALES:

$ _____

Please indicate the value of your establishment's purchases in 1974.

TOTAL PURCHASES: $ _____

Please indicate the value of your establishment's net inventory change in 1974. (This may be a positive or negative figure.) NET INVENTORY CHANGE: $_____

At what level of output capacity did your establishment operate during 1974?

LEVEL OF CAPACITY UTILIZATION: % _____

What is your estimate of your establishment's total water use for all phases of your operation? (Note: please use any convenient unit of measurement; e.g., gallons per day, 1000 gallons per day, acre feet per year, etc.)

TOTAL WATER INTAKE: _____

PURCHASES ANALYSIS

SUPPLY SOURCE; SECTORS FROM WHICH YOU PURCHASE	PURCHASES IN N.W. COLORADO COUNTIES $ or % of Total	PURCHASES FROM OTHER COLORADO COUNTIES $ or % of Total	PURCHASES OUTSIDE COLORADO $ or % of Total
1. IRRIGATED AGRICULTURE			
2. DRYLAND AGRICULTURE			
3. LIVESTOCK; RELATED PRODUCTS (dairy and poultry products; honey; animal specialties; etc.)			
4. AGRICULTURAL SERVICES (veterinary, custom FORESTRY field work, etc.)			
5. METAL MINING; RELATED SERVICES			
6. COAL MINING; RELATED SERVICES			
7. OIL AND GAS EXTRACTION; RELATED SERVICES			
8. SHALE OIL EXTRACTION; RELATED SERVICES			
9. NON-METALLIC MINING; RELATED SERVICES			
10. ALL CONSTRUCTION			
11. FOOD AND KINDRED PRODUCTS (processed foods for human and animal consumption)			
12. LUMBER; WOOD PRODUCTS (loggers, sawmills, cabinet shops, miscellaneous wood products manufacturers)			
13. PRINTING AND PUBLISHING; PAPER AND ALLIED PRODUCTS (includes newspaper advertising, etc.)			
14. CHEMICALS; PETROLEUM REFINERS; RUBBER MANUFACTURERS			
15. STONE, GLASS, CLAY PRODUCT MANUFACTURERS			
16. FABRICATED METALS; NON-ELECTRICAL MACHINERY MANUFACTURERS			
17. ELECTRICAL MACHINERY AND EQUIPMENT; TRANSPORTATION EQUIPMENT; ELECTRONIC INSTRUMENTS AND COMPONENTS MANUFACTURING			
18. ALL OTHER MANUFACTURERS (Jewelry, precious metals, musical instruments, sporting goods, etc.)			
19. TRANSPORTATION: AIRLINES, BUS LINES, RAILROADS, TRUCK LINES, AMBULANCES, U.P.S., R.E.A., etc.			
20. U. S. POSTAL SERVICE (postage, mail box rental, etc.)			
21. COMMUNICATION: RADIO, TELEVISION, TELEPHONE, TELEGRAPH (includes media advertising, cable subscriptions, etc.)			
22. ELECTRICITY; NATURAL GAS (Utilities)			
23. WATER, SEWERAGE, TRASH REMOVAL SERVICES (Utilities)			
24. WHOLESALE TRADE (wholesaling intermediaries)			
25. AUTOMOBILE DEALERS; GASOLINE SERVICE STATIONS			
26. EATING AND DRINKING ESTABLISHMENTS; HOTELS, MOTELS, OTHER LODGING			
27. RETAIL - NOT ELSEWHERE LISTED			
28. FINANCE (interest payments; payments on outstanding principal)			
29. INSURANCE PREMIUMS--LIFE, ACCIDENT, HEALTH, MEDICAL, FIRE, CASUALTY, SURETY, TITLE; PENSION, HEALTH, AND WELFARE FUNDS (non-government)			
30. REAL ESTATE (value of real estate purchased, commissions, and management fees)			
31. HEALTH SERVICES (medical, dental, hospitals, laboratories, other patient care facilities)			
32. EDUCATIONAL SERVICES (primary, secondary, post-secondary, technical, professional)			
33. SOCIAL SERVICES AGENCIES			
34. ALL OTHER SERVICES (legal, personal, data processing, equipment leasing, recreation, etc.)			
35. LOCAL AND COUNTY GOVERNMENTS (taxes, permits, licenses)			
36. STATE GOVERNMENT (taxes, permits, license fees)			
37. FEDERAL GOVERNMENT (taxes, permits, license fees, employers FICA, unemployment insurance)			
38. HOUSEHOLDS (payments subject to withholding)			
39. RENTS; DIVIDEND PAYMENTS; RETAINED EARNINGS; BAD DEBTS			
40. DEPRECIATION EXPENSE			

SALES ANALYSIS

DEMAND SOURCE: SECTORS TO WHICH YOU SELL	SALES IN N.W. COLORADO COUNTIES $ or % of Total	SALES TO OTHER COLORADO COUNTIES $ or % of Total	SALES OUTSIDE COLORADO $ or % of Total
1. IRRIGATED AGRICULTURE			
2. DRYLAND AGRICULTURE			
3. LIVESTOCK; RELATED PRODUCTS (dairy and poultry producers; bee keepers; animal breeders; etc.)			
4. AGRICULTURAL SERVICES (veterinarians, custom field work operators, etc.); FORESTRY			
5. METAL MINING; RELATED SERVICE OPERATORS			
6. COAL MINING; RELATED SERVICE OPERATORS			
7. OIL AND GAS EXTRACTION; RELATED SERVICE OPERATORS			
8. SHALE OIL EXTRACTION; RELATED SERVICE OPERATORS			
9. NON-METALLIC MINING; RELATED SERVICE OPERATORS			
10. ALL CONSTRUCTION			
11. FOOD AND KINDRED PRODUCTS (processors of foods for human or animal consumption)			
12. LUMBER; WOOD PRODUCTS (loggers, sawmills, cabinet shops, miscellaneous wood manufacturers)			
13. PRINTERS AND PUBLISHERS; PAPER AND ALLIED PRODUCTS (includes newspaper advertising, etc.)			
14. CHEMICALS; PETROLEUM REFINERS; RUBBER MANUFACTURERS			
15. STONE; GLASS; CLAY PRODUCT MANUFACTURERS			
16. FABRICATED METALS; NON-ELECTRICAL MACHINERY MANUFACTURERS			
17. ELECTRICAL MACHINERY AND EQUIPMENT; TRANSPORTATION EQUIPMENT; ELECTRONIC INSTRUMENTS AND COMPONENTS MANUFACTURERS			
18. ALL OTHER MANUFACTURERS (jewelry, precious metals, musical instruments, sporting goods, etc.)			
19. TRANSPORTATION; AIRLINES; BUS LINES, RAILROADS; TRUCK LINES; AMBULANCES; U.P.S.; R.E.A.; etc.			
20. U. S. POSTAL SERVICE			
21. COMMUNICATION: RADIO, TELEVISION, TELEPHONE, TELEGRAPH			
22. ELECTRICITY; NATURAL GAS COMPANIES			
23. WATER, SEWERAGE, TRASH REMOVAL SERVICE ENTERPRISES			
24. WHOLESALE TRADE (wholesaling intermediaries)			
25. AUTOMOBILE DEALERS; GASOLINE SERVICE STATIONS			
26. EATING AND DRINKING ESTABLISHMENTS; HOTELS; MOTELS; OTHER LODGING			
27. RETAILERS — NOT ELSEWHERE LISTED			
28. FINANCE INSTITUTIONS (banks, trust companies, credit agencies, brokers, etc.)			
29. INSURANCE (companies, agents, brokers)			
30. REAL ESTATE (owners, lessors, buyers, sellers, agents, developers)			
31. HEALTH SERVICE ESTABLISHMENTS (medical, dental, hospitals, laboratories, other patient care facilities)			
32. EDUCATIONAL INSTITUTIONS (primary, secondary, post-secondary, technical, professional)			
33. SOCIAL SERVICES AGENCIES			
34. ALL OTHER SERVICE ESTABLISHMENTS (legal, personal, data processing, equipment leasing, recreation, etc.)			
35. LOCAL AND COUNTY GOVERNMENTS			
36. STATE GOVERNMENT			
37. FEDERAL GOVERNMENT			
38. HOUSEHOLDS (direct sales for private consumption)			

APPENDIX F

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