

# **Economic Base Assessment of Delta & Montrose Counties, Colorado**

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November 2001

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## Economic Background

Delta and Montrose counties are located in western Colorado and are part of a larger planning region that also includes Gunnison, Hinsdale, Ouray, and San Miguel counties. All of the counties are designated non-metropolitan as none have a total countywide population that exceeds 35,000 (*see* Table 1). Among the counties Montrose is the largest followed by Delta, which has nearly double the population of the next largest county, Gunnison. In fact, more than two-thirds of the region’s population resides in Delta and Montrose counties, which in 2000 had density rates of only 24.4 and 14.9 persons per square mile, respectively.<sup>1</sup> The largest municipality of the region is the City of Montrose, which had a population of 12,585 in 1998, followed by the City of Delta with a 1998 population of 6,253.<sup>2</sup> There are six municipalities in Montrose County, but 40 percent of the population resides in the City of Montrose and another 50 percent resides in unincorporated areas. The same is true for Delta County, with six municipalities and 50 percent of the population residing in unincorporated areas, however, only 23 percent of the population reside in the largest city.

Table 1. Land Area, Public Land, Population, Population Density, & Poverty Rate; Delta, Montrose, CO & Surrounding Counties; 2000

	Total Square Miles	Public Lands (Sq Miles)	Percent Public Lands	Population	Population Density	Poverty Rate (1997 est.)
Delta	1,142	628	55%	27,834	24.4	16.2%
Gunnison	3,239	2,526	78%	13,956	4.3	11.8%
Hinsdale	1,118	1,051	94%	790	0.7	10.8%
Montrose	2,241	1,456	65%	33,432	14.9	13.2%
Ouray	540	249	46%	3,742	6.9	7.2%
San Miguel	1,287	849	66%	6,594	5.1	8.5%

*Data Sources:* U.S. Census Bureau, State & County QuickFacts and Colorado Department of Local Affairs, Colorado Demography Section.

The regional economy was historically based on agriculture and mining, but in the last three decades has seen a great deal of growth in the services, trade, and government sectors, and slower but steady growth in FIRE (Finance, Insurance, and Real Estate) and TCPU

<sup>1</sup> Region 10- League for Economic Assistance & Planning, Landuse.

<sup>2</sup> Sub-county stats from League for Economic Assistance & Planning. Autumn 1999. *Region 10 Review*. Vol. 6.

(Transportation, Communication, and Public Utilities). However, farms, ranches, and orchards remain a significant part of the area economy, in addition to forestry, although the agricultural and forest industry's viability is to a large extent dependent on federal initiatives. In conjunction, approximately 65 percent of Montrose County's land is publicly owned and 28 percent is agricultural land, while in Delta County 55 percent is public and 37 percent is agricultural.<sup>3</sup> An abundance of fruit and vegetables are cultivated on those lands, and traditional livestock, as well as llamas, miniature horses, and pot-bellied pigs can be seen grazing on both publicly and privately owned parcels. However, in Montrose County, a larger percentage of the population is employed in services and retail trade, as the county and the City of Montrose has in the past, and continues to serve as the economic center for the region.

The poverty rate in the area is high, but it is not extreme,<sup>4</sup> with a rate of 13.2 percent in Montrose and 16.2 percent in Delta in 1997, and lesser rates in the surrounding counties (*refer to* Table 1). In fact, poverty in the region is near or below that of most other non-metro counties in the country. Yet, there is a growing concern for the economic health of the region's residents. Income has been rising, but a large percentage of it is from transfer payments, which the region receives in a relatively high proportion compared to other counties across the state. Transfers (e.g. social security, welfare, and unemployment compensation) make up 20 to 30 percent of income in Delta and Montrose counties while consisting of only 8 to 9 percent of income on average for all of Colorado.<sup>5</sup> This may be explained to some extent by the growing concentration of retirees in the area, but the problem is mostly associated with changes in industry structure and related transitions in land use.

Over the last several decades, but more so in the last ten years, a number of communities in the region have actively pursued and achieved tourism sector growth. These efforts have been centered on the utilization of public lands for recreational and tourist activities in addition to support services. As recreation and tourism on public lands has increased, it has replaced other economic activities that are dependent on the resource, like timbering, mining, and grazing. This has been done not only by way of changing demand, but also through increased land values and perspectives in opposition to traditional activities (e.g., in relation to environmental

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<sup>3</sup> Region 10- League for Economic Assistance & Planning, Landuse.

<sup>4</sup> The estimated 1997 poverty rate for the State of Colorado was 10.2 percent and the national rate was 13.3 percent. U.S. Census Bureau, *State and County Quickfacts*.

preservation).<sup>6</sup> For instance, land values have escalated as resort development and second-home ownership has ensued, making other uses less valuable and making it increasingly more difficult for those who work in those communities to also reside in them. In addition, the growth in the related services industry, although providing the area with needed employment, offers little stability due to its highly seasonal nature and low wages in comparison to other industries (*see* Table 2).

Table 2. Average Annual Wage by Industry; Two-County Region, CO; 1990, 1992, 1994, 1995, & 1996

Year/Industry	1990	1992	1994	1995	1996
Agriculture & Forestry	\$10,599	\$10,824	\$12,951	\$13,807	\$14,110
Mining	\$28,902	\$36,901	\$32,209	\$32,423	\$28,794
Construction	\$16,852	\$17,703	\$20,369	\$21,299	\$21,559
Retail	\$11,232	\$10,736	\$12,680	\$12,823	\$12,686
Wholesale	\$16,807	\$17,078	\$19,359	\$19,957	\$20,337
Manufacturing	\$15,437	\$13,550	\$19,525	\$19,829	\$20,244
FIRE	\$19,048	\$21,318	\$19,731	\$20,783	\$21,883
Services	\$11,849	\$12,862	\$14,797	\$18,324	\$18,238
TCPU	\$23,222	\$24,623	\$26,088	\$25,738	\$24,800
Government	\$20,967	\$11,622	\$22,881	\$23,409	\$29,624
Tourism & Recreation	n/a	\$6,859	\$6,958	\$7,328	\$7,850
Average Annual Wage	\$13,496	\$15,742	\$18,440	\$19,874	\$19,715

Data Source: Region 10- League for Economic Assistance & Planning, Landuse.

Clearly, the main concern for the region is whether or not there is the potential to diversify the economy in a stable and equitable manner or if the area is otherwise doomed to a service economy that caters to wealthy second-home owner's, retirees, and tourists. In an attempt to address the issue to some extent, the first half of this report presents general trends that describe the broad historical changes in the Delta/Montrose economy. The second half of this work offers a more detailed analysis of the current structure of the two-county region's economy. However, it should be kept in mind that this analysis is not intended to be a comprehensive assessment of area conditions, as estimates like the health of the natural resource base and community capacity are beyond the scope of this work. Its purpose is to offer a means

<sup>5</sup> Chapman, M. March 1996. Is the Rural West Doomed to a Servant Economy? *Colorado Central Magazine*. Rural Life. No. 25, p. 26.

<sup>6</sup> *Ibid.*

for evaluating the structure of the region's economy in a manner that helps to identify how that structure will likely influence that of its future, and the possibility to achieve the desired economic growth and stability based on current conditions.

### **Trend Analysis of Economic Base**

A region's wealth is a function of its resources and the ability to utilize those resources in a sustainable manner to produce income. Income is maintained and generated in a number of ways, such as: through the conversion of resources to commodities by local businesses and the selling of those commodities to customers outside the region, the attraction of new customers or businesses into the region, capture of local demand for goods and services, and obtainment of government transfers. The purpose of an economic base study is to define the linkages between local resources and income that flows from outside to inside the region in order to identify current and potential factors of economic growth. However, as indicated, economic systems are comprised of circular rather than linear flows. A regional economy consists of export producers, businesses that support export producers as well as residents, and a resident population that buys both locally and externally produced goods and services. Thus, all contribute to a region's economy and must be considered in the analysis. Indicators of economic growth and stability examined in this section include historical changes in population, employment, industry structure, and income. The relationships among those factors are further defined in the second part of this work, which consists of an input-output analysis of the region's economic base.

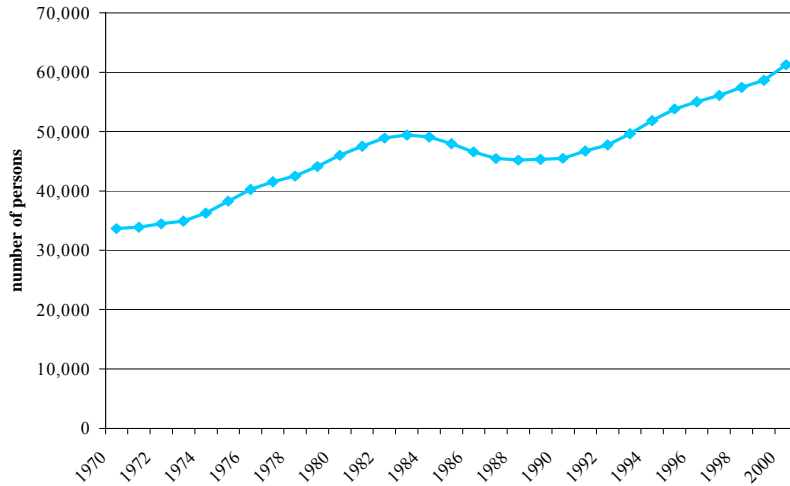
### **Population and Employment**

Maintaining a healthy economy requires a stable or growing population, to work and consume and thereby support economic activity. A changing population is a reflection of a region's ability to attract and retain resident consumers and producers over a given period of time. Therefore population change is an indirect measure of past and potential economic prosperity. Figure 1 shows that the population for the study area has had a net increase since 1970. In fact, between 1970 and 2000, the region's population increased by 45.1 percent, while the population for the State of Colorado grew by 48.3 percent. Both region and state growth



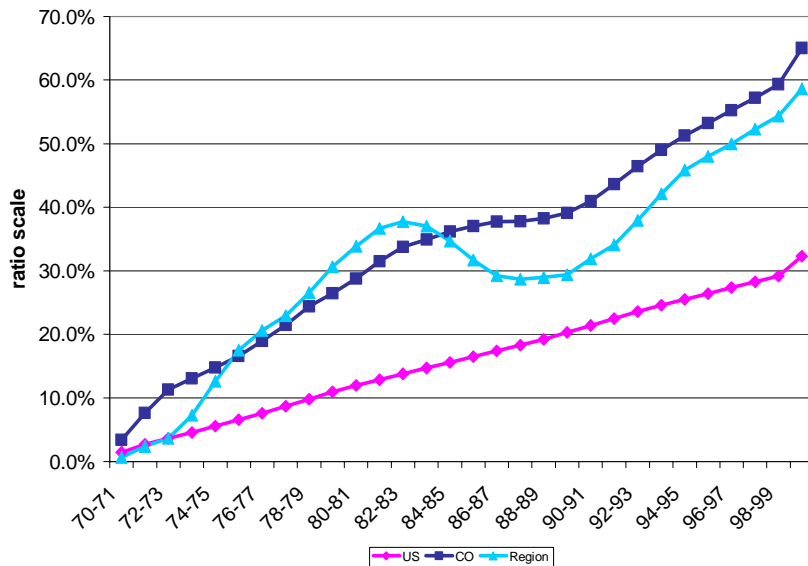
surpassed that of the nation, which increased by 27.6 percent during the same period. Yet, like the nation, approximately half of that percentage change for the region and state has taken place in the last decade, at 13.1 percent, 25.7 percent, and 23.2 percent from 1990 to 2000, respectively.

Figure 1. Population; Number of Persons; Two-County Region, CO; 1970-2000



Data Source: Bureau of Economic Analysis, Regional Accounts Data, Local Area Personal Income, CA1-3 Population, Number of Persons.

Figure 2. Population; Relative Percent Change; U.S., CO, & Two-County Region, CO; 1970-2000



Data Source: Bureau of Economic Analysis, Regional Accounts Data, Local Area Personal Income, CA1-3 Population, Number of Persons.

The pattern of growth for both the nation and state since the 1970s has been fairly stable while the region has had two periods of rapid growth, one during the 1970s and the other in the 1990s. During the 1970s growth the region actually became more rural by definition because a greater percentage of those persons moved into unincorporated areas. The opposite was true for the 1990s, in which growth was near urban and service (tourist-related) centers. The 1980s slowdown was likely due to the national farm crisis and a similar halt in non-metro county growth across the nation at that time. The rapidity and periodicity of those changes is made clearer in Figure 2, whereby population change is plotted on a ratio scale so that the slope of the line represents per annum growth. By looking at the relative slope of the lines and distance between point markers the difference in growth rates at various times for the region is immediately apparent. So too are the points of divergence and convergence with the state and nation.

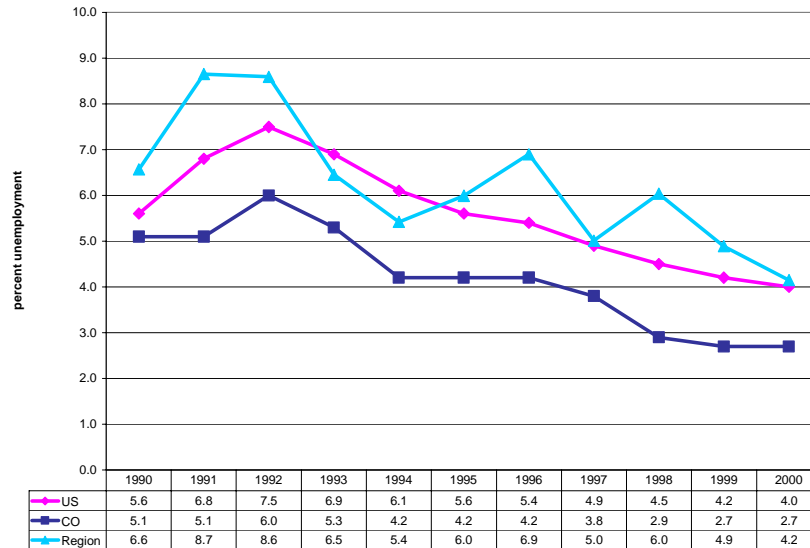
Traditionally, it is understood that changes in population reflect changes in employment opportunity in a region. However, it has also been suggested that the reverse is true where quality of life factors rather than employment draw individuals to an area. In the latter case economic growth takes place to meet the demands of an increasing population. It is difficult to quantify the latter without a more detailed analysis, but historical change in the region supports the quality of life scenario. Much of the population growth in the region can be attributed to those who have migrated to the area, many of whom are retired persons who were attracted to the region's natural beauty, moderate climate, and the casual life style that is often associated with rural places. Of the larger region, including the surrounding counties, Delta and Montrose have a much larger older resident population.

Between the two counties, Delta holds the greatest concentration of older residents, with 22.3 percent of its population age 60 or older as of 1996.<sup>7</sup> That number has since increased, but not so much from immigration, but from a loss of the younger population due to mine closures, and the lack of both employment and educational opportunities. This is supported to some extent by the unemployment rate, which has been declining in the last decade and although more variable, has become increasingly more in line with the national unemployment rate, but as of 2000 both remained significantly higher than the State of Colorado (*see* Figure 3).

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<sup>7</sup> Colorado Department of Local Affairs, Colorado Demography Section.

Figure 3. Unemployment Rate; Monthly Average; U.S., Co, & Two-County Region, CO; 1990-2000



Data Source: Bureau of Labor Statistics, Local Area Unemployment Statistics, Unemployment Rates, NSA

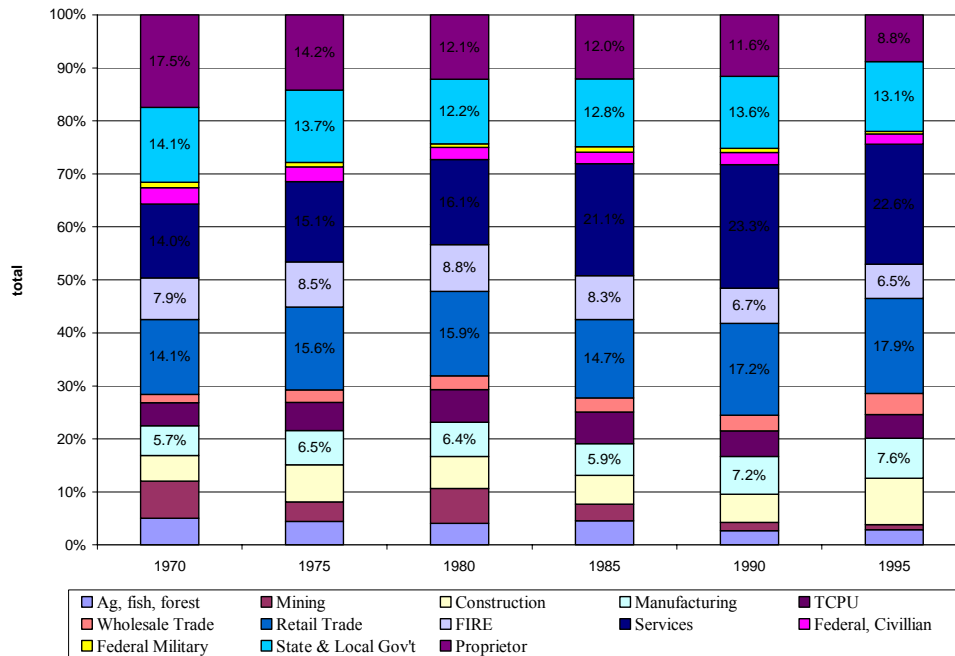
## Industry Structure

Changes in the activity-mix of the region can be measured by focusing on the relative importance of each industry. That relationship to total employment in the county between 1970 and 1995 is examined (Figure 4) as well as the concentration of that employment in comparison to the nation (Table 3). A preliminary discussion of import/export activity in conjunction with industry employment is also offered, but this is better explained by way of the input-output analysis that follows the trend analysis.

Percent employment by industry, as shown in Figure 4, reveals that proprietor employment (includes farming and ranching, among other things), state and local government, services, and retail trade have consistently been leading employers in the region, consisting of approximately 60 percent of combined total county employment since 1970. Although the industry mix has not changed much, proprietor employment has significantly declined as a percentage of total employment, losing 8.7 percentage points from 1970 to 1995, while services has gained 8.6. However, the percent of proprietor employment in the region has increased by 2.7 percent, suggesting that a reduction has not actually taken place in proprietor employment, but rather growth in wage and salary employment has been more intense. Yet, the make-up of

proprietor employment in the region has changed significantly. Between 1970 and 1995 farm employment as a percentage of proprietor employment was reduced by 6 percent in Delta County and by 16 percent in Montrose County.

Figure 4. Percent Total Full- & Part-time Employment by Industry; Two-County Region, CO; 1970, 1975, 1980, 1985, 1990, & 1995



Data Source: Bureau of Economic Analysis, Regional Economic Information System, County Level Variables, CA25- Total Full- and Part-time Employment by Industry.

The onset of decline in the Delta and Montrose counties' agricultural industry can be expressed in terms of total agricultural market value in comparison to the larger region and the state. From 1969 to 1974 it grew by 84 percent while the region as a whole went up by 65 percent and the state by 76 percent.<sup>8</sup> That growth slowed significantly from 1974 to 1979, with only a 14 percent increase for both the two-county and larger regions, and 9 percent for the state. During the 1980s the industry attempted to diversify its commercial field crops, but the failure of that effort in addition to the withdrawal of one of the region's major purchasers,<sup>9</sup> led to the continuation of decline. Livestock ranching, on the other hand, weathered the 1980s crisis better and has found increased success in the development of an exotic and wild game industry in the

<sup>8</sup> Historical statistics for agriculture market values and income percentages provided by Region 10- League for Economic Assistance & Planning, Economic Data.

<sup>9</sup> Adolph Coors Brewing Company withdrew its purchases of barley in the mid-1980s.

1990s, which are sold in both domestic and international markets. Commercial fruit production has also represented a large portion of the agricultural industry over time, but lower market prices and related lack of revenue have decreased the incentive for continued investment in this area. Many growers have recently sold their orchards for profit in meeting the increased demand for land for residential and commercial development. The end result, with agriculture and forestry and agricultural services combined, was that by 1997 the industry represented only 2 percent of total income for the larger region.

Industry concentration can also be examined using location quotients, which compare the percentage of population employed in each industry in the county to the corresponding percentage for the nation in the same year.<sup>10</sup> For example, the location quotient for construction in 1970, 1.1588 or 115.9 percent, tells us that the regional concentration of construction employment at that time was slightly higher than that of the nation (*see* Table 3).<sup>11</sup> Reading across for the same industry, the coefficient rises to 1.8134 in 1995, indicating a significantly greater representation of construction employment in the region to the U.S. (81 percent greater) and a growing industry specialization for the area. The concentration of construction employment is likely due to the intense population growth and resort and residential development that has taken place over the last few years, as expressed previously. Yet, regional trends in construction also correlate with population growth and the impact of national economic crises on non-metro areas, as the location quotient dips down during the 1980s and 1990s recessions. The former intensity of agricultural and forestry in the region is also quite apparent, as agricultural, fishing, and forestry services went from 10.1627 in 1970 to 2.5487 in 1995.

Another use of the location quotient comes from recognizing that industry activities in a region supply both a local market and an external or export market and the desire to estimate how much of each activity is for export consumption. The simplest way to make such estimates is to use location quotients in conjunction with the basic/non-basic industry concept.<sup>12</sup> The idea is that some regional activities (basic) lead to growth while others (non-basic) are simply consequences of growth. In other words, a region, like a business, must earn its livelihood by

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<sup>10</sup> The location quotients were obtained by dividing employment in each sector for the region by total regional employment ( $E_i/\sum E_{i-n}$ ). The same was done for the United States and the resultant decimals were divided into those derived for the region.

<sup>11</sup> Assumes even distribution of industry activity across geographic areas.

<sup>12</sup> Location quotients used in this manner assume homogenous consumption patterns, constant labor productivity across regions, and that local demands are first met by local production.

producing something for which there is a willingness to pay by others. Economic activities that serve the local market are simply the result of the level of income and demand achieved in the past and as such, they are participants in growth but not the motivating factors of that growth. On the other hand, activities that serve an external market provide the means for generating income. A useful example is the difference between subsistence farming and commercial farming. That which is generated for consumption by the farmer alone cannot advance the economic position of that farmer, but production in excess of primary needs provides the opportunity for the generation of wealth (given market demands for farm product).

Table 3. Location Quotients; County Industry Sector Compared to U.S.; Two-County Region, CO; 1970, 1975, 1980, 1985, 1990, & 1995

Industry Sector	1970	1975	1980	1985	1990	1995
Ag, Fishing, Forestry	<b>10.1627</b>	<b>7.4200</b>	<b>5.5745</b>	<b>5.4774</b>	<b>2.7874</b>	<b>2.5487</b>
Mining	<b>9.8674</b>	<b>4.6858</b>	<b>6.4731</b>	<b>3.0811</b>	<b>2.3248</b>	<b>1.7347</b>
Construction	<b>1.1588</b>	<b>1.6517</b>	<b>1.3559</b>	<b>1.1604</b>	<b>1.1402</b>	<b>1.8134</b>
Manufacturing	0.3046	0.3848	0.3847	0.4124	0.5600	0.6346
TCPU	0.4008	0.5419	0.5693	0.5941	0.6824	0.9250
Wholesale Trade	<b>1.0881</b>	<b>1.1381</b>	<b>1.1177</b>	<b>1.0018</b>	<b>1.1598</b>	<b>1.1415</b>
Retail Trade	<b>1.0881</b>	<b>1.1381</b>	<b>1.1177</b>	<b>1.0018</b>	<b>1.1598</b>	<b>1.1415</b>
FIRE	<b>1.3572</b>	<b>1.2875</b>	<b>1.2646</b>	<b>1.2023</b>	0.9622	0.9391
Services	0.8682	0.8262	0.8089	0.9307	0.9274	0.8113
Gov't Federal, civilian	<b>1.1220</b>	<b>1.0535</b>	<b>0.9480</b>	<b>0.9964</b>	<b>1.0762</b>	<b>1.0141</b>
Gov't Military	0.3333	0.3538	0.3560	0.5204	0.4655	0.4096
Gov't State and local	<b>1.5030</b>	<b>1.2679</b>	<b>1.1561</b>	<b>1.3096</b>	<b>1.3748</b>	<b>1.2843</b>

*Data Source:* Bureau of Economic Analysis, Regional Accounts Data, Local Area Personal Income, CA25- Total Full- and Part-time Employment by Industry.

A location quotient greater than one suggests that the area economy has more than enough employment in that industry to supply the region with the amount of industry product demanded while also having a surplus of employment (i.e. production of goods/services) that can be sold outside of the region. Such industries are defined as basic and benefit the local economy by drawing dollars into the area from the outside, thus contributing to total regional wealth. A location quotient less than one is interpreted as an industry that does not provide the necessary level of employment to produce that which is required to maintain normal consumption patterns. This is referred to as a non-basic industry, which leads to the importation of goods and services, and is therefore a source of loss or leakage of wealth from the region.<sup>13</sup> According to Table 3, manufacturing, TCPU, and services have historically and continue to be sources of leakage for

<sup>13</sup> Leakages are payments made to imports or value added sectors that do not re-spend the dollars in the region.

the region. This suggests that despite the growth in services over the years, they have yet to reach a capacity that would fully serve area residents. But once again, this can only be thought of as a rudimentary measure since location quotients only estimate net surpluses over area consumption for aggregated industries.<sup>14</sup> However, they are helpful in gaining an initial understanding of the efficiencies and deficiencies of industry make-up over time as they pertain to regional growth.

## **Income**

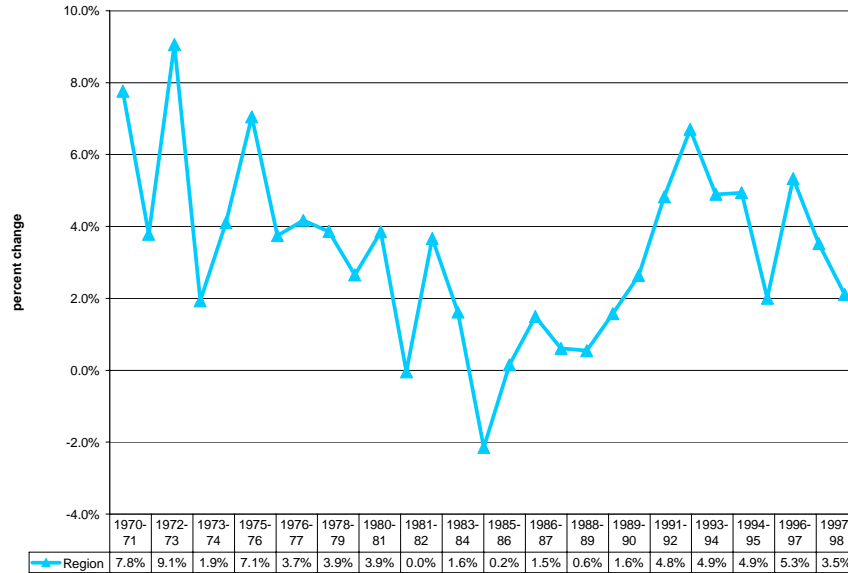
Income serves as one of the main indicators of regional economic prosperity. While there are multiple measures of income, the one most widely used in tracking growth is personal income.<sup>15</sup> Per capita income, in addition to total personal income, can be used as scale measures of a region's economic health and that of the individuals that reside there. The following paragraphs describe income in the region in both current and real dollars and in comparison to change in income for the nation and state.

Annual change in personal income in the region has been variable over the study period, but it has for the most part shown consistent growth, with just one reduction, which was during the 1980s economic downturn (*see* Figure 5). Relatively, its growth was on par with the rest of the state until the 1980s and has since grown at a lesser rate, but its growth has remained above that of the nation (*see* Figure 6). Relative per capita income rates of change for the region, state, and nation have been much the same since the 1980s, yet prior to that, the region outgrew the other two (*see* Figure 7). However, as of 1999 per capita income in the region remained significantly below the nation, with a value of 19,861 dollars in the region compared to the nation's 28,546 dollars. In fact, per capita income for the region has remained at a rate between 69.4 percent and 78 percent of the nation, while for the State of Colorado it has been between 99 and 110.5 percent (*see* Figure 8).

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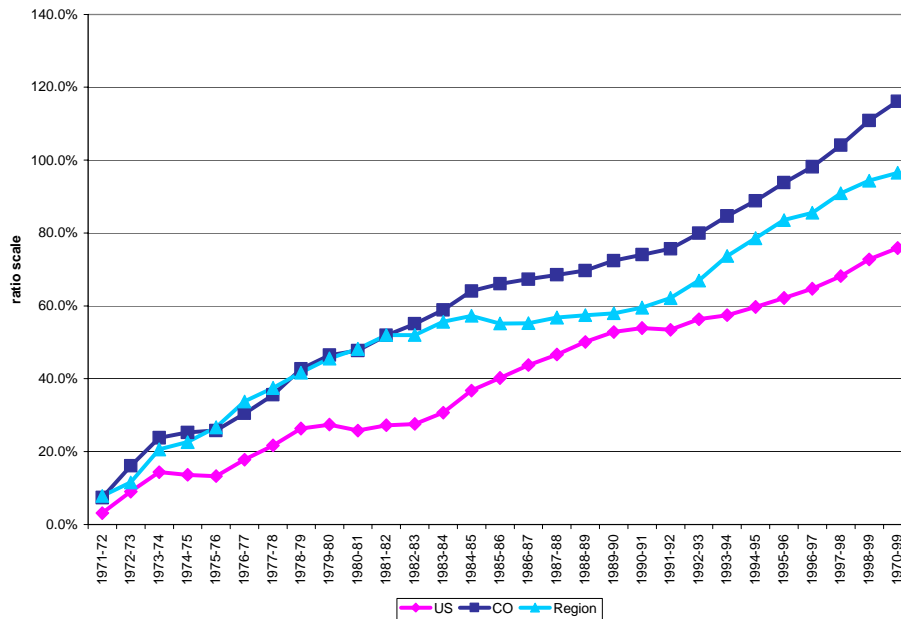
<sup>14</sup> The under-estimation of a region's gross exports are likely due to factors of aggregation and previously noted assumptions in reference to consumption and production patterns.

Figure 5. Personal Income; Real (2000) Change Thousands of Dollars; Two-County Region, CO; 1970-1999



Data Source: Bureau of Economic Analysis, Regional Accounts Data, Local Area Personal Income, CA05 Personal Income by Major Source and Earnings by Industry,

Figure 6. Personal Income; Real (2000) Relative Change; Thousands of Dollars; U.S., CO, & Two-County Region, CO; 1970-1999

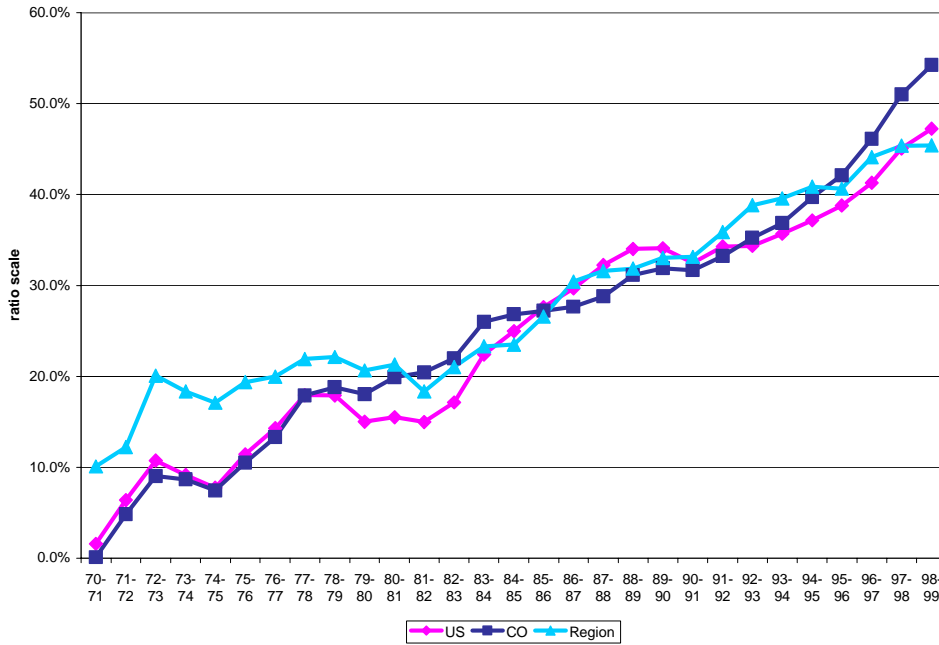


Data Source: Bureau of Economic Analysis, Regional Accounts Data, Local Area Personal Income, CA05 Personal Income by Major Source and Earnings by Industry,

<sup>15</sup> Personal income, as defined by the U.S. Department of Commerce, Bureau of Economic Analysis, is the sum of wages and salaries, dividends, rents, and interests, transfer payments, other labor income, and income of proprietors.

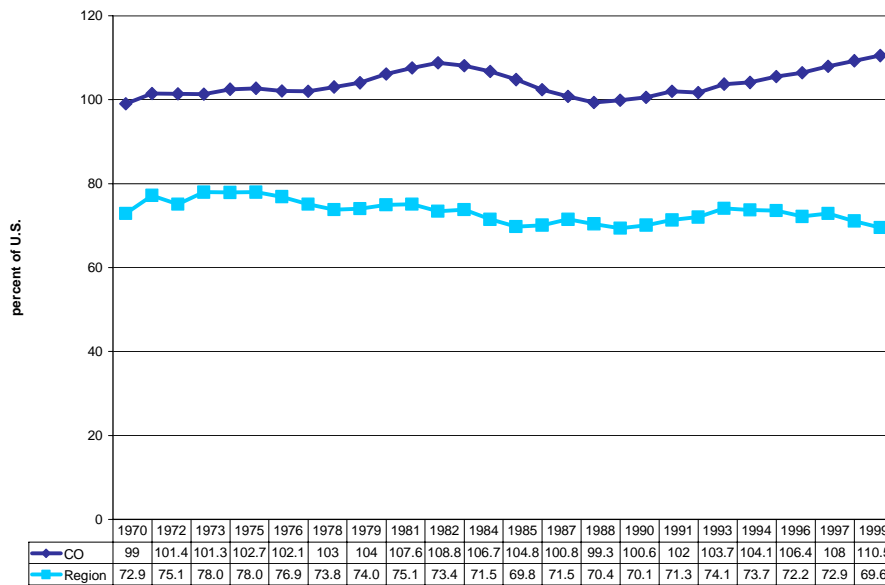


Figure 7. Per Capita Income; Relative Change; Real (2000) Dollars; U.S., CO, & Two-County Region, CO; 1970-1999



Data Source: Bureau of Economic Analysis, Regional Accounts Data, Local Area Personal Income, CA1-3 Per Capita Personal Income, Percent of U.S.

Figure 8. Per Capita Income; Percent of the U.S., CO, & Two-County Region, CO; 1970-1999



Data Source: Bureau of Economic Analysis, Regional Accounts Data, Local Area Personal Income, CA1-3 Per Capita Personal Income, Percent of U.S.

It would be expected that per capita income for a predominantly rural region like Delta/Montrose would be below the nation, as in the United States as a whole, per capita income levels have been consistently higher in areas with greater population concentrations.<sup>16</sup> However, the difference from region to state can be associated with significantly lower average annual wages by industry for the region than for the state. As shown in Table 4, in 1998 only wages in retail trade for the region came close to state averages. Yet, they were still nearly 16 percent below that of the state, while the retail trade industry also had the lowest value of all industries in Colorado. And services, which represent the largest percentage of employment in the two-county region, were only 59.3 percent of those across the state.

Table 4. Average Annual Wages by Industry; Colorado, Montrose & Delta Counties, & Two-County Region; 1998

Industry Sector/Place	Colorado	Percent of State Average		
		Montrose	Delta	Region
Ag, Forestry, Fish	\$20,249	80.3%	66.7%	73.5%
Mining	\$58,835	68.4%	N/A	N/A
Construction	\$33,409	72.0%	63.8%	67.9%
Manufacturing	\$41,077	51.4%	54.4%	52.9%
TCPU	\$46,154	67.7%	55.1%	61.4%
Wholesale Trade	\$43,226	55.7%	42.7%	49.2%
Retail Trade	\$17,191	93.0%	75.4%	84.2%
FIRE	\$42,343	61.7%	53.7%	57.7%
Services	\$31,483	59.8%	58.8%	59.3%
Government	\$32,520	84.6%	74.7%	79.7%
Total	\$32,257	68.9%	61.9%	65.4%

Data Source: Colorado Department of Labor & Employment

### Summary Trend Analysis

Population levels in both the state and the region have witnessed intensive growth over the last thirty years. However, the region continues to be sparsely populated, so growth rates are somewhat exaggerated due to the low numbers of persons residing in the area in the first place. Regardless, population change has had a substantial impact on the area, mainly as that change relates to the make-up of the population and the characteristic demands of the dominant population on the regional economy. The influx of retirees has increased the draw on government transfers and the need for community services. In the private sector, nursing and personal care facilities have come to be among the larger employers in the services sector and as

<sup>16</sup> U.S. Department of Agriculture, 2001. *Understanding Rural America*.

the population ages further, health services will likely be met with increased demand. Lodging is also one of the leading employers in the growing services industry and tourist demand for both lodging and restaurant services now constitutes a major segment of service industry employment, as well as employment economy-wide. However, it has been suggested that despite services industry growth, the region's residents remain underserved.

Following services, retail trade has become the area's second largest employer, which can be directly related to both the growth in the resident and tourist populations. This suggests that more income than in the past is being drawn into the region from the outside, and with larger and more diverse retail markets available to resident consumers, it is presumed that more local income is able to remain in the local economy. Income in general has continued to grow on a per capita basis, however, over the last few years the rate of growth has declined. This situation is indicative of the percentage rise in services and retail, which have been shown to generate the least amount of annual wage related income by industry. In conjunction, the unemployment rate, which is on par with the nation but high compared to the state, likely underestimates the economic stability of area residents, as service and retail industry jobs are characteristically weighted by part-time employment.

Agriculture, although continuing to decline as a percentage of total employment, also has shown some employment growth. However, the industry's vitality is increasingly threatened by factors of urbanization and escalation in tourism, such as inflated land values and farmland conversion to residential and recreational uses. The public sector has also played a role in the decline of the agricultural industry as it has greatly contributed to the growth in the tourist industry, and in conjunction with changes in land management policy, has put increased constraints on ranchers, who in many respects depend on that land as an important part of their business resource.

Therefore, the challenge for the region is to not only increase the number of jobs available to its residents, but to provide jobs that pay a living wage while also helping to meet the service needs of the area's growing resident and tourist population. In addition, there is a need to make better use of the region's natural resources so that a shared benefit can be achieved among the industries that demand those resources. In other words, to utilize the area's natural capital in a manner that supports both traditional and conventional industries and provides the region with the greatest degree of value added. This suggests that a more formal analysis of the

regional economy is necessary, like the input-output analysis that follows. Although such an analysis cannot address things like resource supply issues or sub-region distribution of benefits, it can provide a means for determining and assessing potential avenues of economic growth by way of employment, income, output, and their determination based on consumer demands and inter-industry linkages.

### **Input-Output Analysis of Economic Base**

There are many methods used to describe the economic base of a regional economy, including the simple location quotient approach applied previously. Among those methods is input-output modeling, which provides detailed information on individual sectors in relation to their contribution to the local economy. This technique requires the application of rigorous mathematical procedures to an itemized framework of regional accounts, which is information that describes the transactions between a specified region and the rest of the world as well as among the economic activities within that region.<sup>17</sup> It also offers a means for predicting how that economy will respond to change through the production of some type of multiplier ratio that represents the manner in which an initial increase in demand for regional goods and services ultimately impacts levels of income and employment in the region.

Input-output modeling is made easy by the availability of computer software programs and databases specifically designed for such analysis. There are a number of programs that have been developed, but at their core is the IMPLAN (IMpact analysis for PLANning) modeling system that was introduced by the USDA Forest Service.<sup>18</sup> The initial creation of IMPLAN was aimed at internal use by the Forest Service, but due to the overabundance of analyses requested its developers packaged the software and related databases for dissemination among interested parties.<sup>19</sup>

The IMPLAN system can be used to construct custom input-output models for any county or multi-county region in the United States.<sup>20</sup> The research presented in the remainder of

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<sup>17</sup> For a full explanation of methods a useful source is Miller and Blair, 1985.

<sup>18</sup> Alward, G., et al. 1989. *Micro-IMPLAN*.

<sup>19</sup> IMPLAN was made available to the public through a joint effort by the Center for Community Economic Development and the University of Wisconsin Extension and is currently available for purchase through the Minnesota IMPLAN Group, Inc.

<sup>20</sup> Databases are also available by zip-code designation, therefore regions may also be specified on that basis.

this work is the result of its application to Delta and Montrose counties, Colorado. The regional model was constructed from relevant IMPLAN Pro 1998 data sets and parameters obtained from the Minnesota IMPLAN Group. The model and its interpretation reported here should be perceived of as descriptive in nature and should not be used for any detailed analysis without further consultation with the primary investigators. An overview of the input-output framework is first given in order to assist in the understanding of the technique's offerings and shortcomings.

### **Overview of Input-Output**

The focus of input-output analysis is the interdependency of each industry's sales and purchases with the contraction and expansion of the region's overall economy. In tracing those changes the flow of money can be followed backward as payments from purchaser to seller or forward in the form of goods and services from the producer to consumer. The framework of the economy is thereby symmetrical with respect to supply and demand, or in other words, inputs and outputs. As such, neither supply nor demand is assumed to be the sole determinant of growth.

A simplistic example of the linkages between an industry and its suppliers and consumers are depicted in Figure 9.<sup>21</sup> Industry I purchases the inputs needed to produce its products, such as labor, parts and transportation, utilities, and so forth. Those transactions or accounts with suppliers of goods and services are referred to as backward linkages. Forward linkages exist between an industry producing a good or service and its consumers. Those consumers may be households<sup>22</sup>, the outside world<sup>23</sup> (exports), or other local industries (intermediate demand<sup>24</sup>) or institutions (e.g. government<sup>25</sup>) that may use the product of industry I for consumption (final

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<sup>21</sup> Derived from conceptual model presented in *IMPLAN Pro Version 2 (2000) User's Guide, Analysis Guide, and Data Guide*.

<sup>22</sup> Households are considered both consumers of goods and services as well as sellers (e.g. labor) and are defined as individuals or families either employed or residing in the region.

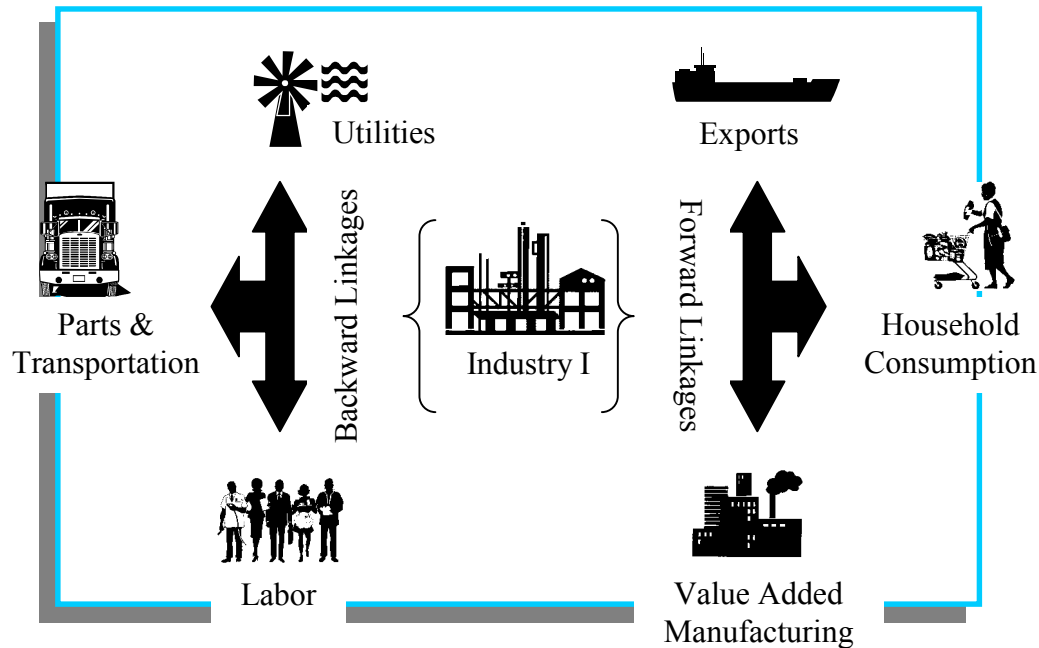
<sup>23</sup> The outside world refers to individuals and activities other than government outside of the region.

<sup>24</sup> Intermediate or inter-industry demand refers to transactions among private industries within the region.

<sup>25</sup> Government can be Federal, state, or local public authorities within or outside the region.

demand<sup>26</sup>) or as inputs to which they will add further value in the production of their own product.<sup>27</sup>

Figure 9. Forward and Backward Linkages Supporting Industry



Input-output analysis works in the reverse, stressing the effects of change from final demand backward to intermediate and primary supply sectors.<sup>28</sup> Therefore the method is market rather than input oriented and pays no attention to resource constraints or forward or complementary linkage effects.<sup>29</sup> As such, input-output is said to be a demand-driven model of a regional economy that implicitly assumes that input supplies needed to meet demand are immediately forthcoming with no additive cost. For example, if export demand for a region's

<sup>26</sup> Final demands are sales of output considered to be in its final form, ready for the final stage of use rather than additional processing. In other words, they are goods and services leaving the region's stream of processing activity by way of exports, household or public sector consumption, or through incorporation into capital stock.

<sup>27</sup> Value added is the portion of total value of output exclusively contributed by the intermediate industry.

<sup>28</sup> Inputs are known as factors of primary supply where they are inputs entering the region's processing system for the first time (e.g. labor and capital imports).

<sup>29</sup> The technical limitations of input-output are based on the following assumptions: 1. The output of each sector is produced with a unique set of inputs, as such, there is no substitution of inputs. 2. The amount of input purchased is determined solely by level of output. Therefore, price effects, changes in technology, and economies of scale are not accounted for. 3. There are no external economies of scale (no agglomeration economies or new industries are included in an additive manner). 4. The in-state and out-of-state distribution of purchases and sales is fixed. 5. There are no constraints on resources, supply is infinite and perfectly elastic. 6. Local resources are efficiently

manufacturing products increased so that the sector's demand for labor exceeded the local labor force then it is inferred that workers from outside the region would move inside, thus filling the additional need. Conversely, a supply-driven model is dependent on the availability of input resources and assumes unlimited demand of regional products. Accordingly, supply-driven models work forward from primary supply to final demand, and changes in the draw upon primary supplies, rather than final demand, give rise to income and employment growth.

The two models of economic growth are complementary, and if taken together, would provide greater insight into the real processes of change. However, the impacts of changes to input supplies are not as easily detected as that which is due to changes in input demand. For instance, besides some special occasions where technological difference is prevalent within a sector, goods normally pass through successive stages of processing that can be defined in a general production function. Therefore, the necessary increase in inputs due to change in output demand can reasonably be determined. Increases to supply, on the other hand, are not readily traceable. It cannot legitimately be stated that the increased availability of a particular supply will be used for the process and handling of any one product, unless, once again, the form of that input is highly specialized. Given that difficulty, there is presently no model that adequately incorporates the two approaches. As such, input-output remains one-sided and the user must be aware of the implications of that bias.<sup>30</sup>

There are three descriptive measures of economic contributions associated with input-output models: output, value added, and employment. Employment represents the number of jobs or people employed in an industry and output is the total dollar value of industry production. Value added is comprised of wages, profits, and taxes that result from economic activity and it is the most readily accepted measure of economy-wide effects because it avoids the measurement error that takes place when the value of industry output is used. The error stems from multiple counting that occurs when output is summed across industries, in other words, output of an industry may be part of the value of output from another or several industries due to inter-industry linkages. Since value added is unique to each industry, it can be summed across the

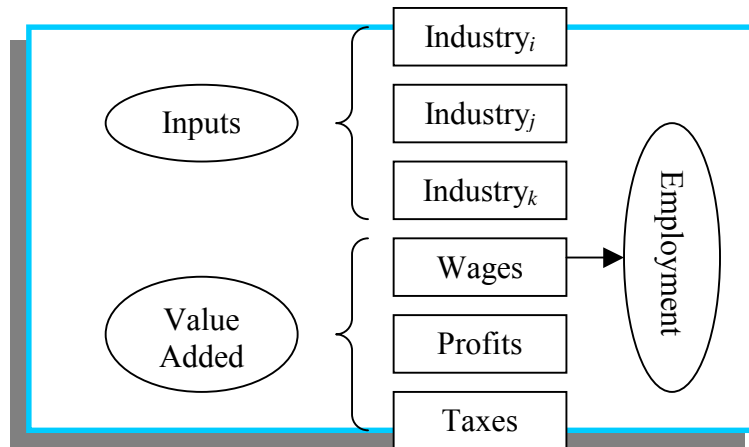
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employed, meaning there is no under employment of resources. All new employment stems from employees moving into the region and anyone who loses their job will leave the region.

<sup>30</sup> To guard against misleading conclusions the analysis results must be checked against the known conditions of the study region. For instance, knowledge of excess capacity or resource shortages should be considered during the process of interpretation and wherever possible the analytical technique should be modified to reflect those conditions.

economy without suffering the same. Employment is a value added concept and is also exclusive to individual industries, yet it lacks as a measurement of effects by itself because it does not account for differences in productivity among industries. Figure 10 shows the relationship among these individual measures.<sup>31</sup>

Figure 10. Total Value of Output of Industry I



As previously expressed, input-output models are driven by final demand for goods and services. In order to meet those demands industries respond by way of direct or indirect supply in the sense that each producing industry generates its own demand that other industries must fulfill. This is an iterative process that is captured by input-output through what are known as multipliers.

Multipliers break the round by round impacts of economic stimuli into three components: direct effects, indirect effects, and induced effects. Direct effects represent the impacts of the initial change to final demand, therefore it is the change under consideration, such as an increase in product output to the manufacturing sector where demand for manufactured goods has gone up. Indirect effects are the inter-industry changes that would result from purchases made by the manufacturing sector as it responds to that new demand. This may not only result in increased activity for other sectors, but may also invoke additional changes to manufacturing as well. Induced effects represent the impacts to all local industries that result from the growth in

<sup>31</sup> Derived from conceptual model presented in Deputy and Hopkins, February 1999.



expenditures of households.<sup>32</sup> Those expenditures stem from the generation of new income by way of the direct and indirect effects. For instance, that initial change in manufacturing output may yield new jobs thus producing additional income, of which a portion is spent within the regional economy, creating additional demands for goods and services in multiple industries, and so on and so forth.<sup>33</sup>

The process described is sometimes referred to as the circular flow of income, which is presented in Figure 11.<sup>34</sup> Beginning with industry I, an economic stimulus (i.e. change in final demand) will result in factor payments made from industry I to land, labor, capital, and government in return for inputs and supplies, thereby creating induced effects. Those induced effects will return to industry I as well as other industries as product payments, which is income used to purchase more goods and services. The initial stimuli will also cause other industries to respond due to demands placed on them by industry I as it meets its needs. This will in turn create indirect effects that also move back through the system as factor payments in exchange for the inputs and supplies needed to meet their new demand.

This seemingly endless flow of money continues until all income generated leaks out of the region, meaning that with each iteration some of that income may go to purchase imports<sup>35</sup> or into other financial realms, such as household savings. In that respect, it should be recognized that the size and location of the study area, and even the make-up of its population, might significantly alter the amount of leakage, and therefore, the magnitude of the multiplier. For instance, the greater the size of the defined region, the greater the opportunity may be to conduct economic activity within that region (e.g. a larger selection of businesses from which to make purchases). In reference to geography, locations near major economic centers external to the region may draw from the local income pool more so than would be the case for remote study areas. The last example, population, presents multiple factors related to consumption and savings patterns, such as differences based on income levels or life-cycle stages. Therefore, for multipliers to prove useful for estimating impacts to changes in the local economy or identifying

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<sup>32</sup> The input-output model treats households as a separate industry and changes in spending from within that industry reflect increases or decreases in income and/or population that result from changes in final demand. Induced effects from other factors, such as government and investment, may also be counted, but the most prevalent measure is household alone.

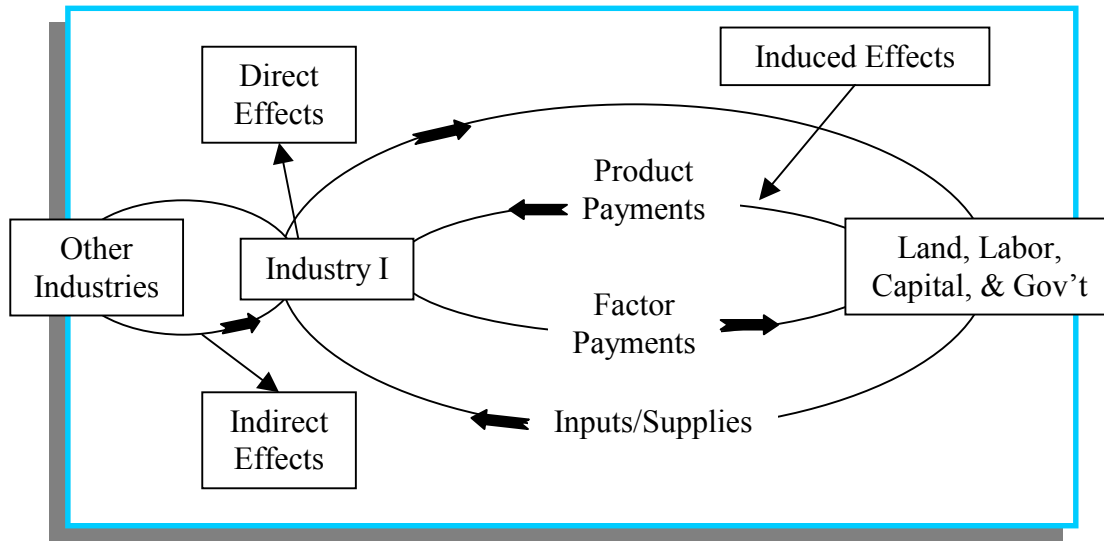
<sup>33</sup> Regional purchase coefficients, an econometrically derived measure of trade flows, are used to adjust for those portions of industry purchases made outside the region.

<sup>34</sup> Derived from conceptual model presented in Deputy and Hopkins, February 1999.

<sup>35</sup> Purchases made from outside the region under consideration, whether they be domestic or foreign.

the structural interdependence between sectors, they must be accompanied by additional insight with respect to the region's situation.

Figure 11. Circular Flow of Income



IMPLAN offers three basic sets of multipliers: output, employment, and total value added. The difference between these multipliers is relative to the relationships shown in Figure 10. Output multipliers represent the sum of direct and indirect requirements from all sectors needed to deliver a one-dollar unit of output to final demand. Employment multipliers measure the total change in employment due to a one-unit change in labor force employed for a given sector. Value added multipliers represent income or any value added component derived from the relationship between income and output. They include labor income (personal income = employee compensation + proprietor's income), other property type income, and indirect business taxes. The total value added multiplier represents the additive change in those components based on the individual dollar shift in final demand.

There are also three common types of multipliers and they vary based on the effects that are counted. Type I multipliers measure the direct and indirect effects of change in economic activity. They are limited to capturing inter-industry effects, that is, the result of local industries buying from other local industries. Type II multipliers capture direct and indirect effects that stem from income and expenditures of households in addition to the inter-industry effects. This results in a higher estimate of economic activity (i.e. larger multiplier values) than for Type I.

Finally, type SAM multipliers capture the same effects as type II, but in a more well-defined manner by using complete social accounting information to generate a model that includes non-industrial financial flows (e.g. taxes).<sup>36</sup> This allows for the incorporation of such things as the effects of additional institutions (e.g. government) into the model as well as the resultant effects of the disaggregation of internal and external income flows, labor by household location, and households by income.<sup>37</sup> Generally, type SAM multipliers will be smaller than Type II, in part because household expenditures are based on disposable rather than total income.

Although type SAM multipliers more realistically capture the process of change in a regional economy than type II, and type II more so than type I, they are also more prone to error given the level of detail. However, since government activity is thought to be directly linked to the local economy and the role of income (i.e. poverty) is of particular concern for the region under consideration in this report, social accounts were used in the construction of the input-output model that follows.

## **Commodity Supply**

Commodity supply is a measure of the resources available to a region from which to extract value added. In other words, it represents the product base on which other economic activity is dependent (i.e. by way of production and trade of those commodities). Two different forms of commodity production are considered in this analysis, industry commodity production, which represents the production of commodities by industries and institutional commodity sales or those commodities produced by non-industry sources, such as households. Each are presented as a percentage of total production for all commodities and that which is available for local and

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<sup>36</sup> The social accounting matrix contains standard input-output information (value added factors, institutional final demand, and import/export trade) as well as: 1. Factor and institution exports- value added and institution payments received from outside the region. 2. Factor imports- distribution of payments outside the region. 3. Factor distribution- payments from value added sectors to institutions. 4. Inter-institutional transfers- payments from one institution to another.

<sup>37</sup> Social accounts include data on income distribution, commuting, tax payments, and savings. This allows for labor income to be distributed among households living in the region, households outside the region, and social security taxes. Therefore consumption expenditures of in-region households are based on disposable income only and measures of government and investment can also be derived if so desired.

domestic consumption (Table 5).<sup>38</sup> Industry production is further broken down into production as a percentage of market shares by individual sectors (Table 6).<sup>39</sup>

Table 5. Commodity Supply; Percent of Total; Two-County Region, CO; 1998

Commodity	Industry Commodity Production*	Institutional Commodity Sales*	Total Commodity Supply*	Net Commodity Supply*
Ag, Fishing, Forestry	7.5%	4.7%	7.4%	7.2%
Mining	2.4%	0.3%	2.3%	2.1%
Construction	14.5%	0.0%	14.2%	14.7%
Manufacturing	16.0%	0.7%	15.6%	15.3%
TCPU	10.1%	0.8%	9.9%	9.8%
Trade	12.2%	4.2%	12.0%	12.1%
FIRE	12.8%	0.0%	12.5%	12.4%
Services	15.9%	66.1%	17.0%	17.5%
Government	8.4%	0.1%	8.2%	8.5%
Other	0.2%	23.1%	0.7%	0.4%
<b>Total</b>	<b>320.97</b>	<b>20.24</b>	<b>341.20</b>	<b>326.84</b>

Total percentages may not sum to 100 due to rounding

\*Millions of Dollars

Industry based production is distributed fairly evenly across most commodity types, suggesting that the region is not only diversified in terms of industries, but also by commodities produced. However, the largest percentages are held by manufacturing and services, which make up nearly 32 percent of that which is produced locally (*see* Table 5). Institutional commodities, on the other hand, are overwhelmingly service oriented with 66.1 percent.

Industry sectors are defined by the product that they produce the most; however, total industry output may also include alternative commodity types. For instance, in Delta and Montrose counties, only 85.8 percent of service commodities are produced by the service industry. The remaining market share is for the most part produced by government (8.4 percent), but with some also by manufacturing, TCPU, and FIRE (*see* Table 6).<sup>40</sup> Like most other places, government commodity production is highly diversified, government contributes 8.5 percent to service commodity production, 6 percent to TCPU, and 3.6 elsewhere, on top of nearly 100

<sup>38</sup> Local commodity demand + domestic commodity demand = net commodity supply = total commodity supply – foreign exports. Foreign exports are commodities exported beyond national borders while domestic exports are commodities exported (outside of the region) but that which remains within national boundaries.

<sup>39</sup> Market shares are the percentage of the total production of a commodity that is produced by each industry.

<sup>40</sup> Inventory consists of output that is produced but not sold within one year. The inventory production sector can be thought of as a regional warehouse in which all commodity produced that is not immediately consumed or used to produce more commodities gets placed.

percent of all government commodities. Yet, in general, the majority of the region's industries are single commodity type.

Table 6. Market Share of Commodity Produced; Percent of Total; Two-County Region, CO; 1998

Commodity / Industry	Ag, Fishing, Forestry	Mining	Const- ruction	Manu- facturing	TCPU	Trade	FIRE	Service	Govern- ment	Other
Ag, Fishing, Forestry	98.6%	0.0%	0.0%	0.2%	0.0%	0.0%	0.0%	0.2%	0.0%	0.0%
Mining	0.0%	99.5%	0.0%	1.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Construction	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Manufacturing	0.0%	0.2%	0.0%	98.7%	0.0%	0.0%	0.0%	2.0%	0.0%	1.3%
TCPU	0.0%	0.0%	0.0%	0.0%	94.0%	0.0%	0.0%	2.0%	0.1%	0.2%
Trade	0.0%	0.0%	0.0%	0.0%	0.0%	98.8%	0.0%	0.0%	0.0%	0.5%
FIRE	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	99.1%	1.5%	0.0%	0.0%
Services	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	85.8%	0.0%	0.0%
Households	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	25.8%
Government	1.3%	0.1%	0.0%	0.0%	6.0%	1.2%	0.8%	8.5%	99.9%	0.2%
Other	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	23.8%
Capital	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	48.1%
Inventory	0.0%	0.2%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Total percentages may not sum to 100 due to rounding

## Commodity Demand

Demand can also be broken into two categories, intermediate commodity demand or locally generated demand by industries for local and/or imported commodities and institutional commodity demand, which is local demand by non-industry sources for the same commodities. Institutional demand is comprised of household, government, and other institution final commodity demands, such as capital.<sup>41</sup> Each represents end users that buy goods and services for consumption (includes imports and exports). These goods and services leave the regional economy, and therefore, are not used to generate more products locally.<sup>42</sup> Both total intermediate and institutional demands, as well as relevant breakdowns are given in the following tables (Tables 7-13).

<sup>41</sup> Capital is representative of private expenditures for durable goods or capital equipment, but expenditure values are not representative of those made by industrial sector, but rather, are increases to a region's overall durable goods assets.

<sup>42</sup> This is the same as final demands as discussed in the overview.

Table 7. Commodity Demand; Percent of Total; Two-County Region, CO; 1998

<b>Commodity / Industry</b>	Intermediate Commodity Demand*	Institutional Commodity Demand*	Total Gross Commodity Demand*
Ag, Fishing, Forestry	3.9%	0.5%	1.8%
Mining	3.2%	0.0%	1.2%
Construction	3.6%	16.3%	11.6%
Manufacturing	35.0%	14.8%	22.3%
TCPU	10.2%	5.8%	7.5%
Trade	10.7%	16.2%	14.1%
FIRE	22.4%	19.7%	20.7%
Services	1.0%	11.4%	7.5%
Government	1.0%	11.4%	7.5%
Other	0.7%	1.5%	1.2%
<b>Total*</b>	134.49	323.37	457.86

Total percentages may not sum to 100 due to rounding

\*Millions of dollars

Table 8. Intermediate Commodity Demand; Percent of Total; Two-County Region, CO; 1998

<b>Industry/Commodity</b>	Ag, Fishing, Forestry*	Mining*	Con-struction*	Manu-facturing*	TCPU*	Trade*	FIRE*	Services*	Govern-ment*
Ag, Fishing, Forestry	34.3%	0.0%	1.1%	5.2%	0.0%	1.3%	2.4%	0.3%	0.4%
Mining	0.2%	0.0%	1.2%	3.9%	10.0%	0.0%	0.0%	0.0%	4.8%
Construction	2.3%	0.0%	0.2%	1.1%	5.3%	1.6%	12.5%	2.2%	28.9%
Manufacturing	28.0%	0.0%	52.7%	54.5%	10.3%	21.1%	2.3%	18.2%	17.5%
TCPU	7.5%	0.0%	6.1%	7.9%	34.8%	11.5%	6.5%	9.0%	19.4%
Trade	11.0%	0.0%	15.3%	11.4%	4.5%	8.9%	1.2%	5.0%	2.6%
FIRE	11.2%	0.0%	3.4%	3.0%	6.4%	13.6%	50.2%	16.1%	7.7%
Services	5.2%	0.0%	19.9%	11.6%	25.1%	39.3%	22.5%	46.4%	14.3%
Government	0.1%	0.0%	0.3%	0.4%	0.6%	1.8%	2.2%	2.4%	2.2%
Other	0.0%	0.0%	0.0%	1.0%	3.1%	0.9%	0.2%	0.3%	2.2%
<b>Total Demand*</b>	48.93	27.03	219.63	265.63	80.21	67.48	77.56	143.36	14.25

Total percentages may not sum to 100 due to rounding

\*Millions of dollars

The leading intermediate commodity demands in the region include manufacturing and FIRE (*see* Table 7). FIRE (23.6 percent) is also among the leaders for institutional demand, holding the number one spot, followed by construction and trade. Intermediate commodity demand is broken into industry sectors in Table 8. This table gives an indication as to the backward linkages that exist for local industries. For instance, 52.7 percent of total demand for the construction industry is for manufacturing commodities, which is produced almost entirely by the manufacturing industry (*refer to* Table 6). However, the extent to which local

manufacturing industry production is used to meet that demand will be discussed in a later section.

Total institution commodity demands include household and government demand as well as capital formation, inventory purchases, and foreign exports. In the study area households make up the largest proportion of institutional commodity demand (*see* Table 9). However, the single largest percentage of commodity demand by institution is held in capital formation for construction commodities.

Table 9. Institutional Commodity Demand; Percent of Total; Two-County Region, CO; 1998

<b>Institution/ Commodity</b>	Sum of Households	Sum of Federal	Sum of State & Local*	Capital*	Inventory*
Ag, Fishing, Forestry	0.7%	0.0%	0.4%	0.0%	6.0%
Mining	0.0%	0.0%	0.0%	0.0%	0.0%
Construction	0.0%	3.1%	21.3%	81.1%	0.0%
Manufacturing	19.0%	8.3%	6.2%	6.6%	16.9%
TCPU	7.6%	1.5%	3.8%	1.0%	11.9%
Trade	19.3%	1.0%	1.3%	5.3%	24.4%
FIRE	22.8%	2.8%	2.6%	4.5%	0.0%
Services	28.0%	12.1%	5.1%	1.5%	0.1%
Government	0.7%	70.0%	59.2%	0.0%	0.0%
Other	1.9%	1.2%	0.1%	0.0%	40.7%
<b>Total Demand*</b>	1055.48	46.29	242.30	257.39	7.34

Total percentages may not sum to 100 due to rounding

\*Millions of dollars

Table 10. Household Commodity Demand; Percent of Total; Two-County Region, CO; 1998

<b>Household Income/ Commodity</b>	<\$5k	\$5-10k	\$10-15k	\$15-20k	\$20-30k	\$30-40k	\$40-50k	\$50-70k	\$70k+
Ag, Fishing, Forestry	0.7%	0.7%	0.8%	0.8%	0.7%	0.6%	0.7%	0.6%	0.5%
Mining	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Construction	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Manufacturing	16.1%	17.7%	20.9%	20.4%	19.4%	18.1%	19.8%	19.0%	17.7%
TCPU	8.5%	8.5%	9.2%	8.3%	7.7%	7.1%	6.9%	6.7%	6.8%
Trade	16.1%	15.9%	19.3%	18.8%	20.4%	19.0%	20.6%	20.6%	19.2%
FIRE	21.2%	20.8%	23.3%	21.9%	22.1%	23.1%	24.5%	23.6%	24.8%
Services	35.3%	34.0%	24.1%	27.5%	27.1%	29.6%	24.8%	26.4%	28.1%
Government	0.6%	0.6%	0.7%	0.8%	0.8%	0.6%	0.7%	0.6%	0.8%
Other	1.6%	1.7%	1.7%	1.6%	1.9%	1.8%	2.0%	2.5%	2.1%
<b>Total Demand*</b>	45.68	94.19	101.76	109.63	207.54	169.31	107.63	146.08	73.67

Total percentages may not sum to 100 due to rounding

\*Millions of dollars

Household commodity demand consists of payments by individuals and households to industries for goods and services used for personal consumption. Household demand makes up the largest component of final demand, as shown in Table 9. Yet, spending patterns can differ dramatically when disaggregated by income level and commodity types. For instance, spending on services is greatest in the region for the lowest two income groups, 35.3 percent for those below \$5k and 34 percent for \$5k-10k, compared to 24.1 percent for the next highest income group (*see* Table 10). In addition, table 10 suggests that spending on services is greatest for all households regardless of income range and the same holds for FIRE in the second place spot. However, there is a clear break from lower to higher income groups for the third position, manufacturing for \$5,000 to \$20,000 household incomes and Trade (combined retail and wholesale) for the \$20,000 to \$70,000 range.

Table 11. Government Commodity Demand; Percent of Total; Two-County Region, CO; 1998

<b>Institution/ Commodity</b>	Federal Non- defense*	Federal Defense*	Federal Investment*	State & Local Non-education*	State & Local Education*	State & Local Investment*
Ag, Fishing,						
Forestry	0.0%	0.0%	0.0%	0.6%	0.2%	0.0%
Mining	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Construction	2.6%	0.3%	19.0%	5.8%	1.4%	97.4%
Manufacturing	2.8%	4.2%	75.2%	8.4%	4.7%	2.0%
TCPU	2.2%	0.4%	0.3%	5.1%	3.8%	0.0%
Trade	0.9%	0.1%	5.5%	2.0%	0.7%	0.3%
FIRE	4.5%	0.0%	0.0%	4.7%	0.2%	0.0%
Services	18.7%	1.4%	0.0%	8.2%	2.7%	0.0%
Government	66.5%	92.9%	0.0%	65.2%	86.3%	0.0%
Other	1.6%	0.6%	0.0%	0.0%	0.1%	0.2%
<b>Total Demand*</b>	28.76	14.29	3.24	129.83	68.05	44.43

Total percentages may not sum to 100 due to rounding

\*Millions of dollars

Government commodity demand is broken into federal expenditures on military purchases, non-military purchases, and investment and state and local expenditures on non-education, education, and investment. Non-military expenditures supply all other federal government functions (e.g. natural resource management of public lands) and non-education expenditures are for all other state and local government activities, such as police protection. Both federal and state and local investment expenditures are for capital goods and construction. As would be expected, the majority of state and local expenditures are on education and are derived from the government (*see* Table 11). The majority of all other government institutional



demands are for government commodities, except for significant amounts in manufacturing for federal investment. However, although commodities in federal non-defense and state and local non-education institutions a predominately of the government type, each demands a broad range of commodities.

The last category of commodity demands is exports. Foreign exports are shipments from local industries to destinations outside of the United States, while domestic exports are shipments outside of the local area but within the U.S. Manufacturing commodities make up the greatest percentage share of both foreign and domestic exports (*see* Table 12). When the regional industries are disaggregated by ranching/forest sectors, ranch commodities are by far the most in demand, particularly for the domestic market, followed closely by wood products in the foreign market (*see* Table 13).<sup>43</sup>

Table 12. Commodity Exports; Percent of Total; Two-County Region, CO; 1998

<b>Export/Commodity</b>	<b>Foreign*</b>	<b>Domestic*</b>	<b>Total*</b>
Ag, Fishing, Forestry	13.2%	21.3%	20.4%
Mining	9.9%	6.3%	6.7%
Construction	0.0%	4.2%	3.8%
Manufacturing	26.7%	56.2%	53.0%
TCPU	12.8%	8.6%	9.1%
Trade	9.2%	0.0%	1.0%
FIRE	16.7%	3.3%	4.8%
Services	3.5%	0.0%	0.4%
Government	0.1%	0.0%	0.0%
Other	8.1%	0.0%	0.9%
<b>Total*</b>	<b>69.48</b>	<b>567.66</b>	<b>637.14</b>

Total percentages may not sum to 100 due to rounding

\*Millions of dollars

Table 13. Commodity Exports; Ranching/Forest Sectors; Percent of Total; Two-County Region, CO; 1998

<b>Export/Commodity</b>	<b>Foreign*</b>	<b>Domestic*</b>	<b>Total*</b>
All Others	88.1%	69.9%	72.7%
Ranching	4.9%	18.4%	16.3%
Non-timber	2.7%	2.1%	2.2%
Ag, Forestry, Fishing	0.0%	1.6%	1.4%
Wood Products	4.4%	7.6%	7.1%
Wood Furniture	0.0%	0.0%	0.0%
Pulp and Paper	0.0%	0.4%	0.3%
<b>Total*</b>	<b>69.48</b>	<b>378.37</b>	<b>447.85</b>

Total percentages may not sum to 100 due to rounding

\*Millions of dollars

<sup>43</sup> The data necessary to subdivide agricultural, forestry, and fishing services into their respective industries/commodities were not available. Therefore, this is the only sub-sector that is not wholly applicable to forestry.

## Consumption Patterns

In order to understand the conjunction between the supply and demand factors noted for the region and the growth potential as they relate to the local economy, consumption patterns must also be examined. Local supply and demand relationships are translated through the S/D ratio, average RPCs, and average RSCs (Tables 14 and 15). The domestic S/D ratio is the relationship of net commodity supply to total gross commodity demand. (If supply exceeds demand then the ratio is set to one). The regional purchase coefficient (average RPC) is the estimated fraction of the county's gross regional commodity demand that is satisfied by local commodities. For example, if the RPC for agriculture is equal to .75 then 75 percent of local demand is met by locally produced commodities and therefore, 25 percent of that demand must be met by imports (Tables 16 and 17). On the other hand, the regional sales coefficient (average RSC) is the fraction of net commodity supply used to meet county gross commodity demand. If the RSC for agriculture is .91 then 91 percent of that which is produced locally is consumed locally.

Table 14. Comparison of Commodity Supply and Demand; Two-County Region, CO; 1998

Commodity	Domestic S/D Ratio	Average RPC	Average RSC
Ag, Fishing Forestry	1	0.8279	0.222
Mining	1	0.3213	0.1839
Construction	1	1	0.9249
Manufacturing	0.5868	0.0252	0.0407
TCPU	1	0.8687	0.7416
Trade	0.8465	0.8465	0.9764
FIRE	0.7472	0.695	0.8917
Services	0.7203	0.7203	0.9937
Government	0.9657	0.9657	0.9998
Other	0.3116	0.3116	0.6292

Domestic export demand for commodities produced in the region exceed supply for all commodities except agriculture, fishing, and forestry services, mining, construction, and TCPU (see Table 14). The percentage of local demand met by locally produced commodities is greatest for construction (100 percent) and government (97 percent). Yet, government, services, trade, and construction have high percentages of total commodity produced and consumed locally. In

general, besides other<sup>44</sup> commodities, manufacturing shows the greatest potential for growth domestically and locally. However, when disaggregating for the ranching/forest sectors pulp and paper and wood furniture show the greatest growth potential in both local and domestic markets. Non-timber forest products would also be a likely candidate for expansion at the local level since less than 20 percent of the market is currently served by locally produced commodities (*see* Table 15).

Table 15. Comparison of Commodity Supply and Demand; Ranching/Forest Sectors; Two-County Region, CO; 1998

Commodity	Domestic S/D Ratio	Average RPC	Average RSC
All Others	0.8188	0.7116	0.8436
Ranching	1	0.9181	0.1991
Non-timber	0.8707	0.1943	0.1892
Ag, Forestry, Fishing	1	0.9444	0.3665
Wood Products	1	0.7414	0.3846
Wood Furniture	0.4576	0.4576	0
Pulp and Paper	0.0688	0.0013	0.0193

Imports in manufacturing make up the most significant portion of total imports (*see* Table 16). However, service commodity purchases represent the highest level of leakages for the county in terms of intermediate imports, thereby supporting the findings of the location quotient analysis.

Table 16. Commodity Imports; Two-County Region, CO; 1998

Import/ Commodity	Intermediate*	Institutional*	Total*
Ag, Fishing, Forestry	3.7%	0.3%	0.8%
Mining	12.0%	0.0%	2.2%
Construction	0.0%	0.0%	0.0%
Manufacturing	13.0%	49.2%	58.9%
TCPU	7.5%	2.6%	2.7%
Trade	8.0%	7.3%	5.1%
FIRE	18.1%	16.9%	11.7%
Services	34.8%	18.9%	15.7%
Government	0.2%	1.3%	0.7%
Other	2.8%	3.5%	2.2%
<b>Total*</b>	169.80	470.58	940.38

Total percentages may not sum to 100 due to rounding  
\*Millions of dollars

<sup>44</sup> “Other” is a catch-all grouping of that which does not readily lend itself to categorization in any of the alternative sectors, therefore it is difficult to infer any relationships from it.

Only a small percentage of ranching and forest sector commodities are imported compared to all others (*see* Table 17), and when taken as a comparison of imports to exports the percentage of exports for those sectors extremely high relative to those for all sectors (*see* Figure 12). The region as a whole is importing far more than it is exporting, which suggests that its level of self-sufficiency is low. Yet, the ranching and forest sectors are clearly defined as the dominant export base for the area, which means that the region is highly dependent on those sectors for the draw of wealth from outside to inside the region, but more so for ranching, which has very little in the way of imports.

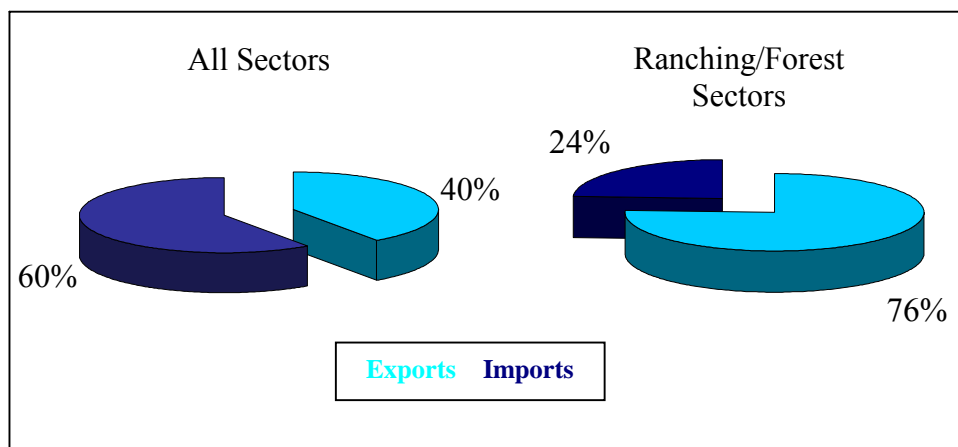
Table 17. Commodity Imports; Ranching/Forest Sectors; Two-County Region, CO; 1998

Import/ Commodity	Intermediate*	Institutional*	Total*
All Others	62.4%	98.2%	94.8%
Ranching	1.9%	0.0%	0.2%
Non-timber	7.9%	0.7%	1.3%
Ag, Forestry, Fishing	0.2%	0.0%	0.0%
Wood Products	8.2%	0.0%	0.9%
Wood Furniture	0.2%	0.2%	0.2%
Pulp and Paper	19.2%	0.8%	2.6%
<b>Total*</b>	<b>82.19</b>	<b>468.90</b>	<b>751.09</b>

Total percentages may not sum to 100 due to rounding

\*Millions of dollars

Figure 12. Trade Balance; Percent of Total Imports & Exports; Two-County Region, CO; 1998



## Economic Contributions

A relative measure of the economic contributions of the aforementioned activities to the region can be ascertained from examining the value of each industry's total production (output), number of jobs (employment), and related income flows (i.e., value added). Values for all aggregated industry sectors are given as well as the total in comparison to the ranching/forest sectors (Tables 18 and 19).

Table 18. Output, Employment & Value Added; Percent of Total;  
Two-County Region, CO; 1998

Industry	Industry Output*	Employment	Employee Compensation*	Proprietor Income*	Other Property Income*	Indirect Business Tax*	Total Value Added*
Ag, Fishing, Forestry	7.6%	10.5%	3.9%	14.0%	14.9%	13.6%	9.3%
Mining	2.5%	0.7%	2.3%	2.9%	1.4%	4.9%	2.3%
Construction	14.5%	10.6%	10.1%	20.9%	2.3%	1.9%	8.0%
Manufacturing	16.1%	6.9%	8.2%	1.9%	8.7%	2.2%	7.1%
TCPU	9.9%	3.8%	5.9%	11.6%	17.1%	15.7%	10.9%
Trade	12.1%	21.1%	18.4%	8.1%	9.7%	32.9%	15.8%
FIRE	12.9%	6.7%	5.6%	11.9%	32.8%	22.8%	16.5%
Services	14.9%	23.0%	18.9%	28.7%	6.2%	6.0%	14.7%
Government	9.2%	15.5%	26.3%	0.0%	6.6%	0.0%	15.0%
Other	0.2%	1.2%	0.5%	0.0%	0.2%	0.0%	0.3%
<b>Total*</b>	<b>2200.98</b>	<b>31848.00</b>	<b>612.34</b>	<b>131.38</b>	<b>400.56</b>	<b>112.61</b>	<b>1256.89</b>

Total percentages may not sum to 100 due to rounding

\*Millions of dollars

Total output for the regional economy was 2200.98 million dollars in 1998, of which 16.1 percent was produced by manufacturing and 14.9 percent by services (*see* Table 18). As in the trend analysis, the largest employers in 1998 continued to be services (23.0 percent), trade (21.1 percent), and government (15.5 percent). Government, which includes schools, state and local government, and federal government and military, also generated the largest percentage of employee compensation in the county (26.3 percent). However, FIRE was the most significant industry overall for total value added for the year. The ranching/forest sectors in comparison to the rest gave the region 7.5 of its output, 10.4 percent of its employment, and 7.3 percent of total value added (*see* Table 19). The majority of that contribution was in the ranching sector, which outweighed the forest sectors combined by 36 percent.

Table 19. Output, Employment, & Value Added; Ranching/Forest Sectors;  
Percent of Total; Two-County Region, CO; 1998

Industry	Industry Output*	Employment	Employee		Other	Indirect	Total Value Added*
			Compensation*	Proprietor Income*	Property Income*	Business Tax*	
All Others	92.5%	89.6%	96.2%	90.4%	89.4%	88.2%	92.7%
Ranching	4.2%	7.0%	1.2%	8.1%	7.9%	10.6%	4.9%
Non-timber Ag, Forestry,	0.5%	0.7%	0.6%	0.3%	0.8%	0.6%	0.6%
Fishing	0.4%	1.6%	0.5%	0.7%	0.2%	0.2%	0.4%
Pulp & Paper	2.3%	1.0%	1.4%	0.5%	1.7%	0.4%	1.3%
Wood Furniture	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Wood Products	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
<b>Total*</b>	2200.98	31847.00	612.34	131.38	400.56	112.61	1256.89

Total percentages may not sum to 100 due to rounding

\*Millions of dollars

The industry to industry impact of economic activity can be determined by examining production relationships in the region. The benefit of doing so is that it allows for the estimation of changes to total economic contribution based on change in demand. One way to accomplish this is to state the patterns of expenditures made by a sector as proportions of all inputs needed to produce one dollar of output in a given sector, thus identifying linear production relationships.<sup>45</sup> This information is commonly presented in what is known as a direct requirements table (Tables 20 and 21).<sup>46</sup>

The direct requirements table can only be read down, as each column essentially represents a “production recipe” for one dollar of output for the purchasing sector at the column head.<sup>47</sup> Each number in the column is the dollar amount of inputs required from the processing sector on the left in order to produce that unit of output. For example, in the two-county region, for every dollar of sales by the manufacturing sector 41 cents worth of additional output from itself, 9 cents of output each for trade and services, and an additional 17 cents from remaining industries is required (*see* Table 20).

Given this example, an additional dollar of output by the manufacturing sector leads to the purchase of a total of 75 cents from other firms located in the region.<sup>48</sup> If those production

<sup>45</sup> This is done by dividing the dollar value of inputs purchases from each sector by total expenditures.

<sup>46</sup> This is also referred to as the matrix of technical coefficients excluding households and imports, which if included would set the total row to one for each industry.

<sup>47</sup> This production formula is assumed to be constant and the same for all sector establishments regardless of input prices or production levels (e.g. no economies of scale).

<sup>48</sup> Sums may not be exact due to rounding.

requirements are not met by industries within the region then they are either obtained from institutions (i.e. households) or are imported. Therefore, in the region's manufacturing sector 25 cents worth of inputs are derived from institutions or imports. This gives a sense for the level of industry and inter-industry self-sufficiency of the region and its ability to generate wealth. The greater the factor payments for intermediate inputs and supplies made externally, the greater the dependency of the local economy on the outside world (i.e sensitivity to exogenous factors of change) and the greater the opportunity for leakage. This is discussed in more detail in the remainder of this section.

Table 20. Direct Requirements Table; All Sectors; Two-County Region, CO; 1998

<b>Purchasing / Processing Sectors</b>	Ag, Fishing, Forestry	Mining	Const- ruction	Manu- facturing	TCPU	Trade	FIRE	Service	Govern- ment
Ag, Fishing, Forestry	0.10	0.00	0.01	0.04	0.00	0.00	0.01	0.00	0.00
Mining	0.00	0.14	0.01	0.03	0.04	0.00	0.00	0.00	0.00
Construction	0.01	0.14	0.00	0.01	0.02	0.00	0.03	0.01	0.02
Manufacturing	0.08	0.06	0.36	0.41	0.04	0.05	0.01	0.08	0.01
TCPU	0.02	0.04	0.04	0.06	0.13	0.03	0.02	0.04	0.01
Trade	0.03	0.02	0.10	0.09	0.02	0.02	0.00	0.02	0.00
FIRE	0.03	0.05	0.02	0.02	0.02	0.03	0.14	0.07	0.01
Services	0.02	0.03	0.14	0.09	0.09	0.10	0.06	0.20	0.01
Government	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00
Other	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00
<b>TOTAL</b>	<b>0.29</b>	<b>0.48</b>	<b>0.69</b>	<b>0.75</b>	<b>0.37</b>	<b>0.25</b>	<b>0.27</b>	<b>0.44</b>	<b>0.07</b>

Assuming the direct requirements table represents the spending patterns necessary for additional production in all sectors, the effects of a change in a final demand for output in one can be traced to that of another. For instance, in the direct requirements table for the ranching/forest sectors, a one dollar unit change in demand for pulp and paper output results in an additional 27 cents worth of demand in pulp and paper products, 5 cents in wood products, and 50 cents from all other (*see* Table 21). Therefore, the direct effects of that one-dollar change on the economy would be 181 cents (the initial change plus the direct effect). However, the effect of that change does not stop at that point, the indirect effects must then be estimated by carrying those changes through the impacted sectors. In other words, the 50 cents worth of new demand on all other sectors, the 5 cents on wood products, and the additional 27 cents to pulp and paper must be accounted for. This is accomplished by multiplying the value of the direct

effects by the numbers in the relevant columns, which would result in an additional 47 cents, making a total region-wide impact of 228 cents.

Table 21. Direct Requirements Table; Ranching/Forest Sectors; Two-County Region, CO; 1998

Purchasing / Processing Sectors	All		Non-timber	Ag, Forest, Fish, Svc	Wood Products	Wood Furniture	Pulp and Paper
	Others	Ranching					
All Others	0.41	0.21	0.13	0.37	0.31	0.49	0.50
Ranching	0.00	0.10	0.00	0.01	0.00	0.00	0.00
Non-timber	0.00	0.00	0.02	0.03	0.08	0.00	0.00
Ag, Forest, Fish Svc	0.00	0.02	0.04	0.01	0.00	0.00	0.00
Wood Products	0.01	0.00	0.00	0.00	0.29	0.17	0.05
Wood Furniture	0.00	0.00	0.00	0.00	0.00	0.01	0.00
Pulp and Paper	0.01	0.00	0.00	0.01	0.00	0.04	0.27
<b>Total</b>	<b>0.43</b>	<b>0.34</b>	<b>0.20</b>	<b>0.43</b>	<b>0.68</b>	<b>0.70</b>	<b>0.81</b>

Table 22. Total Requirements Table; All Sectors; Two-County Region, CO; 1998

Purchasing / Processing Sectors	Ag, Fishing, Forestry	Mining	Const- ruction	Manu- facturing	TCPU	Trade	FIRE	Services	Government	Other
	Ag, Fishing, Forestry	1.09	0.00	0.01	0.04	0.00	0.00	0.01	0.00	0.00
Mining	0.00	1.05	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00
Construction	0.01	0.15	1.01	0.01	0.03	0.01	0.04	0.01	0.02	0.00
Manufacturing	0.00	0.00	0.01	1.01	0.00	0.00	0.00	0.01	0.00	0.00
TCPU	0.03	0.05	0.05	0.06	1.12	0.03	0.02	0.05	0.01	0.00
Trade	0.32	0.03	0.09	0.08	0.02	1.02	0.01	0.02	0.00	0.00
FIRE	0.03	0.05	0.03	0.03	0.03	0.03	1.11	0.07	0.01	0.00
Services	0.02	0.04	0.11	0.07	0.08	0.08	0.05	1.15	0.01	0.00
Government	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00
Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00
<b>Total</b>	<b>1.50</b>	<b>1.37</b>	<b>1.31</b>	<b>1.32</b>	<b>1.30</b>	<b>1.18</b>	<b>1.24</b>	<b>1.32</b>	<b>1.06</b>	<b>1.00</b>

The cycle of effects does not stop after just two rounds, however, the process continues until the level of indirect effects becomes insignificant (*refer to Figure 11 discussion*). IMPLAN calculates the sum of these effects or total requirements, which are presented in Tables 22 and 23 for all sectors and the ranching/forest sectors in comparison to all others.<sup>49</sup> Each column value indicates the total dollar value of output required from the processing sector by the purchasing sector for a one-dollar increase in its final demand.<sup>50</sup> For example, the first element in the construction column (.01) indicates the total dollar increase in agriculture, fishing, and forestry

<sup>49</sup> The total requirements table is also referred to as the Leontief inverse table.

<sup>50</sup> Total requirements are representative of inter-industry effects only (i.e. direct plus indirect), therefore induced effects are not included in the measure.

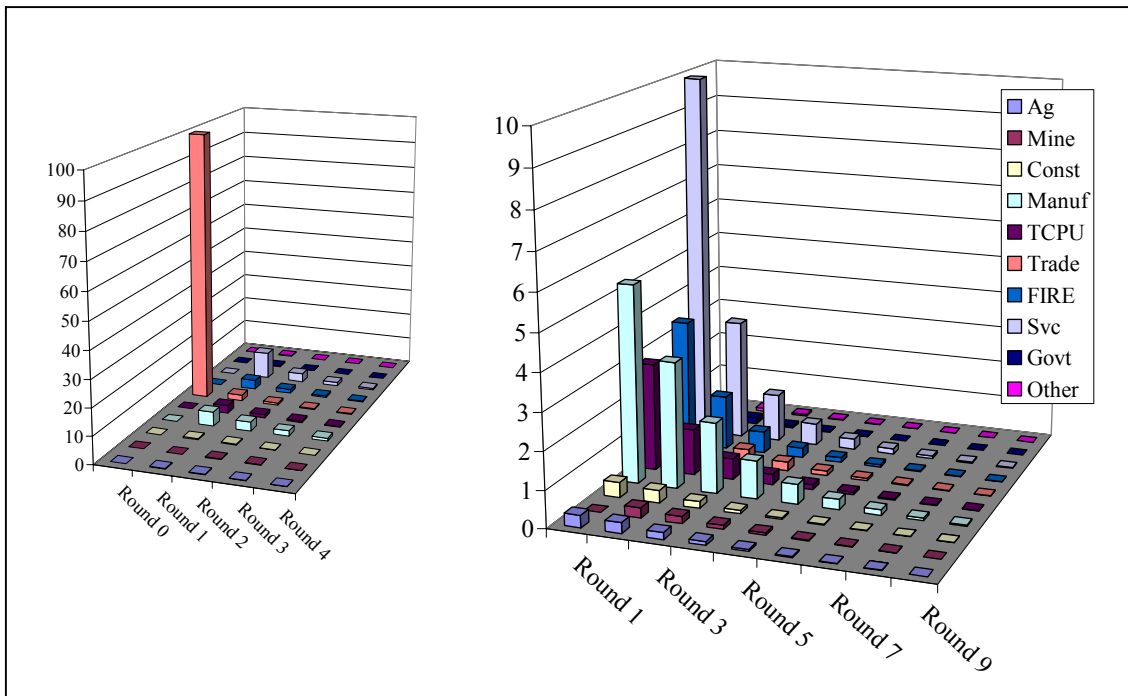


service production that results from a one-dollar increase in final demand for construction products. The second element indicates the total increase in mining output (.00) due to that same one-dollar increase in final demand for construction products. The one-dollar effect across industries continues to be captured down the row, totaling an industry-wide effect of nearly one-third times the original change to the construction industry (1.31).

Table 23. Total Requirements Table; Ranching/Forest Sectors; Two-County Region, CO; 1998

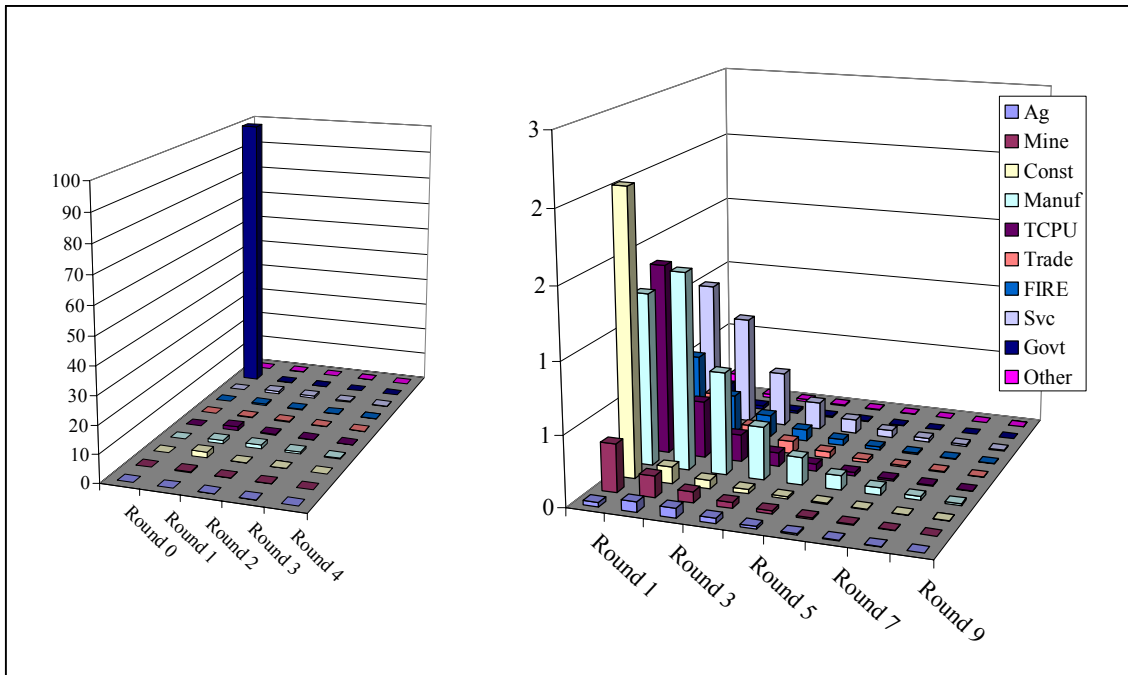
Purchasing / Processing Sectors	All		Non-	Ag, Forest,	Wood	Wood	Pulp and
	Others	Ranching	timber	Fish, Svc	Products	Furniture	Paper
All Others	1.40	0.23	0.14	0.37	0.39	0.53	0.50
Ranching	0.01	1.11	0.00	0.01	0.00	0.00	0.00
Non-timber	0.00	0.00	1.00	0.00	0.02	0.00	0.00
Ag, Forest, Fish Svc	0.00	0.02	0.03	1.01	0.00	0.00	0.00
Wood Products	0.01	0.00	0.00	0.00	1.28	0.17	0.05
Wood Furniture	0.00	0.00	0.00	0.00	0.00	1.00	0.00
Pulp and Paper	0.00	0.00	0.00	0.00	0.00	0.00	1.00
<b>Total</b>	<b>1.41</b>	<b>1.37</b>	<b>1.19</b>	<b>1.40</b>	<b>1.68</b>	<b>1.70</b>	<b>1.55</b>

Figure 13. Ripple Effect; One Hundred Trade Units; Two-County Region, CO; 1998



An additional interpretation of the total requirements table is the amount of openness within the economy based on its measure of economic linkages. As mentioned previously, highly linked economies are more self-sufficient in production and are less dependent on outside input sources. A perfectly self-sufficient economy is referred to as a closed economy, whereas open economies are those which must rely on imports and therefore suffer leakages. The degree of linkage or openness of the region can be obtained by reviewing the off-diagonal values in the total requirements table.<sup>51</sup> The larger the values the more tightly linked (closed) the economy, likewise, the smaller the values the more open the economy. The table can be difficult to interpret, however, therefore two illustrative examples for individual sectors are given (Figures 13 and 14).

Figure 14. Ripple Effect; 100 Government Units; Two-County Region, CO; 1998



Figures 13 and 14 show the flow or ripple effect of a one hundred-dollar unit change in final demand for trade and government output, respectively. The smaller graph on the left begins with round 0, the initial change, therefore the small graphs in both figures are to scale and can be directly compared. Round 0 is dropped in the larger graph so that the changes are visually more

<sup>51</sup> Off-diagonal values are those that are less than one.

apparent. Clearly, the industry-wide direct effect of the change to trade is greater than that for government, as the impact of those 100 units is barely detectable in the smaller figure for government. In addition, the scale of effects in the larger graph is more than 3 times greater for trade than government. However, as the larger graphs reveal, the backward linkages of the government sector are more extensive (reaching more local industries) than the trade sector. Also, the initial 100 dollars circulates through about the same number of rounds of economic activity for both industries, but a greater percentage of that 100 dollars leaks out of the economy in the first round of government activity. As such, from a policy perspective, the preferred sector change would depend on the desired outcome (e.g. diversification and more self-sufficient vs. greater dollar returns but less self-sufficient).

The industry to industry relationships presented numerically in the total requirements table and graphically by the ripple effect figures are equivalent to Type I output multipliers. Output is the basis of the other sets of multipliers as well, income per dollar of output for value added and output per worker ratios for employment. All three sets of final demand multipliers are given for all sectors as well as the forestry sector (Tables 24 and 25). Looking at the Type SAM multipliers in Table 24, manufacturing has the greatest overall effect for total value added (3.1061), mining for employment (5.6442), and services for output (2.1965) followed closely by TCPU (2.1923). For the ranching/forest sectors, pulp and paper, which falls within the aggregated manufacturing sector, has the largest multiplier for total value added (4.5635), while wood products and wood furniture have the largest for employment and output, respectively (*see* Table 25).

Multipliers can be used to assess the potential impacts of change to a region based on a “shock” or change in economic stimuli, such as the decrease of one ranching job used to produce an example impact analysis for the region, as shown in Table 26. As is evident, the loss of one job in ranching has a significant impact on the regional economy as a whole, however, it is felt most in the forest sector through total value added in agricultural, fishing, and forestry services and wood products. In addition, it causes significant reductions in output for domestic trade. However, the determination as to whether or not a multiplier is accurate or the impact results reasonable requires additional research time, particularly time to answer a number of important questions. The most essential is of course: How closely does the estimate reflect economic relationships in the region under consideration? The answer may be dependent on the type of

data used (e.g. primary or secondary), the level of sector aggregation, the base year from which the model was constructed, the size of the impact in relation to the size of the affected industry, whether or not households or other institutions were included, and a number of other relevant factors. Therefore use of multipliers should be dealt with caution.

Table 24. Final Demand Multipliers; Two-County Region, CO; 1998

<b>Effect / Industry</b>	<b>Direct</b>	<b>Indirect</b>	<b>Induced</b>	<b>Total*</b>	<b>Type I**</b>	<b>SAM***</b>	
<b>Value Added</b>	Ag, Fishing,						
	Forestry	0.7056	0.1397	0.5828	1.4280	1.1980	2.0239
	Mining	0.5157	0.1885	0.5300	1.2342	1.3655	2.3933
	Construction	0.3141	0.1959	0.3912	0.9011	1.6236	2.8690
	Manufacturing	0.2526	0.1993	0.3328	0.7848	1.7889	3.1061
	TCPU	0.6316	0.1760	0.5792	1.3868	1.2786	2.1956
	Trade	0.7467	0.1105	0.6480	1.5053	1.1480	2.0158
	FIRE	0.7277	0.1489	0.5964	1.4730	1.2046	2.0242
	Services	0.5636	0.1912	0.5800	1.3348	1.3393	2.3683
	Government	0.9295	0.0302	0.6720	1.6317	1.0325	1.7554
	Other	1.0000	0.0000	0.6799	1.6799	1.0000	1.6799
<b>Employment</b>	Ag, Fishing,						
	Forestry	20.0868	3.5131	15.3369	38.9369	1.1749	1.9384
	Mining	3.8928	4.2201	13.8589	21.9718	2.0841	5.6442
	Construction	10.5620	5.5906	10.1807	26.3333	1.5293	2.4932
	Manufacturing	6.1415	5.1958	8.7580	20.0952	1.8460	3.2720
	TCPU	5.5366	3.5586	15.3019	24.3971	1.6427	4.4065
	Trade	25.2723	2.8659	16.9308	45.0690	1.1134	1.7833
	FIRE	7.5440	2.9325	15.7490	26.2255	1.3887	3.4763
	Services	22.2867	5.0291	15.1052	42.4210	1.2257	1.9034
	Government	24.3453	0.7070	17.4471	42.4994	1.0290	1.7457
	Other	109.1522	0.0000	17.6836	126.8358	1.0000	1.1620
<b>Output</b>	Ag, Fishing,						
	Forestry	1.0000	0.2087	0.9080	2.1167	1.2087	2.1167
	Mining	1.0000	0.3740	0.8049	2.1788	1.3740	2.1788
	Construction	1.0000	0.3098	0.5943	1.9041	1.3098	1.9041
	Manufacturing	1.0000	0.3169	0.5110	1.8279	1.3169	1.8279
	TCPU	1.0000	0.2962	0.8961	2.1923	1.2962	2.1923
	Trade	1.0000	0.1792	0.9817	2.1608	1.1792	2.1608
	FIRE	1.0000	0.2434	0.9343	2.1777	1.2434	2.1777
	Services	1.0000	0.3156	0.8809	2.1965	1.3156	2.1965
	Government	1.0000	0.0586	1.0277	2.0863	1.0586	2.0863
	Other	1.0000	0.0000	1.0480	2.0480	1.0000	2.0480

\*Total = direct + indirect + induced, \*\* Type I = direct + indirect, \*\*\* Type SAM = Type I + induced

Table 25. Final Demand Multipliers; Ranching/Forest Sectors; Two-County Region, CO; 1998

<b>Effects / Industry</b>		Direct	Indirect	Induced	Total*	Type I**	SAM***
<b>Value Added</b>	All Others	0.5724	0.2364	0.5846	1.3935	1.4130	2.4343
	Ranching	0.6635	0.2188	0.6060	1.4883	1.3297	2.2432
	Non-timber	0.8017	0.1092	0.6337	1.5446	1.1362	1.9266
	Ag, Forestry, Fishing	0.5682	0.2303	0.6023	1.4007	1.4052	2.4652
	Wood Products	0.3162	0.3245	0.4564	1.0971	2.0260	3.4693
	Wood Furniture	0.2972	0.3589	0.4825	1.1386	2.2074	3.8307
	Pulp & Paper	0.1859	0.3025	0.3601	0.8485	2.6268	4.5635
	<b>Employment</b>	All Others	14.0168	5.8675	14.3881	34.2724	1.4186
Ranching		24.0576	7.1261	14.9139	46.0977	1.2962	1.9161
Non-timber		21.5217	4.2689	15.5958	41.3864	1.1984	1.9230
Ag, Forestry, Fishing		58.6213	6.1819	14.8224	79.6257	1.1055	1.3583
Wood Products		6.3472	7.6418	11.2323	25.2213	2.2040	3.9736
Wood Furniture		14.0408	8.6123	11.8746	34.5277	1.6134	2.4591
Pulp & Paper		8.2214	7.3761	8.8621	24.4596	1.8972	2.9751
<b>Output</b>		All Others	1.0000	0.4149	1.0229	2.4379	1.4149
	Ranching	1.0000	0.3655	1.0603	2.4258	1.3655	2.4258
	Non-timber	1.0000	0.1908	1.1088	2.2996	1.1908	2.2996
	Ag, Forestry, Fishing	1.0000	0.3991	1.0538	2.4529	1.3991	2.4529
	Wood Products	1.0000	0.6845	0.7985	2.4830	1.6845	2.4830
	Wood Furniture	1.0000	0.7006	0.8442	2.5448	1.7006	2.5448
	Pulp & Paper	1.0000	0.5492	0.6300	2.1792	1.5492	2.1792

\*Total = direct + indirect + induced, \*\* Type I = direct + indirect, \*\*\* Type SAM = Type I + induced

Table 26. Impact Estimates; Loss of One Ranching Job; Type SAM Multipliers; Two-County Region, CO; 1998

<b>Total Impact / Industry</b>	Value Added	Employment	Output
All others	-\$27,869	-1	-\$48,684
Ranching	-\$28,106	-1	-\$42,363
Non-timber	-\$39	0	-\$48
Ag, Fish, Forest, Svcs	-\$460	0	-\$810
wood products	-\$87	0	-\$277
wood furniture	-\$6	0	-\$20
pulp & paper	\$0	0	-\$1
Foreign Trade	\$0	0	-\$112
Domestic Trade	\$0	0	-\$3,447
<b>Total</b>	<b>-\$56,568</b>	<b>-1.8</b>	<b>-\$95,761</b>

## **Input-Output Analysis Summary**

The input-output analysis of Delta and Montrose counties, Colorado revealed that the economy is fairly diversified, both by way of industries in existence and types of commodities produced. Despite the heavy demand for services in the area suggested earlier, manufacturing commodities are the most in demand at the intermediate level and are in demand more than services across all institutions as well. However, services are by far the greatest for households and among households, lower income groups are the largest consumers. This latter point correlates with the large number of retirees in the region.

Manufacturing continues at the top for export demand in both the domestic and foreign markets. Yet, for the ranching/forest sectors model, ranch commodities are by far the most in demand in the foreign as well as domestic markets, followed closely by wood products in the former. However, both ranching and wood products show little potential for growth given current conditions as demand for each compared to supply presents saturated domestic and near saturated local markets. Due to structural limitations in the model, it was not possible to estimate market potential as it pertains to foreign markets, which may or may not serve as an opening. Overall, manufacturing shows the greatest potential for growth based on demand, both domestically and locally, while services shows some but more limited growth potential.

Services are the most imported commodity of all in the region for intermediate purposes and are also fairly high for institutional. The input-output model suggests that the reason for this is that almost 100 percent of services commodities produced locally are consumed locally and yet only 72 percent of total services demand is being filled at the local level. Therefore, there is an excess demand that must be met outside of the region and that leads to a loss of wealth for the area. As such, in order to reduce the level of leakage in the economy more services need to be produced in the region. Also, since most of that leakage occurs in the intermediate or processing sector, the lack of services is likely a drain on the value added ability of manufacturing and other goods producing industries.

Very few ranching and forest sector commodities are imported for the region. And as a balance of imports to exports the economy as a whole is a predominantly import economy, while for the ranching/forest sectors, exports outweigh imports by 52 percent, thereby suggesting that ranching and forest sectors serve as an export base for the region and a dominant means for

wealth generation. Yet its current role in the economy is not all that great from a proportional perspective as it contributes only 10.4 percent of employment and 7.3 percent of total value added to the region. However, among the two leaders in demand, ranching and wood products, wood products has the greatest value added multiplier effect, once again leaning toward the potential strength of the manufacturing industry, which has the largest multiplier for the economy as a whole. Services, on the other hand, while contributing a great deal to the economy directly by way of employment and employee compensation, has a significantly smaller total multiplier effect on the economy for value added as well as employment.

As such, it can be concluded that the current economic base for the region shows little room for growth except for in manufacturing. But, if growth is to be achieved via manufacturing then it is likely that it needs to be in areas that are alternatives to wood products. As far as the forest sector is concerned, wood furniture is a likely candidate for that change in structure, provided there is a proper forest resource base to support it. In addition, service industry growth needs to take place if for no other reason than to reduce the level of leakage from the economy, but this industry has little to offer in terms of value added and therefore needs to be accompanied by other forms of industry growth.

### **Conclusion**

In general the Delta/Montrose economy appears to be strong, but the capacity of its traditional resource base is diminishing and industry growth areas are those which show little potential for increasing the degree of wealth in the region. Therefore, unless a concerted effort to also strengthen the economy by way of value added industries such as manufacturing takes place, then it is likely that the region will indeed become a for the most part servant economy, thereby providing little financial stability for its residents. However, there are also areas within the service industry that provide higher degrees of value added than others. As such, an attempt at diversification within the services industry into those sectors may be a worthwhile endeavor.

As far as the ranching and forest sectors are concerned, although evidence was not found to support a positive growth potential, their importance in the economy as generators of regional wealth was shown. Therefore, the further removal of employment and output in those sectors in the region will likely have a significant negative effect on the economy overall. Unless they can

be replaced with an equally powerful source of wealth production, which at the moment does not appear to be likely, their preservation is essential to the economic health of the region.

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## Appendix

Table A-1. Two-County Region Industry Sectors

Code	Industry	Industry Output*	Employment	Total Value Added*
1	Dairy Farm Products	13.091	87	8.66
2	Poultry and Eggs	9.217	48	5.121
3	Ranch Fed Cattle	24.755	383	11.734
4	Range Fed Cattle	22.933	372	8.831
5	Cattle Feedlots	3.807	16	3.04
6	Sheep, Lambs and Goats	4.02	283	2.245
7	Hogs, Pigs and Swine	1.149	12	0.865
8	Other Meat Animal Products	0.296	4	0.119
9	Miscellaneous Livestock	1.797	104	1.219
11	Food Grains	0.405	7	0.377
12	Feed Grains	8.713	57	8.413
13	Hay and Pasture	25.177	998	24.893
14	Grass Seeds	0.465	36	0.46
16	Fruits	5.971	151	5.931
18	Vegetables	30.665	163	27.693
20	Miscellaneous Crops	0.978	23	0.806
22	Forest Products	0.594	13	0.587
23	Greenhouse and Nursery Products	0.02	1	0.02
24	Forestry Products	2.496	29	0.721
26	Agricultural, Forestry, Fishery Services	8.681	509	4.932
27	Landscape and Horticultural Services	0.957	40	0.587
34	Metal Mining Services	1.471	14	0.883
35	Uranium-radium-vanadium Ores	0.521	8	0.5
37	Coal Mining	52.754	176	26.613
40	Dimension Stone	0.323	4	0.216
41	Sand and Gravel	0.736	15	0.565
48	New Residential Structures	116.415	949	21.709
49	New Industrial and Commercial Buildings	66.621	617	20.232
50	New Utility Structures	16.374	189	6.134
51	New Highways and Streets	15.42	164	5.383
53	New Mineral Extraction Facilities	5.066	87	2.624
54	New Government Facilities	39.261	290	13.202
55	Maintenance and Repair, Residential	16.867	243	6.152
56	Maintenance and Repair Other Facilities	41.836	827	24.561
57	Maintenance and Repair Oil and Gas Wells	2.338	17	0.571
58	Meat Packing Plants	12.208	38	1.159
65	Fluid Milk	37.003	105	4.499
67	Canned Fruits and Vegetables	0.718	4	0.11
82	Confectionery Products	146.763	725	33.598
101	Manufactured Ice	0.125	4	0.067
103	Food Preparations, N.E.C	1.754	10	0.346
108	Broadwoven Fabric Mills and Finishing	0.346	3	0.073
124	Apparel Made From Purchased Materials	1.908	25	0.331
128	Canvas Products	1.54	25	0.637
132	Fabricated Textile Products, N.E.C.	2.817	26	0.606

Table A-2. Two-County Region Industry Sectors

Code	Industry	Industry Output*	Employment	Total Value Added*
133	Logging Camps and Logging Contractors	6.077	37	2.184
134	Sawmills and Planing Mills, General	6.031	40	1.233
137	Millwork	3.25	44	1.061
138	Wood Kitchen Cabinets	2.413	38	0.898
142	Wood Pallets and Skids	1.876	28	0.699
146	Reconstituted Wood Products	31.489	134	10.058
147	Wood Products, N.E.C	0.479	6	0.189
148	Wood Household Furniture	0.833	12	0.248
150	Metal Household Furniture	1.092	9	0.291
169	Die-cut Paper and Board	0.882	7	0.164
174	Newspapers	10.322	168	3.979
175	Periodicals	1.139	9	0.316
178	Miscellaneous Publishing	1.075	11	0.499
179	Commercial Printing	2.828	35	0.566
216	Rubber and Plastics Footwear	0.931	6	0.058
217	Rubber and Plastics Hose and Belting	0.115	1	0.032
218	Gaskets, Packing and Sealing Devices	1.838	17	0.632
220	Miscellaneous Plastics Products	0.476	3	0.166
230	Glass and Glass Products, Exc Containers	1.104	8	0.625
244	Ready-mixed Concrete	16.616	108	5.773
248	Abrasive Products	6.729	35	1.859
269	Brass, Bronze, and Copper Foundries	0.334	9	0.225
282	Fabricated Structural Metal	0.907	5	0.337
285	Sheet Metal Work	0.356	3	0.154
286	Architectural Metal Work	0.532	8	0.264
288	Miscellaneous Metal Work	2.451	7	0.19
290	Iron and Steel Forgings	0.633	5	0.258
294	Metal Stampings, N.E.C.	0.564	5	0.225
296	Metal Coating and Allied Services	1.033	9	0.311
321	Special Dies and Tools and Accessories	0.537	9	0.247
354	Industrial Machines N.E.C.	4.005	46	1.792
355	Transformers	0.834	9	0.334
360	Electrical Industrial Apparatus, N.E.C.	1.657	6	0.116
367	Electric Lamps	0.089	2	0.06
368	Wiring Devices	3.841	36	1.896
373	Radio and Tv Communication Equipment	4.367	23	1.529
386	Motor Vehicle Parts and Accessories	3.994	20	0.903
399	Transportation Equipment, N.E.C	3.171	13	0.5
400	Search & Navigation Equipment	0.231	1	0.053
403	Mechanical Measuring Devices	7.368	61	2.299
404	Instruments To Measure Electricity	0.125	1	0.033
405	Analytical Instruments	0.149	1	0.011
406	Optical Instruments & Lenses	0.086	1	0.009
407	Surgical and Medical Instrument	0.211	1	0.062
408	Surgical Appliances and Supplies	0.781	5	0.158
411	Electromedical Apparatus	0.205	1	0.018

Table A-3. Two-County Region Industry Sectors

Code	Industry	Industry Output*	Employment	Total Value Added*
413	Photographic Equipment and Supplies	0.17	1	0.028
420	Games, Toys, and Childrens Vehicles	0.069	1	0.017
421	Sporting and Athletic Goods, N.E.C.	7.258	75	2.4
424	Marking Devices	0.021	1	0.013
425	Carbon Paper and Inked Ribbons	0.075	1	0.013
429	Signs and Advertising Displays	6.595	95	2.389
433	Railroads and Related Services	2.335	15	1.352
434	Local, Interurban Passenger Transit	4.354	171	2.013
435	Motor Freight Transport and Warehousing	33.824	351	13.264
437	Air Transportation	14.35	168	9.165
439	Arrangement Of Passenger Transportation	1.129	40	0.823
440	Transportation Services	0.224	5	0.135
441	Communications, Except Radio and TV	30.483	91	19.675
442	Radio and TV Broadcasting	6.212	51	2.649
443	Electric Services	92.212	200	75.631
444	Gas Production and Distribution	25.137	40	7.878
445	Water Supply and Sewerage Systems	2.823	36	1.832
446	Sanitary Services and Steam Supply	4.676	37	3.128
447	Wholesale Trade	76.756	1,212	52.178
448	Building Materials & Gardening	23.171	503	20.427
449	General Merchandise Stores	15.691	508	12.628
450	Food Stores	34.651	932	32.46
451	Automotive Dealers & Service Stations	30.382	640	26.312
452	Apparel & Accessory Stores	2.917	100	2.165
453	Furniture & Home Furnishings Stores	7.638	216	6.559
454	Eating & Drinking	52.011	1,690	26.639
455	Miscellaneous Retail	23.233	932	19.6
456	Banking	64.378	551	48.02
457	Credit Agencies	10.57	283	9.232
458	Security and Commodity Brokers	2.538	50	1.754
459	Insurance Carriers	2.622	30	1.174
460	Insurance Agents and Brokers	9.733	326	7.565
461	Owner-occupied Dwellings	42.615	0	32.625
462	Real Estate	152.39	908	106.914
463	Hotels and Lodging Places	8.668	284	5.368
464	Laundry, Cleaning and Shoe Repair	3.544	251	2.665
465	Portrait and Photographic Studios	0.682	18	0.297
466	Beauty and Barber Shops	3.266	170	2.034
467	Funeral Service and Crematories	2.497	69	1.72
468	Miscellaneous Personal Services	4.822	81	1.472
469	Advertising	2.656	47	1.282
470	Other Business Services	18.866	263	10.833
471	Photofinishing, Commercial Photography	0.477	11	0.166
472	Services To Buildings	0.796	29	0.486
473	Equipment Rental and Leasing	8.06	126	4.684
474	Personnel Supply Services	2.727	193	2.512

Table A-4. Two-County Region Industry Sectors

Code	Industry	Industry Output*	Employment	Total Value Added*
475	Computer and Data Processing Services	3.274	43	2.137
476	Detective and Protective Services	0.195	16	0.124
477	Automobile Rental and Leasing	2.448	38	1.579
478	Automobile Parking and Car Wash	0.462	20	0.346
479	Automobile Repair and Services	18.63	252	10.177
480	Electrical Repair Service	1.943	32	0.795
482	Miscellaneous Repair Shops	5.884	104	2.339
483	Motion Pictures	3.603	60	0.674
484	Theatrical Producers, Bands Etc.	32.34	117	23.632
485	Bowling Alleys and Pool Halls	0.048	2	0.028
488	Amusement and Recreation Services, N.E.C.	5.949	284	3.96
489	Membership Sports and Recreation Clubs	0.793	36	0.371
490	Doctors and Dentists	44.342	628	27.464
491	Nursing and Protective Care	22.909	783	16.353
493	Other Medical and Health Services	14.462	367	6.698
494	Legal Services	6.748	139	5.297
495	Elementary and Secondary Schools	0.177	7	0.084
496	Colleges, Universities, Schools	0.026	1	0.013
497	Other Educational Services	0.31	7	0.117
499	Child Day Care Services	1.101	37	0.353
500	Social Services, N.E.C.	19.027	550	5.434
501	Residential Care	0.89	40	0.549
502	Other Nonprofit Organizations	3.946	155	1.458
503	Business Associations	2.736	45	2.102
504	Labor and Civic Organizations	4.761	335	3.88
505	Religious Organizations	27.543	214	3.759
506	Engineering, Architectural Services	15.248	206	5.873
507	Accounting, Auditing and Bookkeeping	25.435	1,112	22.928
508	Management and Consulting Services	2.667	38	1.485
509	Research, Development & Testing Services	3.558	109	1.624
511	State and Local Electric Utilities	1.87	4	0.745
512	Other State and Local Govt Enterprises	16.762	108	6.361
513	U.S. Postal Service	8.682	134	5.964
519	Federal Government - Military	4.475	175	4.475
520	Federal Government - Non-Military	27.924	529	27.924
522	State & Local Government - Education	58.638	1,812	58.638
523	State & Local Government - Non-Education	83.819	2,160	83.819
525	Domestic Services	2.788	395	2.788
528	Inventory Valuation Adjustment	0.828	0	0.828

\*Millions of Dollars