

Socioeconomic Analysis and Economic Base Assessment of Grant County, New Mexico

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Introduction

This report depicts socioeconomic characteristics and trends in Grant County, New Mexico. The analysis begins by providing background information about the county, which is then followed by a more detailed description of various socioeconomic trends, including an analysis of population, employment, industrial make-up, income, and quality of life. Finally, using the IMPLAN input-output model, this report concludes with an economic base analysis that further details economic conditions within the county.

Background Information

Geography and Population

Grant County is located in southwestern New Mexico. Part of the county borders Arizona to the west; Grant County is also near the border of Mexico, of which it was historically a part. The population of the county includes approximately 31,000 people. Grant is not a part of a metropolitan area, and although it is what might be considered a highly rural county, by the census definition approximately half of the population lives in urban areas.¹ Perhaps most indicative of its rural nature is that there are slightly less than 8 persons per square mile, making Grant one of the least densely populated counties in the U.S.

Grant County's largest town, as well as its county seat, is Silver City, with a population of approximately 10,600 people. Silver City is the retail and service hub for Grant County, and it is located 112 miles from Las Cruces, NM, 150 miles from El Paso, TX, 200 miles from Tucson, AZ, and approximately 90 miles north of the U.S./Mexico border. There are few other towns of any significant size in the county, and all of these towns, including Bayard, Santa Clara, and Hurley, are located within close proximity to Silver City. Bayard is the furthest of these three towns from Silver City, yet it is within only 15 miles from the city. All of these towns have relatively high levels of poverty and unemployment compared to national averages, and all have been plagued by a sharp decline in the region's copper-based industries over the past decade.

¹ The U.S. Census definition of urban is a place with more than 2,500 residents.

Euro-American settlement primarily began in the region in the late 1800s. Today, approximately half of the population of Grant is white Hispanic, with the other half being white non-Hispanic. English and Spanish are both widely spoken in the county. As is the case with many parts of the United States that were once a part of Mexico, the Hispanic community in the region has been somewhat marginalized from much of the local economic activity since Euro-American settlement began.

The physical landscape of the county is marked by forests in the north – primarily in the Gila National Forest – and semi-arid desert in the south. Both of these ecosystems are fragile and highly dependent upon relatively unreliable moisture levels. The Gila National Forest includes approximately 3.5 million acres of mountains and forests, making up about half of the total land area in the county. Alpine ranges in the north reach 11,000 feet above sea level, with the forests being home to a range of wildlife and forest species. Forest cover includes ponderosa pine, Douglas-fir, juniper, pinon, spruce, oak, cottonwood, and other species. In efforts to maximize timber production, much of the old-growth tree species in the forests have been replaced by small, fast growing trees. The southern desert primarily rests at about 4,000 feet above sea level.

History and Resource Use

The area of New Mexico that became Grant County was home to ancient people for thousands of years. At the time that Spanish explorers from Mexico reached the area in the 17th century, nomadic Apache tribes inhabited what is now Grant County. The New Mexico Territorial Legislature created Grant County in 1868, and Silver City can trace its history back to approximately 1870 when silver mining first began in the town. Thereafter, the town grew somewhat quickly. Once the silver was depleted, copper mining took over as the major industry in the area. In general, however, mining in the county has occurred almost continuously from the time the Spanish first discovered silver in the area in the late 1700s, though it was not until the 1880s that mining – primarily copper mining – began in the region on a commercial basis.

Agriculture was crucial to the early Native Americans in the region, as they cultivated crops in the valleys and hunted in the surrounding hills. The first purebred cattle were brought to Silver City in the late 1800s, and soon thereafter cattle companies formed and bought up large tracts of land in the region. By the early 1900s Grant County was a leader in regional cattle production. Relative to earlier times, cattle production has become a significantly less important

part of the Grant County economy; however, range fed cattle remains a small though somewhat significant export from the county. Over the past few years there has been a divisive debate in the county, as is the case with numerous other areas in the West, concerning the management of livestock on federal lands. About 94 percent of the Gila National Forest is available for grazing, and a number of parties claim that over time cattle grazing has taken a significant toll on the land.

In general, over the past one hundred years human impact upon the local ecosystem has been significant. The twentieth century was a period where considerable change occurred in the local ecosystems, due primarily to heavy livestock grazing, widespread logging, and fire suppression. This has led to a number of current environmental problems, which include decreased resiliency of trees in the region, a loss of soil moisture and nutrient availability, increased mortality of old-growth trees, and an increase in the severity and size of fires. Considerable fire suppression and logging have led to a high density of small diameter trees in the local forests, causing a significant lack of diversity in such forests and a high vulnerability to fire and other natural disturbances and disease. Overgrazing of the lands has also threatened the local ecosystem. It is currently believed that some levels of restoration will be necessary to decrease the vulnerability of the local ecosystems that has come as a result of overgrazing, logging, and fire suppression, and it is further believed that improved conditions will necessarily have to be the result of active rather than passive efforts. Such active efforts will likely involve an integrated approach that includes prescribed burning, thinning, reduced grazing, erosion control, and other measures.

The Economic Situation Today

For much of Grant County's history, and especially in recent times, copper mining has driven the local economy. Copper mining and related industries have far and away been the largest employers in the county over the past few decades. Phelps Dodge Corporation is the largest mining operation in the county and the world's second largest producer of copper, with mine operations as well as copper manufacturing facilities in 27 countries. The corporation is by far Grant County's biggest employer. However, in October 2001, Phelps Dodge announced that it will close a mine (the Chino Mine) and a neighboring copper smelter in Hurley. This will result in the loss of 650 jobs, close to 5 percent of the county's total employment.

The Chino Mine has suffered numerous cutbacks in its workforce in recent years, but the closing of the mine and smelter in January will result in the most significant cut in recent history. In fact, the planned January closures are the deepest cutbacks in copper related activities in Southwestern New Mexico over the past few years. They are indicative of recent struggles in the copper industry, which has become increasingly less competitive over the past few years due to depressed copper prices and growing inventories. When recently announcing the closing of the mining operations in the county, Phelps Dodge officials suggested that the corporation had been losing approximately \$1 million a day during the previous six months. Financial turmoil in Asian markets has led to a sharp downturn in demand for copper, and in late 2001 worldwide copper prices had dropped to 100-year lows.

In the past, job cuts in the copper industry have sent shock waves throughout the Grant County economy, as the local tax base, state-funding to school districts, and local businesses and citizens have had to deal with the stress of job and financial loss. Copper production created \$2 million in taxes in Grant in 1997, close to one-seventh of county government's expenditures. In 1998, the last period of significant cutbacks in Grant's mining sector, county government was forced to layoff approximately three dozen workers, while cutting remaining staff hours to 30 hours per week. In that same year, due to a loss of families that left the county because of decreased employment opportunities, school districts in Grant faced a \$1.5 million budget shortfall.

Even if the demand for copper recovers, there may not be a corresponding increase in mining jobs in New Mexico in the years ahead. Most of the mines in the state, including the mines in Grant County, have been mined for a number of decades, and the copper ore that can be easily extracted is now gone. Mines elsewhere in the world, such as in South America, still have abundant and easily accessible copper resources, and the future of copper mining will seemingly occur in such places rather than the U.S.

As mining has dwindled in importance in Grant as well as throughout much of New Mexico in recent years, employment in the service sector has grown. Growing employment in the service sector is reflective of national trends. Unfortunately, as opposed to many of the service sector jobs in metropolitan areas, service sector jobs in rural areas such as Grant County typically do not pay well. As will be indicated later in this analysis, this is reflected in the comparison of national per capita income averages compared to Grant County's per capita

income, which has declined significantly compared to the rest of the nation over the past two decades, and especially recently. Mining related jobs have consistently been some of the highest paying jobs in the county, but as Grant continues to lose such jobs, the county's per capita income relative to the rest of the nation dwindles. The number of large service based employers in the county include the following, with approximate employment figures in parentheses: The Gila Regional Medical Center (565); the Silver City School District (495); Ft. Bayard Medical Center (380); Western New Mexico University (525); WalMart (240); and the U.S. Forest Service (220).

A moderate climate has seemingly fostered the attraction of some retirees to Grant in recent years, though unlike numerous other locales in the Southwest the county has yet to become a primary retirement destination. In the summer, part of the county becomes a tourist destination, as the Gila National Forest attracts campers, hikers, and sightseers. Included in the Gila National Forest is the Gila Wilderness Area. Like other Wilderness Areas in the U.S., logging is not allowed in the area. Though the rest of the Gila National Forest is open for logging operations, due to environmental pressures logging has been significantly curtailed over the past decade. Before 1990, 30 million board feet of timber were being cut annually in the Gila National Forest, but logging has declined significantly in the area, and the timber industry is not an important part of Grant's economy. In the late 1990s two local, albeit small, sawmills in Grant County closed down. These closings were reflective of a growing lack of supply of sawmill timber in the region, primarily due to declining amounts of old growth timber along with increased environmental protection related to endangered species in the local forests.

Detailed Socioeconomic Trends and Characteristics

Population

Population change in many ways relates to changing socioeconomic conditions within a place. Population growth or decline is a reflection of a region's ability to attract and retain residents, and maintaining a healthy economy typically requires at the very least a stable if not a growing population. Extensive immigration into a region typically means the availability of employment opportunities; it may also be indicative of natural amenities that attract retirees or

workers who are seeking a certain quality of life. On the other hand, extensive outmigration, and hence population stagnation or decline, is typically indicative of limited or the loss of employment opportunities.

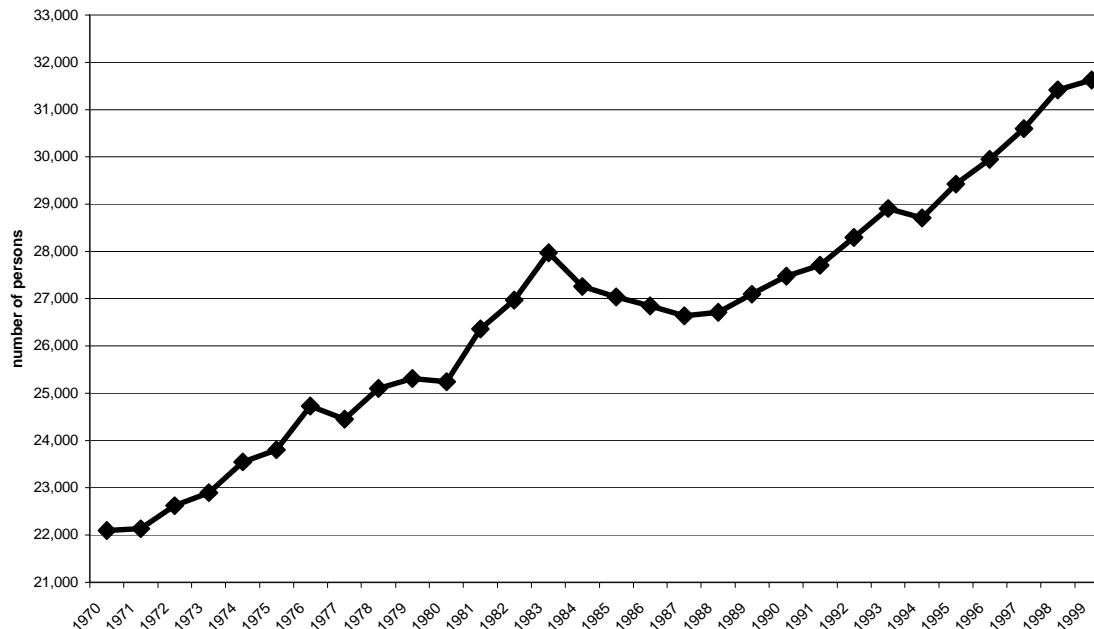
Grant County's population size is fairly average by U.S. standards, though as previously mentioned it is highly rural and the population density of the county is relatively low. The county's population size has close to tripled over the past 100 years, and is currently at its peak with slightly over 31,000 people residing in the county (*see* Figure 1). As indicated in Figure 1, there was notable population growth in Grant between 1900 and 1920 as well as between 1960 and 2000. Nonetheless, population growth in Grant has been for the most part similar to population growth in the U.S. as a whole over the past century. While compared to the rest of the nation population growth in Grant has not been especially dramatic, such growth nevertheless compares relatively favorably with many counties of a similar rural nature elsewhere in the U.S. As indicated in Figure 2, annual population figures from 1970 to 1999 indicate steady population growth between 1970 and the early 1980s, with significant population decline in the mid-1980s followed by the typical historical trend of rising population in the county. Much of the population change in Grant County over time can be explained by corresponding growth or decline in mining employment opportunities.

Figure 1. Decennial Population Change; Grant; 1900-2000



Data Source: U.S. Census

Figure 2. Annual Population Change; Grant; 1970-1999



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

Figure 3 indicates the absolute percent change in population in Grant County during the period 1970 to 1999, and it depicts this change in the broader context of population change in New Mexico and the nation. As is demonstrated in Figure 3, U.S. population change has remained steady over the past few decades, with an absolute percent change of about 1 percent each year. The population of New Mexico has typically grown at a higher rate than the U.S. in any given year, and was especially high relative to the rest of the nation throughout the 1970s and the early 1980s. Recently this growth has seemingly tapered off. In Grant County, absolute percent change in population has fluctuated wildly over time; such fluctuations are often typical of a county or region with an economy that is highly dependent upon natural resources, especially timber and mining. Overall, during the period 1970 to 1999 population change in Grant has been relatively greater than it has been in the rest of the nation, though not nearly as great as it has been in the entire state of New Mexico (*see* Figure 4). Thus, while the state of New Mexico has been experiencing rapid population growth over the past few decades, Grant has not experienced nearly as much relative growth during this period of time.

Figure 3. Population; Absolute Percent Change; U.S., NM, and Grant; 1970-2000
 Data Source: Bureau of Economic Analysis, Regional Accounts Data, Local Area Personal Income,

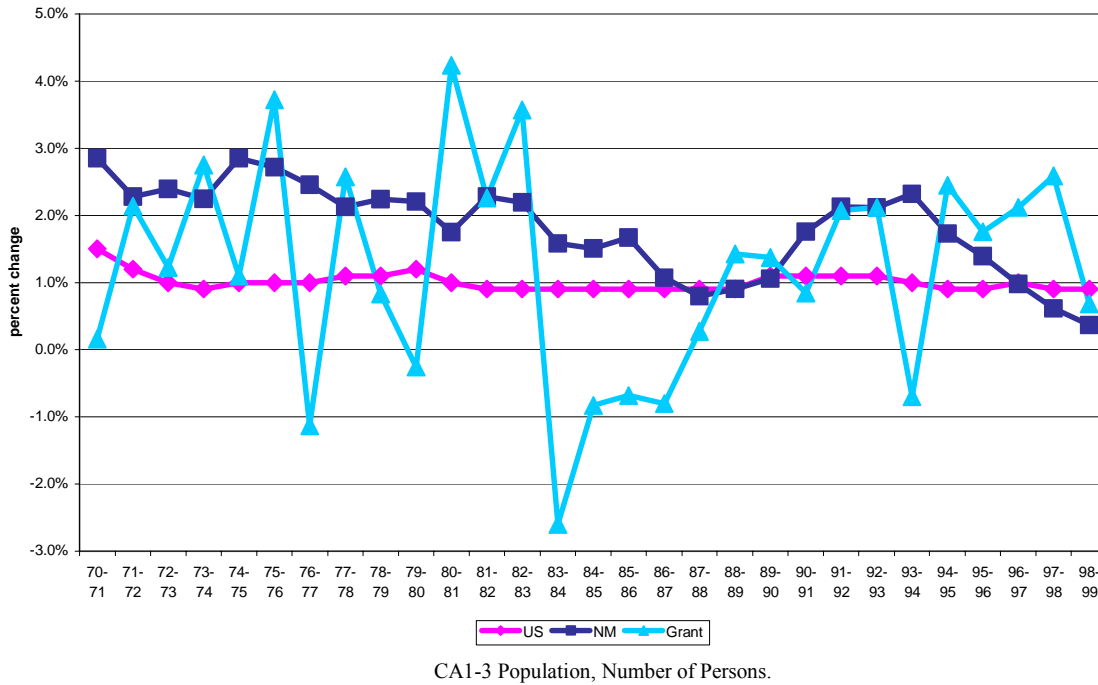
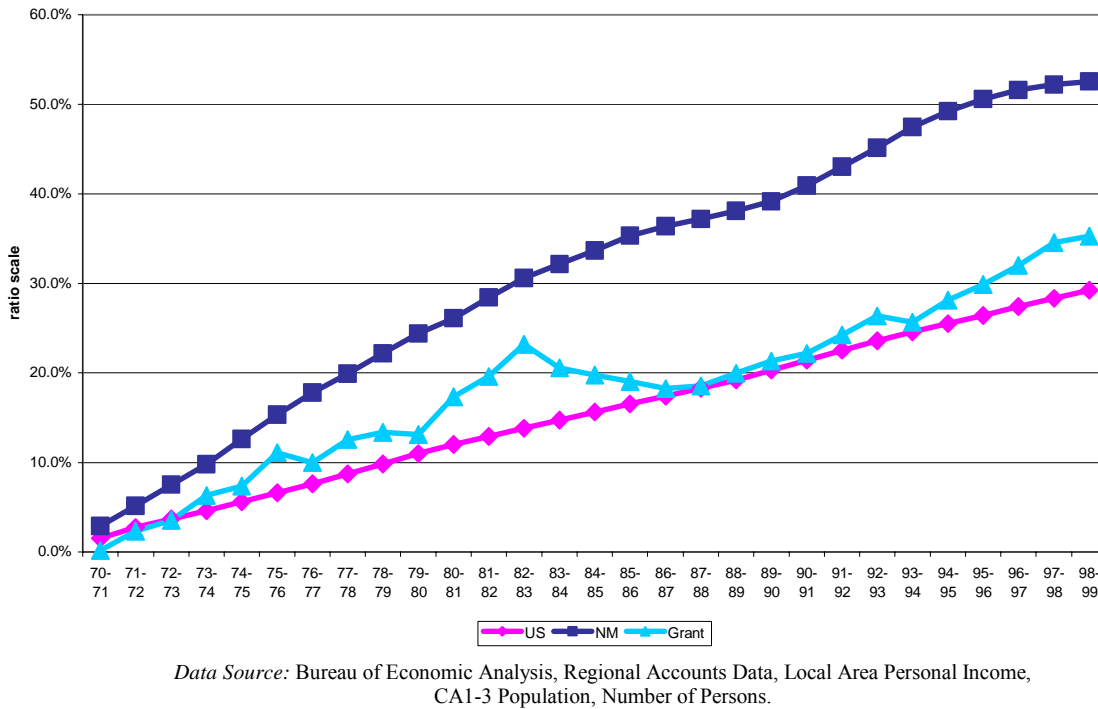


Figure 4. Population; Relative Percent Change; U.S., NM, and Grant; 1970-2000



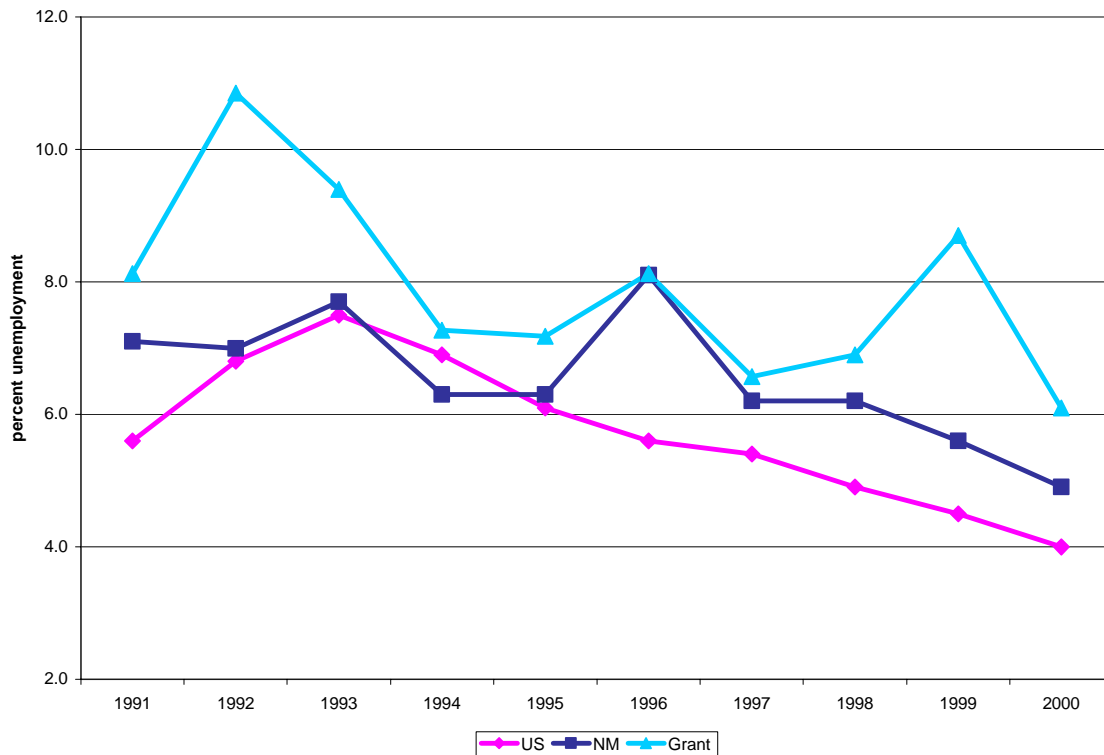
A few other demographic characteristics are also of note. As previously mentioned, the population of Grant is considered to be approximately half urban, though this is largely a reflection of the U.S. Census definition of urban areas. The urban population in Grant has grown slightly since the 1960s, with the urban population in the county being just below 40 percent at that time but approximately 50 percent today. Furthermore, while the county is not considered a part of a metropolitan area, the neighboring county of Dona Ana, New Mexico, with the city of Las Cruces, is considered a metropolitan area. Silver City is slightly more than 100 miles from Las Cruces. Nonetheless, aside from Silver City, most of Grant County should be considered highly rural. The population of the county is virtually divided equally between white Hispanic Americans and white non-Hispanic Americans, with relatively few Native Americans compared to much of the rest of the Southwest. The percent white, non-Hispanic population in the U.S. is approximately 70 percent, so the ethnic make-up of the county has a greater percentage of Hispanics as compared to the nation at large. The age profile is generally similar to broader trends throughout the U.S., with population trends in the nation generally reflecting an aging population base. There has been a relative increase in those 65 and older living in Grant over the past few decades. In the 1960s the percent population aged 65 and older was slightly less in Grant than on average in the U.S.; however, by 2000 the elderly population was somewhat higher than the U.S. average, with the percent of the population 65 and older in Grant being 16.5 percent, compared to 12.4 percent for the entire nation. Aside from this difference, the county should generally be considered as having an age structure that is similar to the U.S.

Employment

Rural areas typically have unemployment rates at least 2 percent higher than the U.S. average, while many areas that are dependent on natural resource based industries such as mining or forestry often have unemployment rates exceeding 10 percent. Figure 5 depicts unemployment rates in Grant County throughout the 1990s. High rates of unemployment have been a problem at times in Grant in the 1990s, though unemployment rates have generally been lower than many other rural areas of the U.S., especially places with natural resource based economies. Unemployment was especially high in Grant in the early 1990s, reaching close to 11 percent in 1992. However, since that time unemployment has been, for the most part, only slightly higher than state and national averages. There was a noticeable uptick in unemployment

in 1999, likely due to the cutback in mining operations in the county. Presumably, with major cuts in copper mining and smelting employment in the coming year, unemployment rates in Grant could rise somewhat dramatically in the months ahead.

Figure 5. Unemployment Rate; U.S., NM, and Grant; 1991-2000

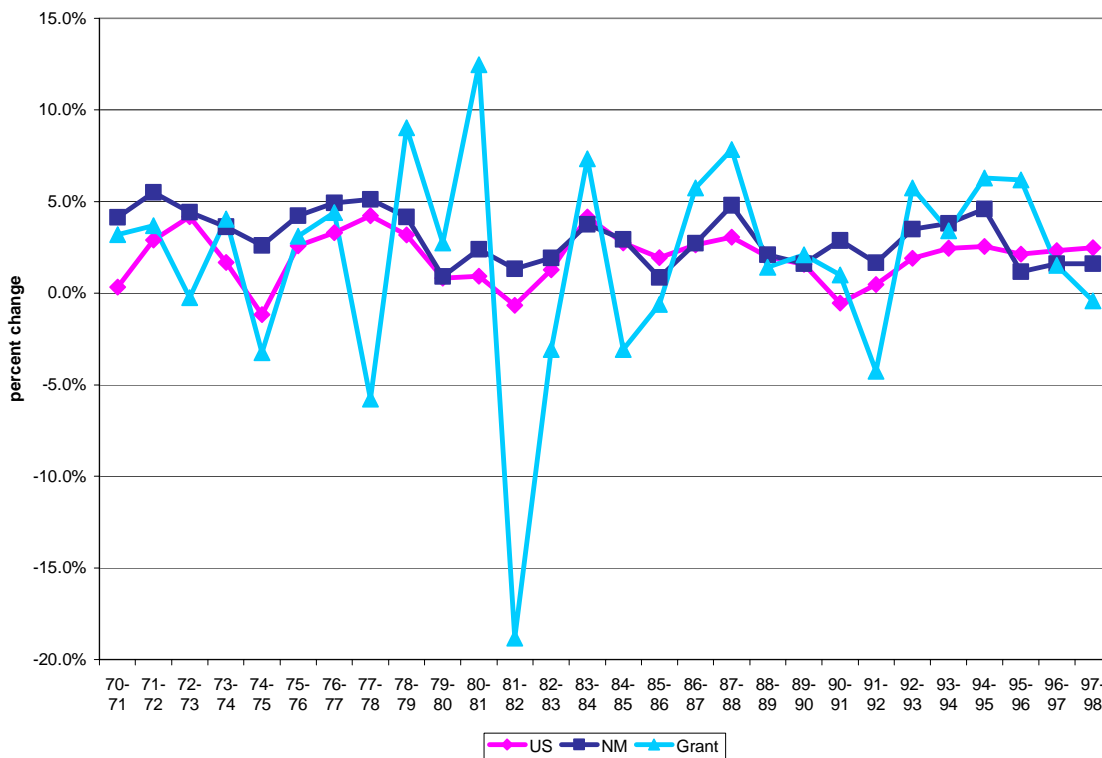


Data Source: Bureau of Labor Statistics, Local Area Unemployment Statistics, Unemployment Rates, NSA

Figure 6 indicates the percentage change in full and part time employment in Grant County between the years 1970 to 1998. In most years there has been job growth in the county, but as indicated in the figure growth and decline in employment has fluctuated dramatically in Grant, especially compared to the rest of the state and the nation. This fluctuation is especially evident in the late 1970s and early 1980s. For example, between 1980 and 1981 employment grew in the county by approximately 10 percent. In the following year, however, close to 2,000 jobs were lost in the county. In general, and despite the wild fluctuations of growth and decline in employment, between the period 1970 to 1998 job growth in Grant County has generally kept pace with the rest of the U.S., with job growth being approximately 70 percent in Grant and about

75 percent in the nation over the past 30 years. However, job growth has taken place at a much greater rate in New Mexico during the same period of time. Between 1970 and 1998, full and part-time employment in New Mexico increased by 140 percent. Thus, while Grant County has fared well in terms of employment growth compared to much of the rest of the nation over the past three decades, employment opportunities have occurred at a much faster rate in the state of New Mexico. Furthermore, the growth in total number of jobs says nothing about types of jobs. As previously suggested, much of the job growth in Grant County has come in the form of low paying service sector jobs, and the highest paying employment opportunities in the county – those in the copper industry – are being lost on a seemingly continual basis.

Figure 6. Percent Change in Total Full-time & Part-time Employment; U.S., NM, & Grant; 1970-1998

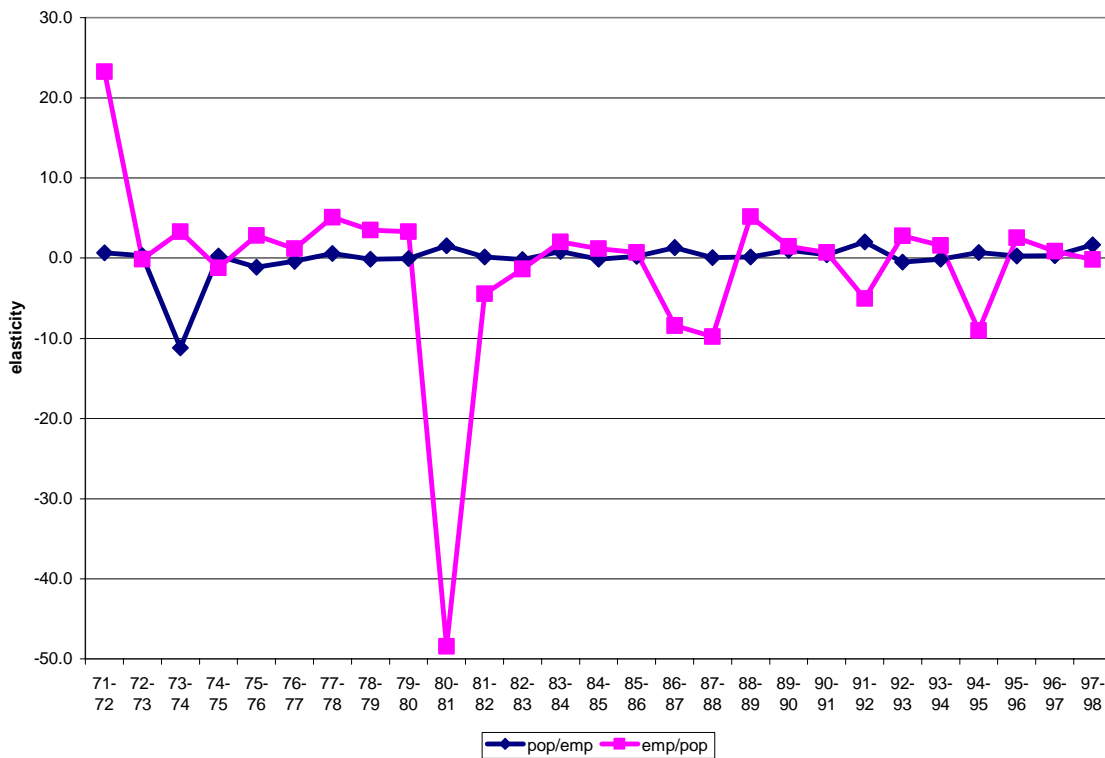


Data Source: Bureau of Economic Analysis, Regional Accounts Data, Local Area Personal Income, CA25- Total Full- and Part-time Employment by Industry.

Trends in employment, whether in terms of total number of jobs or percent unemployed, are in many ways related to population. Changes in population typically reflect changes in

employment opportunity in a region. For example, the growth of an industry within a particular region may draw people to that region; conversely, the loss of employment opportunity may cause outmigration. It is also true that amenities related to quality of life can draw people to a region. In such an instance, economic growth and increasing employment typically takes place to meet the demands of an increasing population. Figure 7 compares population and total employment change rates from 1970 to 1998 by way of elasticity measures. Elasticity is a concept that measures the responsiveness or sensitivity of one variable to another. A value equal to one is referred to as unit elasticity or proportional change, while a value greater than one is elastic and less than one, inelastic.²

Figure 7. Population and Employment Elasticity; Lagged ($\Delta X/\Delta Y_{t-1}$); Grant, NM; 1970-1998



Data Source: Bureau of Economic Analysis, Regional Accounts Data, Local Area Personal Income, CA1-3 Population, Number of Persons and CA25- Total Full- and Part-time Employment by Industry.

² Elasticity measure = $\Delta X/\Delta Y$. Unit elasticity ($\Delta X=\Delta Y$); Elastic ($\Delta X>\Delta Y$); Inelastic ($\Delta X<\Delta Y$). This measure is Lagged ($\Delta X/\Delta Y_{t-1}$)

In Grant County, employment has been more responsive to population change over time rather than vice-versa. Population growth has risen fairly steadily over the past few decades to meet employment opportunities within the region. On the other hand, as is indicated in Figure 7, employment opportunities have been less responsive to changes in population, and in a number of years employment has been highly inelastic in that employment opportunities have not served the growing population in the county. This is likely associated with the vagaries of natural resource based industries, especially the copper mining industry. The county seemingly has a relatively stable population base despite the loss of jobs, suggesting that even when there is job loss within the county, Grant is unlikely to see massive outmigration.

In general, as employment has grown within the region, population has grown along with it to meet these demands. When there have been instances of employment decline in the region, the population has remained relatively stable, suggesting that there has not been massive labor flows out of the region when jobs have been lost. The lack of labor mobility may suggest a significant burden upon local government resources and social services at times when there are large employment layoffs and high unemployment in the region. While it is true that a number of families have migrated out of the region due to loss of jobs in the mining sector in recent years, in the past it has seemingly been the case that many of the plants have closed only temporarily, and many workers have tended to remain in the county waiting for mining operations to resume.

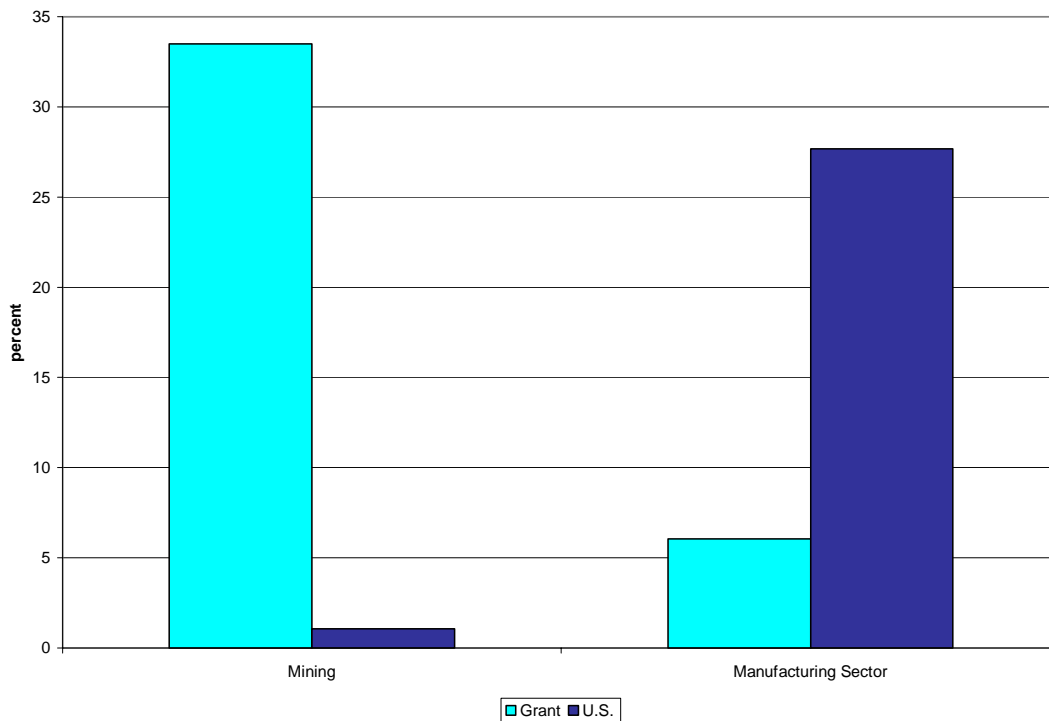
Industry

This part of the analysis examines changing patterns of employment by industry in Grant County over time. Compared to the rest of the U.S., since the 1960s Grant has consistently had much higher rates of employment in mining and much lower rates of employment in the manufacturing sector (see Figures 8 and 9). For example, in 1960 more than 30 percent of those employed in the county were employed in the mining sector, and this number remained high in 1980, especially when compared to the rest of the U.S. However, by 1990 employment in the mining sector had dropped off significantly in Grant, from slightly over 30 percent employed in the mining sector in 1980 to approximately 15 percent in 1990. The percent employed in the agricultural, fisheries, and forestry sector has been similar to national averages over time, though in recent years employment in this sector has been somewhat higher when compared to the rest of the nation. For example, in 1960 approximately 7 percent of the population in the U.S. was

employed in the agricultural, fisheries, and forestry sector, while close to 6 percent of the population in Grant County was employed in this sector. By 1990, however, employment in this sector in the nation had dropped off significantly, to only slightly more than 2 percent, while in Grant employment in the agricultural, fisheries, and forestry sector remained close to 5 percent.

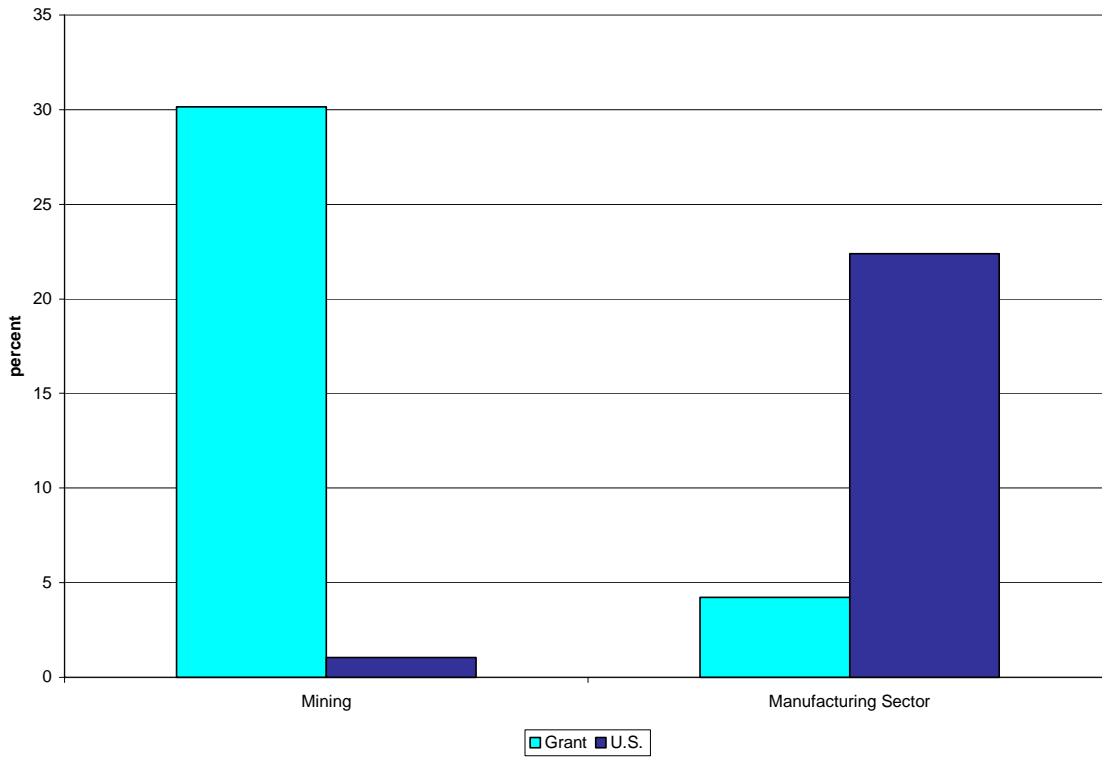
While employment in the mining sector has been extraordinarily high in Grant County when compared to the rest of the U.S. over time, employment in the manufacturing sector has been exceptionally low in Grant when compared to the rest of the nation. In 1960, only 6.1 percent of those employed in Grant were employed in the manufacturing sector, compared to a national employment rate in manufacturing of 27.7 percent. There remained a similar disparity between Grant and the rest of the U.S. in employment in the manufacturing sector in 1980. The high rate of employment in mining and the low rates of employment in other sectors suggests a lack of diversity in terms of employment opportunities in the Grant County economy. As has been the case with recent job losses in the mining industry in Grant, this lack of diversity leaves the local economy highly vulnerable to various events and circumstances, both nationally and internationally, particularly related to the price, availability, and utilization of copper.

Figure 8. Percent Employment by Selected Sectors: U.S. & Grant; 1960



Data Source: 1960 U.S. Census.

Figure 9. Percent Employment by Selected Sectors: U.S. & Grant; 1980



Data Source: 1960 U.S. Census.

Over the past few decades, employment in the service sector has grown dramatically throughout the U.S., with currently more than 70 percent of the U.S. population being employed in this sector. In Grant, the percent employed in this sector has been about 10 percent lower than the national average over time, though in many respects this is a reflection of such a large percentage of the workforce in the county being employed in the mining sector. Much of the service sector employment in the county is in government; according to the Bureau of Economic Analysis, about one-quarter of those employed in Grant County in 1999 were employed by the state or local government. In the same year, slightly less than 4 percent of the population either worked on farms or in the agricultural, fisheries, and forestry sector. Similarly, just below 4 percent of the population worked in the manufacturing sector in 1999, and the trend in Grant has seemingly been one of manufacturing decline over time, at least in terms of the percent of the local population employed in the sector. Though far from historic highs, employment in the mining sector remained high in Grant in 1999, with slightly more than 9 percent employed in the

mining sector.³ Though high compared to national averages, the trend has clearly been one of significant decline in mining in employment in Grant over the past few decades.

Table 1 indicates the ten largest employers by industry in the county, disaggregated by sector names as utilized by the IMPLAN model. These sector names are in many ways related to Standard Industrial Classification (SIC) codes. The Copper Ores industry was the largest employer in the county in 1998. This industry includes establishments primarily engaged in the mining of copper ores. The Primary Copper industry was also a large employer, with this sector including industries primarily engaged in the smelting or refining of copper. As previously suggested, and as is indicated in Table 1, state and local government are a large employer in Grant County. The second largest employer after the Copper Ores industry is education-related state and local government employment, followed by non-education related state and local government employment. Service establishments, such as eating and drinking facilities and food stores, are also large employers in Grant. These top ten employers account for slightly more than 55 percent of all employment in the county. The range fed cattle industry is the 14h largest employer in the county, employing approximately 300 individuals in 1998. Outside of employment by the U.S. Forest Service, there are very few forestry or timber-related jobs in the county. The employment base indicates that the copper mining and smelting industry, along with government and other service-related employment, makes up the economic base of the county.

Table 1: Largest Employers by Industry in Grant; 1998

INDUSTRY	TOTAL EMPLOYMENT
Copper Ores	1,938
State & Local Government - Education	1,730
Eating & Drinking	1,249
State & Local Government - Non-Education	1,179
Primary Copper	444
Doctors and Dentists	416
Miscellaneous Retail	387
Maintenance and Repair Other Facilities	379
General Merchandise Stores	372
Food Stores	370

Data Source: IMPLAN Model, base year 1998

³ Bureau of Economic Analysis, Regional Accounts Data, Local Area Personal Income, CA25- Total Full- and Part-time Employment by Industry.

Income

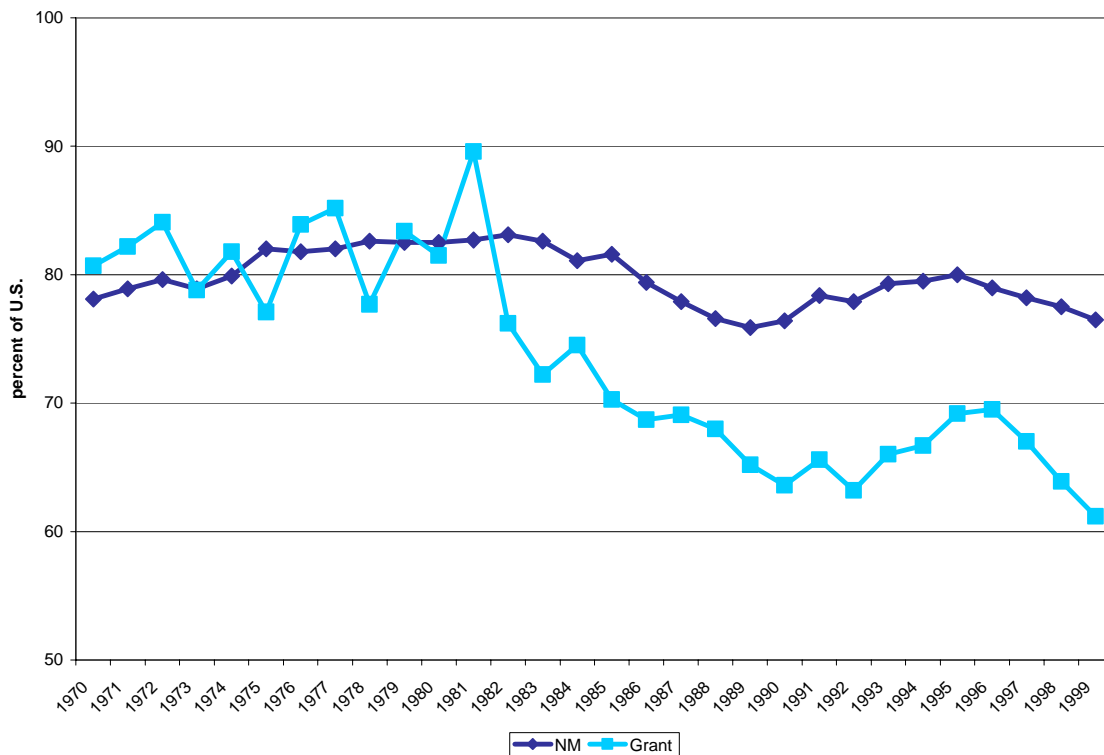
Income serves as one of the main indicators of regional economic prosperity. While there are multiple measures of income, two of the most widely measures used in tracking economic growth are per capita income and personal income.⁴ As can be seen in Figure 10, per capita income in the state of New Mexico remained relatively low compared to the U.S. average during the period 1970 to 1999. It fluctuated around 80 percent of the U.S. average during that period, reaching a low of 75.9 percent in 1989, rising slightly thereafter, but then declining again so that the rate in 1999 was close to the historic low for the period. Per capita income in Grant County has compared even less favorably with the U.S average over the course of the past three decades. Though it fluctuated fairly dramatically in the 1970s and early 1980s, per capita income in Grant was similar to that of the entire state during that time. However, since 1982 per capita income has declined fairly consistently and dramatically compared to the rest of the U.S., hitting 63.2 percent of the U.S. average in 1992, rising only slightly thereafter, then declining again so that in 1999 per capita income compared to the rest of the U.S. was at its historic low (61.2 percent) for the study period. Trends in the state and the county have been somewhat similar over time, with incomes in the state and the county declining relative to the U.S. average throughout much of the 1980s, rising slightly thereafter, but demonstrating decline again in recent years. Current rates of income in Grant County are exceptionally low for U.S. standards, even for a county as rural as Grant.

Figure 11 further demonstrates change in per capita income over time, demonstrating real per capita income growth between 1970 and 1999. While the state of New Mexico and the U.S. have both demonstrated relatively consistent real per capita income growth over the past three decades, with such income being slightly more than 45 percent higher in 1999 than in 1970 in both the U.S. and the state, per capita income growth in Grant during the same period of time has increased by only slightly more than 12 percent. The relatively vast difference in real per capita income growth between the U.S. and Grant provides an indication of how the county has gone from having per capita income levels that were slightly above 80 percent of the national average in 1970 to levels that are now only 61 percent of the U.S. average.

⁴ 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.

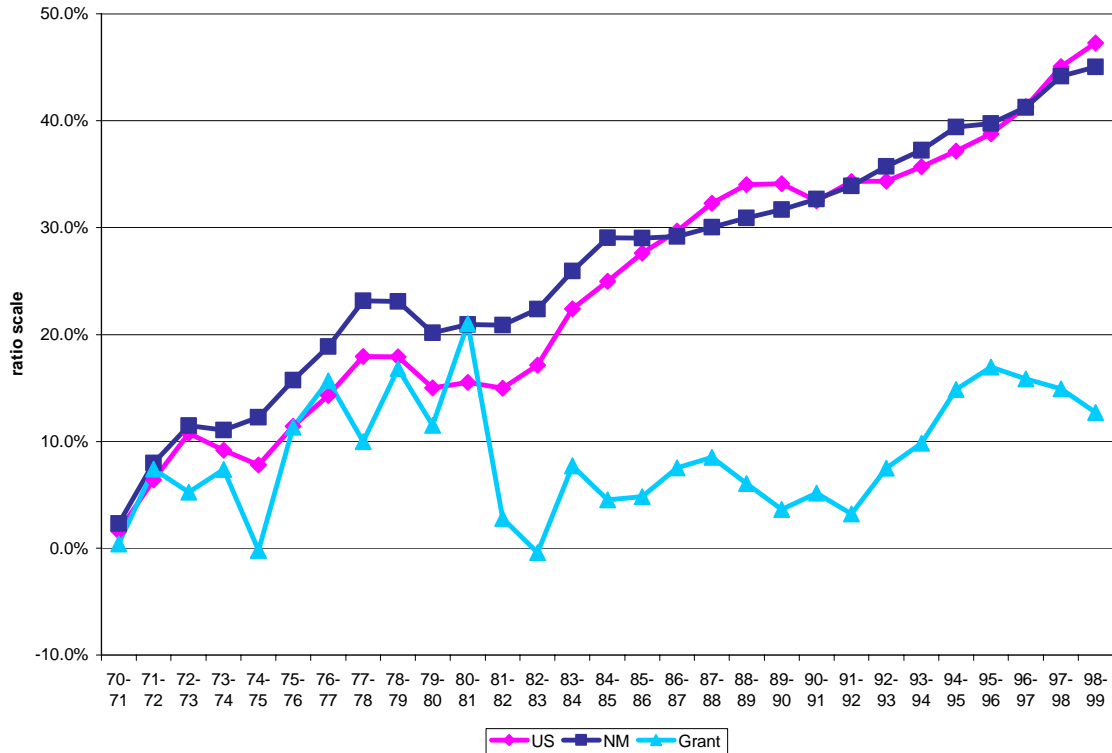
In the United States as a whole, per capita income levels are typically higher in metropolitan than in non-metropolitan areas, and rural, non-metropolitan counties in the U.S. typically have per capita incomes that are only 70 to 80 percent of the U.S. average. While a county such as Grant, that is highly rural and is not a part of a metropolitan area, should not be expected to have income levels similar to many areas of the U.S., per capita income in the county is exceptionally low even by rural, nonmetropolitan standards. What is perhaps most remarkable about per capita income in Grant is how it compared at least somewhat favorably to the U.S. average during the 1970s, but how poorly it has fared relative to the U.S. over the better part of the past two decades, to the point where income in the county compared to the rest of the nation is now the worst that it has been over the past three decades. The decline relative to the U.S. average over time suggests that a once somewhat prosperous rural area has had a significant shock to its economy and has had a difficult time recovering. This shock occurred in the early 1980s, and by 1999 the county actually had less in terms of real per capita income than it did approximately two decades earlier.

Figure 10. Per Capita Income; Percent of the U.S.; NM & Grant; 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 11. Per Capita Income; Relative Change; Real (2000) Dollars;
U.S., NM & Grant; 1970-1999

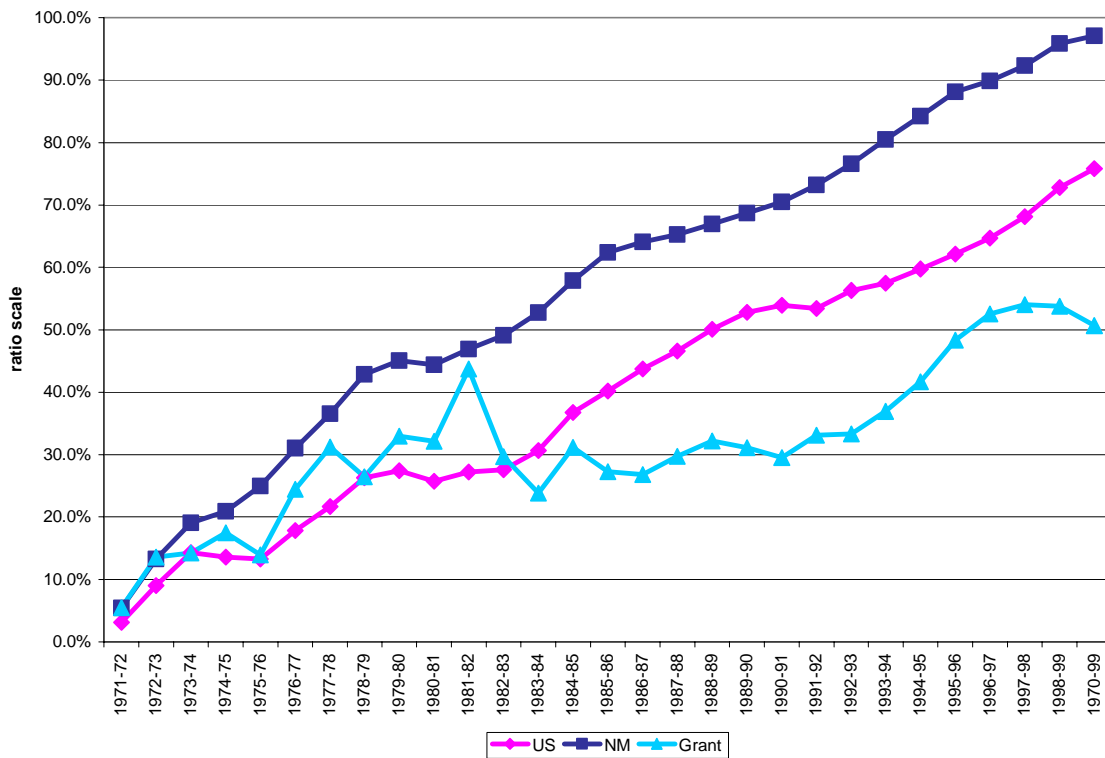


Data Source: Bureau of Economic Analysis, Regional Accounts Data, Local Area Personal Income, CA1-3 Per Capita Personal Income, Percent of U.S.

Aggregate measures of income, such as county-level total personal income, can also be a useful measure of economic performance, though they can be a bit deceiving because they are often related to population growth. Since the 1970s, there has been only limited growth in aggregate personal income in Grant County. Figure 12, which demonstrates real income growth in the U.S., New Mexico, and Grant County over time, shows that total personal income has increased in the state of New Mexico by close to 100 percent since 1970, compared to 76 percent in the rest of the U.S. Much of this growth in income is related to the tremendous population growth that has taken place in the state relative to the rest of the U.S. since the 1970s. However, while population has grown in Grant County at a relatively fast rate as well – faster than the national rate – increases in personal income have not kept pace with this growth. In Grant the increase total personal income has only been 50.7 percent since 1970.

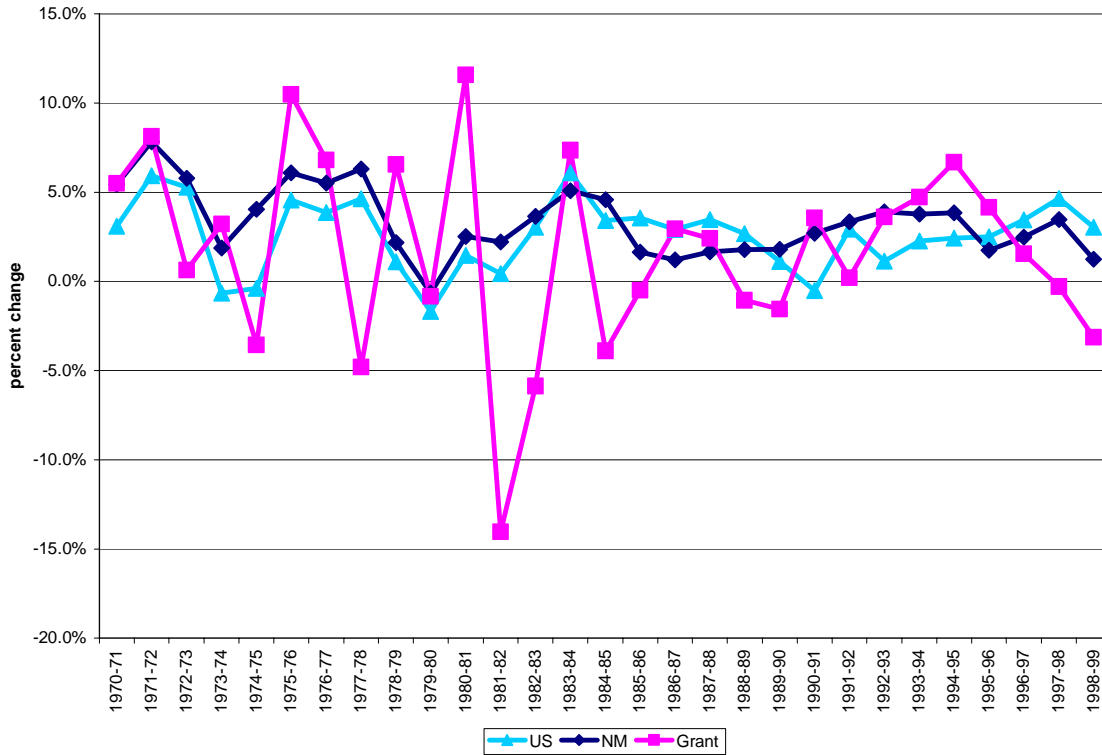
From the early 1970s until the mid-1980s, personal income change in Grant County fluctuated somewhat wildly between growth and decline (see Figure 13). This trend is in stark contrast to the fairly steady income growth in the state and the nation during the same period of time. Income growth stabilized a bit between the mid-1980s and the mid-1990s. However, rates of income growth seem to have waned in recent years. In general, with only modest growth in some years, and significant decline in others, total personal income in Grant has not been able to keep pace with the rest of the state or the nation. Considering that there has been relatively high population growth in the county over the same period of time, such lack of growth does not bode well for the county's economy.

Figure 12. Personal Income; Real (2000) Change; U.S., NM & Grant; 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 13. Personal Income; Real (2000) Relative Change; U.S., NM & Grant; 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,

Quality of Life and Environment

The quality of life in a county or region should not be measured by population, employment, and income figures alone. While economic conditions in Grant County do not compare favorably with much of the rest of the U.S., a number of other socioeconomic characteristics compare at least somewhat favorably with the rest of the nation. For example, educational attainment rates, including high school as well as college educational attainment rates, have been similar to U.S. averages since the 1960s. This is somewhat remarkable considering the rural nature of the county. Available statistics also indicate that health care in the county may be similar to that of the rest of the U.S., which again is remarkable considering Grant’s rural nature. The county has more physicians per capita than many non-metropolitan, as well as metropolitan, counties in the U.S., and it also has very low infant mortality rates.

Accessibility in terms of transportation does not seem to be a major problem in Grant either, as phone ownership as well as car ownership in the county are similar to the U.S. average.

On the other hand, information from the Environmental Defense Fund (EDF) indicates that environmental quality in Grant in terms of air and water pollution compares unfavorably to the rest of the nation as well as to much of the state, as total air, ground, and water toxic releases in the county are high compared to the rest of the nation, and a "cancer risk score" corresponding to these releases as assigned by the EDF is also high as well. The county received the worst scores possible related to these environmental issues, and this is likely due to the preponderance of copper mining operations in Grant. On the other hand, according to the Economic Research Service's (ERS) amenity code, which relates primarily to climate and recreational activities, the county enjoys better than average quality of life than much of the rest of the nation, though the high quality of life score is typical of many areas in the Southwest. Thus, the environment is seemingly in many ways threatened in Grant County, though the quality of life, at least according to ERS measures, is high for citizens residing and recreating in the county.

In terms of overall quality of life as related to employment, most of the residents, more than 96 percent, worked within the county in 1990. This is significantly higher than the U.S. county-level median, which in 1990 was about 75 percent. This low rate of commuting is likely due to the difficulty and distance involved in traveling from any of the main towns in the region to an area of significant population size. Moreover, the average travel time to work for those living in the county in 1990 was 15 minutes, which was slightly lower than the U.S. average. Finally, over time Grant has had similar rates of poverty when compared to the rest of the nation, though in 1990 poverty rates in Grant had risen to 21.2 percent, indicating that poverty had been growing worse in Grant compared to the rest of the U.S. since 1980. In short, in some respects the quality of life in Grant compares favorably with the rest of the U.S., while in other respects it does not. Furthermore, indicators such as poverty rates may point to worsening socioeconomic conditions in the county in recent years.

Economic Base Analysis

The remainder of this analysis will assess the economic base of Grant County. It is therefore relevant to first provide a brief description of economic base theory as well as a

description of input-output models, especially the IMPLAN model. This discussion is by no means exhaustive, and readers should refer to any number of references on economic base theory as well as input-output modeling for a further understanding of these concepts; some references are included in the bibliography of this report. Furthermore, IMPLAN offers a variety of means to analyze the economic base of a community, county, or region, and this analysis provides only a limited assessment of Grant's economic base through the use of IMPLAN.

Economic Base Theory

The use of IMPLAN relates to concepts in regional economics such as economic base theory, linkages, and multiplier effects. All of these concepts are considered important to understanding how economies, especially local economies, function, and they are also considered important to understanding how certain events might affect the structure and performance of an economy. In general, local economic performance is often considered dependent upon a community's economic base. According to economic base theory, a regional economy consists of "basic" and "nonbasic" sectors. The basic sector primarily consists of industries that sell a large portion of their goods and services outside the region, while nonbasic industries serve markets primarily within a region. It is important to note that export industries do not have to explicitly produce commodities, as "export" activities can include services, activities that draw money from tourists visiting from outside of the region, federal government transfer payments, and so on.

The development of an economy and economic growth over time involves basic sector industries utilizing a region's comparative advantage or advantages, which may include the availability of, for example, natural resources or uniquely skilled labor. Regions often pursue various policy measures, such as attracting specific industries to a region, to exploit their comparative advantage. Besides exports, a variety of entities and processes are vital to the functioning of a regional economy, including businesses that support export producers and a resident population that buys both locally and externally produced goods and services. Thus, when considering and analyzing the dynamics of a regional economy, it is important to consider the variety of producers and consumers within the region. Input-output analysis helps to identify these dynamics, primarily through the analysis of a region's current economic structure and through further analysis of what structural changes are needed to foster growth.

A key to economic base theory and input-output analysis is examining the linkages between industries within a region, especially in terms of commodities used in production. A simplistic example of the linkages between an industry and its suppliers and consumers is depicted in Figure 14.⁵ Industry I purchases the inputs needed to produce its products, such as labor, parts and transportation, and utilities. 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,⁶ the outside world⁷ (exports outside the region), other local industries (intermediate demand)⁸, or institutions (e.g. government)⁹ that may use the product of industry I for consumption (final demand)¹⁰ or as inputs to which they will add further value in the production of their own product.¹¹ It is important to realize that the selling of a product to another sector can be as an intermediate good (used in the production process, such as flour to a bakery for making bread) or for final demand (such as electricity sold to a household).

Final demand for goods and services are what drive input-output models. In order to meet final 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 in input-output through what are known as multipliers. Broadly defined, the multiplier is a means of measuring the total effect that a unit of change in an economy has upon the total economy. More specifically, multipliers break the round by round impacts of economic stimuli into three components: direct effects, indirect effects, and induced effects. Direct effects represent the response of an industry to a change in demand for a product produced by the industry. For example, the direct effect on the automotive industry of a large increase in demand for automobiles may be one thousand new jobs.

⁵ Derived from conceptual model presented in *IMPLAN Pro Version 2 (2000) User's Guide, Analysis Guide, and Data Guide*.

⁶ 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.

⁷ The outside world refers to individuals and activities other than government outside of the region.

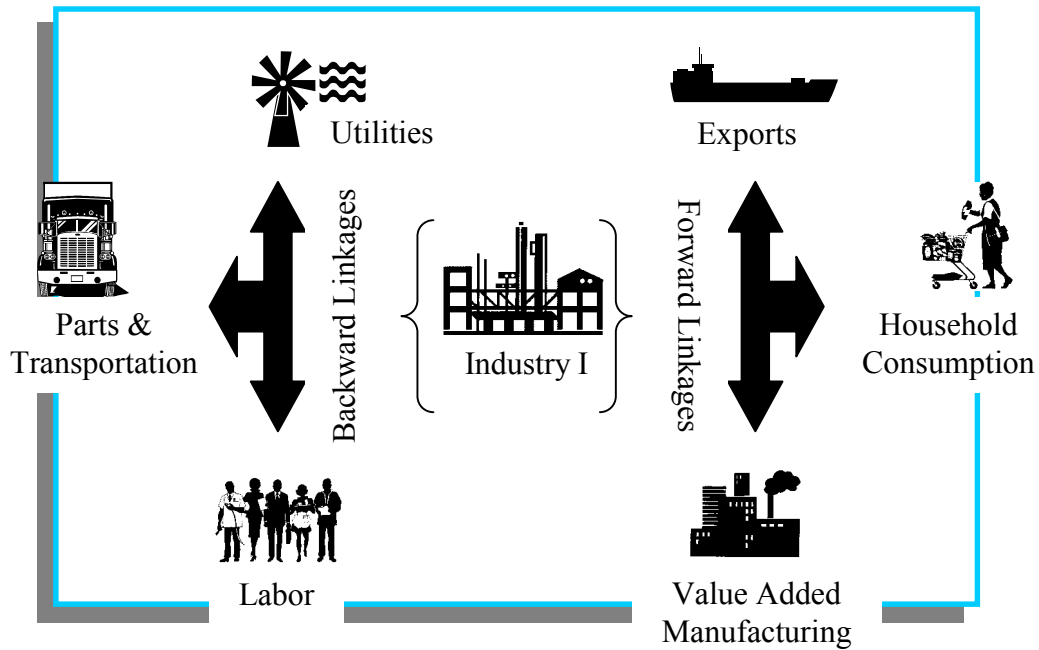
⁸ Intermediate or inter-industry demand refers to transactions among private industries within the region.

⁹ Government can be Federal, state, or local public authorities within or outside the region.

¹⁰ 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.

¹¹ Value added is the portion of total value of output exclusively contributed by the intermediate industry.

Figure 14. Forward and Backward Linkages Supporting Industry



Indirect effects represent the response by all other industries to the initial change in demand. For example, the increased demand for automobiles will require increased electricity, a greater supply of steel, and so on from industries that supply the automobile industry. Induced effects represent the impacts to all local industries that result from the growth in expenditures of households.¹² Those expenditures stem from the generation of new income by way of the direct and indirect effects. For instance, the initial change in automobile 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.¹³

Related to multiplier effects is the concept of economic leakages. Economies, whether within a region or on a national scale, are interconnected. Commodity production tends to rely upon a variety of goods and services, and these goods and services can either be supplied from within or outside of the region. When commodities that a particular industry utilizes in the

¹² 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.

¹³ Regional purchase coefficients, an econometrically derived measure of trade flows, are used to adjust for those portions of industry purchases made outside the region.

production process must be imported from outside the region, this causes what is known as an economic leakage. Economic leakages result in income loss to a community. In such a scenario, local economic development efforts may focus upon import substitution policies, where goods and services imported from outside of the region are replaced by goods and services produced locally. Eliminating economic leakages strengthens the multiplier effects of the export base. Thus, imported commodities that are tied directly to a region's export base are important candidates when a local community is considering focusing its efforts on attracting industry.

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 leakages, and therefore, the magnitude of multipliers. For instance, the greater the size of a region, the greater the opportunity there may be to conduct economic activity within that region (e.g. a larger selection of businesses from which to make purchases). Also, locations near major economic centers may lose more in terms of leakages than remote, rural locations. In such a situation, for example, residents may travel outside of the region in question to the metropolitan area to purchase goods and services, at least more frequently than they would if they were living in a more remote location.

In sum, it is important to realize that local economic sustainability and growth are linked to a variety of factors and processes including the following: geographic location; retention and expansion of the current export base; the substitution of imports with local production; the capture of local demand for goods and services; and obtainment of government transfers. It is important to remember that an export can be virtually anything that brings "outside" money into the local economy. The decline of one exportable commodity typically must be accompanied by the growth of another, or a region's economy will suffer. Major reasons for the decline of an existing exportable commodity include changes in demand from outside the region, exhaustion of a natural resource, decreasing comparative advantage relative to a competing region, and technological change.

There are many methods used to describe and analyze the economic base of a regional economy. Among those methods is input-output analysis, which provides detailed information on individual sectors in relation to their contribution to the local economy. One of the main uses of an input-output model is to assess some sort of "external shock" to an economy, such as increased demand from the outside world for a locally manufactured product or service, a policy measure affecting the utilization of a particular natural resource upon which a local economy is

dependent, or something such as a change in tax rate that could affect all sectors of an economy, including households.

Input-output analysis stresses the effects of change from final demand backward to intermediate and primary supply sectors.¹⁴ Therefore the method is market rather than input oriented and pays no attention to resource constraints or forward or complementary linkage effects.¹⁵ 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 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 into the region, 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

¹⁴ 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).

¹⁵ 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 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.

incorporates the two approaches. As such, input-output remains one-sided and the user must be aware of the implications of that bias.¹⁶

Input-output modeling 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.¹⁷ Such modeling is made relatively easy by the availability of computer software programs and databases specifically designed for such analysis. A number of programs have been developed, one of which is IMPLAN (IMpact analysis for PLANning), a modeling system introduced by the USDA Forest Service, but which is now used by a range of researchers for a variety of tasks.¹⁸

IMPLAN can be used to construct custom input-output models for any county or multi-county region in the United States.¹⁹ The research presented in the remainder of this work is the result of its application to Grant County, New Mexico. The county 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 understood as descriptive in nature and should not be used for any detailed analysis without further consultation with the primary investigators.

Some important details of the specificities of the model are as follows. First, this analysis utilizes, for the most part, Type SAM multipliers, which include industry as well as social accounting information. Furthermore, most of the analysis relies upon fairly broad sectoral aggregations, which limits the details of the analysis, providing a fairly broad portrayal of the Grant economy. Greater detail regarding sectors would likely be necessary if this analysis was attempting to answer a question regarding a specific policy initiative, demand for a specific product, or, in general, a question of a specific nature. Included in each of the following subsections are brief descriptions of the nature of the analysis along with corresponding results.

¹⁶ 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.

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

¹⁸ 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.

¹⁹ Databases are also available by zip-code designation, therefore regions may also be specified on that basis.

Commodity Supply

This section of the analysis examines the commodity production of industries and institutions in Grant County. It is important to note that industries consist of businesses producing goods and services, while commodities are the goods and services themselves. Commodity supply represents the product base of a community upon which other economic activity is dependent. This analysis considers two different forms of commodity supply: industry commodity production and institutional commodity sales, and it further includes total as well as net commodity supply.

Table 2 includes Grant County's industry commodity production, institutional commodity sales, total commodity supply, and net commodity supply. Industry commodity production indicates the total commodities produced by each of the industries within the county, and it is presented in Table 2 as a percentage of total production of all commodities in the county. In 1998, Grant industries produced \$1,498 million worth of commodities, with manufacturing commodities accounting for the largest percentage of this production, followed by mining commodities. Mining commodity production as a percent of total commodity production is much higher in Grant than in most other places, though such findings are to be expected considering the importance of the mining sectors in Grant. The manufacturing commodities are largely related to the mining of copper as well, as primary copper accounts for 98 percent of manufacturing commodity supply.

Institutional commodity sales include commodities produced by non-industry sources such as households. In Grant, institutional commodity sales are small relative to industry commodity production, accounting for only 1.8 percent of total commodity supply in the county. Such a finding is somewhat typical. As is the case with industry commodity production, Table 2 presents institutional commodity sales as a percentage of all commodity sales in the county. Service and manufacturing commodities are the leading institutional commodity supplies.

Total Commodity Supply is simply the combination of industry commodity production and institutional commodity sales. As is indicated in Table 2, commodity supply in Grant County totals \$1,526 million. Manufactured goods are clearly the leader in total commodity supply, followed by mining products and then services. Total mining commodity supply is quite high in Grant compared to most counties in the rest of the U.S.

Table 2. Commodity Supply; Percent of Total; Grant, NM; 1998

Commodity	Industry Commodity Production	Institutional Commodity Sales	Total Commodity Supply	Net Commodity Supply
Agriculture	1.0%	0.3%	0.9%	1.0%
Mining	18.7%	0.1%	18.3%	18.4%
Construction	8.8%	0.0%	8.6%	8.9%
Manufacturing	38.3%	35.5%	38.3%	37.6%
TCPU	4.7%	0.5%	4.6%	4.5%
Trade	7.3%	2.5%	7.2%	7.3%
FIRE	5.0%	0.0%	4.9%	4.9%
Services	8.5%	40.1%	9.1%	9.3%
Government	7.4%	0.0%	7.2%	7.5%
Other	0.5%	21.1%	0.8%	0.7%
Total*	1,498	28	1,526	1,478

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

Net commodity supply is the commodity supply available for local and domestic consumption, which includes domestic but not foreign exports.²⁰ To be more specific, foreign exports include commodities that are exported beyond national borders, while domestic exports are commodities exported outside of the region in question but remain within national boundaries. The majority of total commodity supply, close to 97 percent, remains available for local consumption and domestic export consumption. Thus, very little of what is produced in Grant County is being exported directly to foreign markets. However, it is important to note that much of what is produced in Grant could nonetheless be inputs to the production of exported commodities or could be sold to domestic companies involved in foreign trade. Moreover, in an IMPLAN model of this type, the majority of net commodity supply, whether in a metropolitan or nonmetropolitan area, is typically indicated as being available for local consumption or domestic export consumption.

Industry production is further broken down into production as a percentage of market shares by individual sectors (Table 3). Market shares are the percentage of the total production of a commodity that is produced by each industry. In general, and not simply in relation to the IMPLAN model, industry sectors are defined by the product that they produce. For example, the manufacturing sector is so named due to its production of manufacturing commodities. However,

²⁰ Local commodity demand + domestic commodity demand = net commodity supply = total commodity supply – foreign exports.

industries also produce commodities that are not typically associated with their sector, such as when the manufacturing sector produces what are understood to be service commodities.

In general, the majority of Grant industries are single commodity type, which is typical for most places, whether rural or urban. One notable finding is the level of service provisions provided by the government sector. In Grant, the service industry produces 80 percent of all service commodities, while the manufacturing and government sectors produce 9 and 8 percent of these commodities, respectively. The provision of services from the manufacturing and government sectors is slightly higher than one would find in many other rural and especially metropolitan areas. It is also of note that the government sector accounts for very little of the percent of market share for agricultural commodity supply. This is somewhat surprising for a county with such a large land area owned by the federal government, and may be indicative of the limited timber harvesting activity that has taken place in the Gila National Forest in recent years. Other counties with relatively large amounts of federal lands often have a much larger share of agricultural commodity supply produced by government.

Table 3. Market Share of Commodity Produced; Percent of Total; Grant, NM; 1998

Commodity / Industry	Agri-culture	Mining	Const-ruktion	Manu-facturing	TCPU	Trade	FIRE	Service	Government	Other
Agriculture	99.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Mining	0.0%	99.9%	0.0%	3.2%	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%	0.0%	0.0%	95.1%	0.0%	0.0%	0.0%	9.0%	0.0%	2.5%
TCPU	0.0%	0.0%	0.0%	0.0%	88.7%	0.0%	0.0%	1.6%	0.0%	0.1%
Trade	0.0%	0.0%	0.0%	0.0%	0.0%	98.7%	0.0%	0.0%	0.0%	0.2%
FIRE	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	98.1%	1.1%	0.0%	0.0%
Services	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	80.0%	0.0%	0.0%
Government	0.6%	0.0%	0.0%	0.0%	11.2%	1.3%	1.8%	8.3%	100.0%	0.0%
Other	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	51.3%
Households	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	14.6%
Capital	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	31.2%
Inventory	0.0%	0.0%	0.0%	1.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Total percentages may not sum to 100 due to rounding

Commodity Demand

As is the case with commodity supply, commodity demand can also be broken into two categories: intermediate commodity demand and institutional commodity demand. Intermediate

commodity demand is locally generated demand by industries for local and/or imported commodities. Institutional commodity demand is local demand by non-industry sources, such as households, governments, and other institutions, for local or imported commodities. Though the IMPLAN model generates commodity purchases in terms of gross values, only total purchases (in millions of dollars) are presented in Table 4, while amounts of total commodity demand are indicated as a percent of total demand. The leading intermediate commodity demands in Grant County are for manufacturing and FIRE (Finance, Insurance, and Real Estate) commodities (*see* Table 4). FIRE commodities are also among the leaders for institutional demand.

In Table 5, intermediate commodity demand is broken into industry sectors. This table provides an indication of local industry's backward linkages, though the extent to which local production is used to meet local demand will be discussed in a later section. To provide an indication of how to read Table 5, one can see that 52.7 percent of the construction industry's total demand is for manufacturing commodities. In short, however, nothing in terms of intermediate commodity demand or institutional commodity demand in Grant is particularly surprising or remarkable.

Table 4. Commodity Demand; Percent of Total; Grant, NM; 1998

Commodity / Industry	Intermediate Commodity Demand	Institutional Commodity Demand	Total Gross Commodity Demand
Ag, Fishing, Forestry	3.7%	0.5%	2.1%
Mining	5.4%	2.9%	4.2%
Construction	3.9%	11.9%	7.9%
Manufacturing	44.2%	13.4%	29.0%
TCPU	8.8%	5.7%	7.3%
Trade	6.2%	15.8%	11.0%
FIRE	16.0%	19.5%	17.8%
Services	0.6%	14.4%	7.4%
Government	0.6%	14.4%	7.4%
Other	0.8%	2.2%	1.5%
Total*	798	774	1572

Total percentages may not sum to 100 due to rounding

*Millions of dollars

Table 5. Intermediate Commodity Demand; Percent of Total; Grant, NM; 1998

Industry/ Commodity	Agric- culture	Mining	Con- struction	Manu- facturing	TCPU	Trade	FIRE	Services	Govern- ment
Agriculture	34.2%	0.1%	1.1%	5.2%	0.0%	1.3%	2.4%	0.3%	0.4%
Mining	0.0%	29.8%	1.2%	3.9%	10.0%	0.0%	0.0%	0.0%	4.9%
Construction	2.1%	27.9%	0.2%	1.1%	5.3%	1.6%	12.5%	2.3%	28.8%
Manufacturing	27.9%	12.9%	52.7%	54.5%	10.3%	21.1%	2.3%	18.2%	17.4%
TCPU	7.7%	9.0%	6.1%	7.9%	34.8%	11.5%	6.5%	9.0%	19.4%
Trade	11.2%	4.5%	15.3%	11.4%	4.6%	8.9%	1.2%	5.0%	2.5%
FIRE	11.2%	9.8%	3.4%	3.0%	6.4%	13.6%	50.2%	16.1%	7.7%
Services	5.6%	5.4%	19.9%	11.6%	25.1%	39.3%	22.5%	46.4%	14.2%
Government	0.0%	0.0%	0.3%	0.4%	0.6%	1.8%	2.2%	2.4%	2.2%
Other	0.0%	0.6%	0.0%	1.0%	3.1%	0.9%	0.2%	0.3%	2.2%
Total Demand*	1.4	65.7	86.3	510.3	23.3	32.8	20.3	51.5	6.7

Total percentages may not sum to 100 due to rounding

*Millions of dollars

Total institution commodity demands include household and government demand as well as capital formation, inventory purchases, and foreign exports. In Grant County households make up the largest proportion of institutional commodity demand (*see* Table 6). Household commodity demand consists of payments by individuals and households to industries for goods and services used for personal consumption. For households, 28.1 percent of commodity demand is for services, typical for a region of this and other sizes.

It is noteworthy, however, that spending patterns can differ dramatically when disaggregated by income level and commodity types. For instance, spending on services is greatest in Grant County for the lowest two income groups, 35.3 percent for those below \$5 thousand and 34 percent for those between \$5-10 thousand, compared to 24.1 percent for the next highest income group (*see* Table 7). In addition, Table 7 indicates that households in all income ranges spend more on services than any other commodity, followed by FIRE. Trade and manufacturing are also big sources of household commodity demand. Again, these results are typical for most counties and regions.

Table 6. Institutional Commodity Demand; Percent of Total; Grant, NM; 1998

Institution/ Commodity	Sum of Households	Sum of Federal Gov.	Sum of State & Local Gov.	Capital	Inventory
Agriculture	0.7%	0.0%	0.3%	0.0%	0.1%
Mining	0.0%	0.0%	0.0%	0.0%	74.5%
Construction	0.0%	0.3%	12.3%	88.3%	0.0%
Manufacturing	18.9%	0.7%	4.6%	0.0%	0.4%
TCPU	7.6%	0.2%	2.9%	1.2%	0.9%
Trade	19.3%	0.1%	1.0%	5.4%	1.9%
FIRE	22.8%	0.1%	1.8%	3.0%	0.0%
Services	28.1%	0.7%	3.8%	2.0%	0.0%
Government	0.7%	97.7%	73.2%	0.0%	0.0%
Other	1.9%	0.2%	0.1%	0.0%	22.2%
Total Demand*	514.51	16.89	125.24	86.76	30.26

Total percentages may not sum to 100 due to rounding

*Millions of dollars

Table 7. Household Commodity Demand; Percent of Total; Grant, NM; 1998

Household Income/ Commodity	<\$5k	\$5-10k	\$10-15k	\$15-20k	\$20-30k	\$30-40k	\$40-50k	\$50-70k	\$70k+
Agriculture	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%
Total Demand*	29.29	37.31	45.30	53.93	96.46	93.23	48.59	71.41	39.00

Total percentages may not sum to 100 due to rounding

*Millions of dollars

When commodity types are further disaggregated, there are some interesting trends as indicated in Table 8. For example, owner-occupied dwellings are the commodity most in demand for the majority of income groups. Also, as income increases, a larger percent of income is used for housing. Households with income greater than \$70 thousand spend slightly more than 15 percent of total income on owner-occupied dwellings, while households with income less than \$5 thousand spend only around 7 percent of income on this commodity. Also, as income goes up, expenditures on insurance tend to rise. The reverse is true for hospitals, or what can be considered a proxy for health care: poorer households tend to spend a larger percentage of their

income on health care. The data in Table 8 are indicative of broader societal trends that are not specific to Grant County. Nonetheless, it is of note that the variations in the income make-up of a county can result in vast differences in what types of commodities are purchased in a county, and if the income make-up of the residents in Grant County were to change, overall commodity purchase patterns would also likely change.

Table 8. Top Household Commodity Demands; Percent Total All Commodity Demands by Income Group; Grant, NM; 1998

Household Income/ Commodity	<\$5k	\$5-10k	\$10-15k	\$15-20k	\$20-30k	\$30-40k	\$40-50k	\$50-70k	\$70+
Own.-occ. Dwellings	7.1%	5.5%	8.0%	7.9%	8.1%	9.8%	11.0%	12.5%	15.1%
Hospitals	9.7%	9.4%	4.1%	8.8%	7.3%	9.4%	4.9%	5.0%	4.6%
Doctors/Dentists	4.4%	4.5%	5.4%	5.2%	5.3%	4.7%	5.7%	5.9%	5.3%
Real Estate	8.5%	8.7%	8.0%	6.5%	5.7%	4.7%	3.6%	2.0%	1.2%
Eating & Drinking	4.0%	2.6%	3.6%	4.0%	4.4%	4.4%	4.9%	4.7%	5.0%
Banking	3.7%	4.1%	4.4%	3.8%	4.3%	4.3%	4.7%	4.0%	3.1%
Wholesale Trade	3.3%	3.5%	4.1%	3.8%	3.9%	3.6%	3.8%	3.8%	3.4%
Insurance Carriers	1.4%	1.6%	2.3%	2.6%	2.9%	3.4%	4.0%	4.2%	4.8%
Miscellaneous Retail	2.1%	2.3%	3.0%	2.6%	3.2%	2.8%	3.0%	3.0%	2.6%
Automotive Dealers	1.4%	1.6%	2.3%	2.1%	2.7%	2.5%	2.7%	2.6%	2.1%

Table 9 includes government commodity demands. Demand is broken down by federal as well as by state and local expenditures. Federal expenditures include military purchases, non-military purchases, and investment, while state and local expenditures include non-education, education, and investment expenditures. Non-military federal expenditures are for, amongst other things, the management of public lands. State and local non-education expenditures are for activities such as police protection. Federal as well as state and local investment expenditures are for capital goods and construction.

The majority of federal government commodity demand is not military related. Counties and regions with large military complexes or defense-related activities typically have a greater commodity demand from defense rather than non-defense related activities, though this is not the case in Grant. The majority of government commodity demand in Grant is from state and local sources, with state and local government commodity demand being primarily for government commodities. In general, government commodity demand in Grant, both federal as well as state and local, is typical of what one might expect in a highly rural area. For example, federal non-

defense commodity demand is primarily for government commodities, and state and local investment commodity demand is primarily related to construction commodities.

Table 9. Government Commodity Demand; Percent of Total; Grant, NM; 1998

Institution/ Commodity	Federal Non- defense	Federal Defense	Federal Investment	State & Local Non-education	State & Local Education	State & Local Investment
Agriculture	0.0%	0.0%	0.0%	0.4%	0.1%	0.0%
Mining	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Construction	0.1%	0.3%	18.8%	4.2%	1.0%	97.4%
Manufacturing	0.0%	0.0%	75.2%	6.2%	3.3%	2.0%
TCPU	0.1%	0.3%	0.0%	3.7%	2.7%	0.0%
Trade	0.0%	0.1%	5.4%	1.5%	0.5%	0.3%
FIRE	0.1%	0.0%	0.0%	3.4%	0.2%	0.0%
Services	0.5%	1.0%	0.0%	6.0%	1.9%	0.0%
Government	99.2%	97.9%	0.0%	74.4%	90.3%	0.0%
Other	0.0%	0.4%	0.0%	0.0%	0.1%	0.2%
Total Demand*	9.252	7.484	0.149	63.206	49.535	12.494

Total percentages may not sum to 100 due to rounding

*Millions of dollars

Finally, in this section of the analysis it is pertinent to discuss commodity exports, which include both foreign as well as domestic exports. As previously mentioned, foreign exports are shipments from local industries to destinations outside of the U.S., while domestic exports are shipments outside of the local area but within the country. Domestic exports account for close to 95 percent of all exports from the county, with manufacturing and mining exports accounting for virtually all domestic exports from Grant (*see* Table 10). This is an exceptionally large share of exports from these sectors and is indicative of the heavy reliance upon copper mining and copper manufacturing processes in the local economy. Furthermore, although there are few foreign exports from the county, manufacturing and mining commodities account for the bulk of these exports as well. The share for mining commodity exports is especially high compared to other areas of the country, providing an indication of how mining is such an important part of the county's economic base.

Table 11 includes the percentage contribution to total exports for the top ten exported commodities from the county. As opposed to previous tables, the sectors are disaggregated in Table 11 to provide a more detailed understanding of the individual industries that are contributing to the county's economic base. These 10 commodities account for a total of 92.5

percent of all exports from the county. Clearly, the copper industry is extremely important to the local economy, as copper related commodities account for more than 85 percent of all exports from the county. No other commodities produced in the county come close to being exported at the rate of copper commodities. It is noteworthy that no forest related products are included in the top ten exports in the county. The only forestry-related commodities that are exported from Grant County to any significant degree are Greenhouse and Nursery products, which account for 0.3 percent of total exports, and agricultural, forestry, and fisheries services which account for 0.02 percent of total exports. In short, forestry related activity is virtually absent from the county's export base, while the copper industry almost entirely supports the local economic base, indicating the vulnerability of Grant's economy to vagaries in the copper market.

Table 10. Commodity Exports; Percent of Total; Grant, NM; 1998

Export/Commodity	Foreign	Domestic	Total
Agriculture	0.4%	0.0%	0.0%
Mining	16.2%	27.5%	26.9%
Construction	0.0%	1.0%	0.9%
Manufacturing	59.6%	71.5%	70.8%
TCPU	5.6%	0.0%	0.3%
Trade	4.4%	0.0%	0.3%
FIRE	5.1%	0.0%	0.3%
Services	2.2%	0.0%	0.1%
Government	0.0%	0.0%	0.0%
Other	6.5%	0.0%	0.4%
Total*	47.75	770.65	818.40

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

Table 11. Commodity Exports; Disaggregated; Percent of Total; Grant, NM; 1998

Export/Commodity	Foreign	Domestic	Total
Primary Copper	56.4%	66.2%	65.5%
Copper Ores	16.3%	13.3%	13.5%
Primary Nonferrous Metals	0.0%	6.7%	6.3%
New Government Facilities	0.0%	2.3%	2.1%
Eating & Drinking	0.1%	1.6%	1.5%
Range Fed Cattle	0.1%	1.0%	0.9%
Iron Ores	0.0%	0.9%	0.9%
Chemical Preparations	2.9%	0.5%	0.7%
Social Services	0.0%	0.7%	0.6%
Job Training/Related Services	0.0%	0.6%	0.5%
Total*	75.8%	93.7%	92.5%

Total percentages may not sum to 100 due to rounding
 *Percent of Total Exports

Consumption Patterns

The next part of the analysis considers the topics discussed in the previous two sections, commodity supply and commodity demand, in conjunction with one another. Consumption patterns, while providing an indication of the intersection of supply and demand, further reveal areas of growth potential in a local economy. Table 12 includes information about the domestic supply/demand ratio, average regional purchase coefficients (RPC), and average regional sales coefficients (RSC).

The domestic supply/demand ratio is the relationship of net commodity supply (previously indicated in Table 2, which is the total commodity supply available for local and domestic consumption) to total gross commodity demand in the region (previously indicated in Table 4). It is important to stress here that this ratio includes supply that can be used both within the county or elsewhere within the U.S. If supply exceeds demand then the ratio is set to one, as is the case with mining, construction, and manufacturing commodities in Grant. For all other commodities in Grant, demand exceeds supply, though for government commodities the supply/demand ratio is close to one.

Regional purchase coefficients represent the proportion of local commodity demand actually purchased from local producers. For example, a RPC of .50 for a given commodity indicates that for each \$1 of local need for that commodity, 50 percent will be purchased from local producers. Essentially, a RPC measures local demand that is satisfied by local supply, and remaining demand must therefore be satisfied by imports. It is similar to the domestic supply/demand ratio, except that where the supply/demand ratio assumes availability, an RPC assumes actual purchases. Construction commodities have the highest RPC in Grant with a value equal to one. Though a high RPC for construction commodities is typical of most counties, the RPC for this commodity is somewhat higher than one might expect to find elsewhere. Government also has a high RPC, though this is a very typical finding. The RPC for manufacturing commodities, however, is very low, meaning that the majority of local demand for manufacturing commodities is not being met by local supply.

Regional sales coefficients indicate the fraction of net commodity supply used to meet county gross commodity demand. For example, if the RSC for agriculture is .75, then 75 percent of agricultural commodities that are produced within the region are also consumed within the region, while the remaining 25 percent are exported outside of the region. In an analysis of the

disaggregated industries in Grant, .66 of the copper ores in the county were meeting local demand, suggesting a close linkage between the mining and the smelting of copper in the county.

By considering the difference between RSCs and RPCs for various commodities, it is possible to assess where there is room for growth in a local economy. For example, a high RSC but a low RPC for a particular commodity indicates that while most of the supply of a given commodity within a region is going to meet local demand, there is still excessive demand for that particular commodity that is not being met by local supply, as is the case with agricultural, fishing, and forestry commodities as well as FIRE and service commodities in Grant County. In Grant the service sector has an especially high RSC but a relatively low RPC, suggesting that service supply in the region is only partially going to meet local demand. With an RSC of .99 but a RPC of only .49, there may be room for expansion in the local service sector, as much of the demand for services is being met by supply from outside of the county. The high RSC for agricultural products reflects the relatively high degree of specialization in agricultural production in the county, especially in terms of beef production. Thus, many of the agricultural commodities that are consumed in the county are not produced there, and, simply put, the county produces more than enough beef than it can be expected to consume.

On the other hand, if an RSC is low, then this suggests that commodities are being sold to industries and institutions outside of the region to meet demand elsewhere, as is the case with mining commodities in the county. In such a scenario, economic development efforts could be aimed at attracting such industries that are outside of the region but that are currently purchasing commodities from within the region. However, to suggest that Grant should attempt to attract industries that rely upon mining commodities could be an oversight, especially considering the recent plight of mining operations in the county.

Table 13 includes the top ten export commodities in Grant County. These commodities were previously discussed in reference to Table 11. It is clear that the majority of these commodities are being exported from the county, as is evident in the very low RSCs. It is doubtful, considering the nature of these industries, especially the copper related industries, that a significantly larger portion of these commodities could be consumed within the county. What is perhaps most notable here is that the domestic supply/demand ratios indicate that the domestic markets for all of these products are saturated, indicating little room for growth in demand for these commodities, at least domestically.

Table 12. Comparison of Commodity Supply and Demand; Grant, NM; 1998

Commodity	Domestic S/D Ratio	Average RPC	Average RSC
Ag, Fishing Forestry	0.43	0.43	0.99
Mining	1.00	0.91	0.21
Construction	1.00	1.00	0.94
Manufacturing	1.00	0.01	0.01
TCPU	0.59	0.59	0.96
Trade	0.58	0.58	0.98
FIRE	0.42	0.42	0.97
Services	0.49	0.49	0.99
Government	0.95	0.95	1.00
Other	0.42	0.42	0.76

Table 13. Comparison of Commodity Supply and Demand;
Disaggregated Sectors; Grant, NM; 1998

Commodity	Domestic S/D Ratio	Average RPC	Average RSC
Primary Copper	1.00	0.15	0.06
Copper Ores	1.00	0.91	0.66
Primary Nonferrous Metals	1.00	0.02	0.00
New Government Facilities	1.00	1.00	0.37
Eating & Drinking	1.00	0.90	0.69
Range Fed Cattle	1.00	0.97	0.01
Iron Ores	1.00	0.00	0.00
Chemical Preparations	1.00	0.70	0.13
Social Services	1.00	1.00	0.45
Job Training/Related Services	1.00	1.00	0.14

Table 14 indicates intermediate commodity imports, institutional commodity imports, and total imports for Grant County in terms of share of total commodity imports. Total imports is a combination of intermediate and institutional imports. In 1998 Grant County imported approximately \$531 million of intermediate commodity imports and slightly less than \$333 million of institutional imports. The largest share of intermediate as well as institutional imports was for manufacturing commodities, followed by services in both categories. There is also high institutional commodity demand for manufacturing commodities. Compared to other regions, there are exceptionally high leakages occurring in terms of intermediate commodity demand for manufacturing commodities. The high intermediate and institutional commodity demand for

manufacturing commodities highlights the limited nature of manufacturing within the county, while the relatively low intermediate commodity demand for mining commodities further highlights the high degree of copper mining taking place in the county.

Table 14. Commodity Imports; Grant, NM; 1998

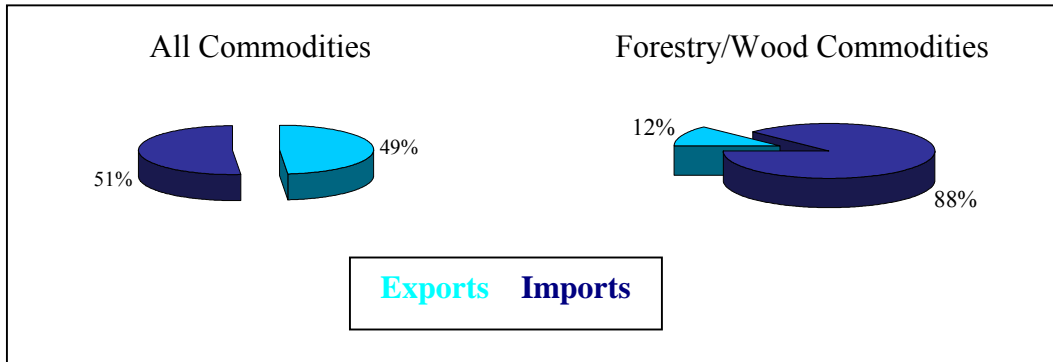
Import/ Commodity	Intermediate	Institutional	Total
Agriculture	3.1%	0.6%	2.2%
Mining	0.7%	0.6%	0.7%
Construction	0.0%	0.0%	0.0%
Manufacturing	65.7%	30.8%	52.3%
TCPU	5.5%	5.5%	5.5%
Trade	6.4%	13.3%	9.1%
FIRE	5.5%	21.4%	11.6%
Services	12.2%	23.0%	16.4%
Government	0.1%	1.8%	0.7%
Other	0.7%	2.9%	1.6%
Total*	531.36	332.99	864.35

Total percentages may not sum to 100 due to rounding

*Millions of dollars

Figure 15 demonstrates the trade balance for all commodities as well as for only forestry-related products in Grant County. With 51 percent of all commodities being imported into Grant and 49 percent of the county's products being exported, this ratio is fairly good in terms of a balance of trade, especially for a county as rural as Grant. Counties of a similar size and rural nature often tend to import much more than they export – typically at a much higher level than is the case for Grant. However, much of this export activity is related to copper, and as previously suggested the future of this industry in Grant is seriously threatened. Considering forestry and wood-related products, including manufacturing industries that utilize such products and consumer purchases of such products, it is clear that Grant is importing far more than it is exporting, and despite the large portion of forest in the county, the export of forestry-related products is far less than the import of such products.

Figure 15. Trade Balance; Percent of Total Imports & Exports; Grant, NM; 1998



Economic Contributions

A relative measure of the economic contributions of industries to a 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). Table 15 provides this information for the aggregated industry sectors, while Table 16 includes the same information for the top ten industries in terms of employment in Grant County.

Table 15. Output, Employment & Value Added; Percent of Total; Grant, NM; 1998

Industry	Industry Output	Employment	Employee		Other Property Income	Indirect Business Tax	Total Value Added
			Compensation	Proprietor Income			
Agriculture	1.0%	3.3%	1.0%	18.4%	1.1%	1.4%	1.9%
Mining	19.9%	12.8%	26.4%	1.6%	47.2%	32.4%	33.2%
Construction	8.8%	9.3%	9.6%	17.1%	1.5%	1.9%	6.4%
Manufacturing	37.9%	3.5%	6.2%	5.4%	11.0%	10.6%	8.2%
TCPU	4.3%	2.7%	3.7%	4.9%	8.3%	9.2%	5.9%
Trade	7.3%	21.7%	11.9%	14.3%	5.8%	26.5%	10.9%
FIRE	5.0%	4.3%	1.9%	10.4%	14.3%	14.2%	7.7%
Services	7.4%	18.8%	11.3%	28.0%	3.0%	3.8%	8.5%
Government	8.0%	22.5%	27.6%	0.0%	5.7%	0.0%	16.3%
Other	0.4%	1.2%	0.3%	0.0%	2.2%	0.0%	1.0%
Total*	1497.81	15150.00	359.44	32.91	254.92	52.31	699.58

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

Table 16. Output, Employment, & Value Added; Largest Employers; Grant, NM; 1998

Industry	Industry Output*	Employment	Employee	Proprietor Income*	Other Property Income*	Indirect Business Tax*	Total Value Added*
			Compensation*				
Copper Ores	297.6	1,938	94.7	0.5	120.1	16.9	232.1
State & Local Government - Education	44.7	1,730	44.7	0.0	0.0	0.0	44.7
Eating & Drinking	34.1	1,249	9.7	1.7	2.9	2.1	16.3
State & Local Government - Non-Education	46.7	1,179	36.6	0.0	10.1	0.0	46.7
Primary Copper	554.7	444	20.8	1.4	27.4	5.5	55.1
Doctors and Dentists	28.9	416	13.5	2.6	1.4	0.3	17.8
Miscellaneous Retail	8.6	387	3.5	0.9	1.4	1.4	7.3
Maintenance and Repair Other Facilities	19.7	379	9.4	1.6	0.6	0.1	11.7
General Merchandise Stores	10.8	372	5.0	0.2	1.7	1.8	8.7
Food Stores	12.0	370	7.0	0.4	2.0	2.0	11.3
Total for All Industries	1497.8	15,150	359.4	32.9	254.9	52.3	699.6

*Millions of dollars

In 1998 industries in Grant County produced a total of \$1,497 million worth of output, with a higher percentage of output from the mining sector as well as the manufacturing sector. Again, these figures demonstrate the importance of the copper mining and smelting industries to Grant County's economy. Furthermore, these figures further underscore the fact that the agricultural sector is not particularly strong in this region, as in many rural areas the agricultural sector accounts for a much higher percent of output. As is demonstrated in the percent employment column in Table 15, government, services, trade, and mining are all exceptionally high employers in the county.

In the IMPLAN model there are four sub-components of value-added, all of which are included in Tables 15 and 16. These subcomponents include employee compensation, proprietary income, other property type income, and indirect business tax. To provide further detail, each of these subcomponents are analyzed in turn. Employee compensation refers to wage and salary payments, as well as benefits which include the following: health and life insurance, retirement payments, and any other non-cash compensation. Basically, employee compensation includes all income paid to workers by employers, and it is typically the largest component of value-added. In 1998, government, which includes schools, state and local government, and federal government and military, generated the largest percentage of employee compensation in the county (27.6 percent), followed by mining (26.4 percent). These two sectors account for an extraordinarily high percentage of total employee compensation in the county.

Proprietary income consists of payments received by self-employed individuals as income. This includes any income received for self-employed work as reported on federal tax forms, and it typically includes income received by private business owners, doctors, lawyers, and so on. Proprietary income, along with indirect business taxes, is typically a much smaller component of value added, especially when compared to employee compensation. Figures in Grant are quite typical of what would be found elsewhere, especially with the service sector being the largest contributor to proprietary income. Other property type income includes payments for rents, royalties, and dividends. More specifically, this includes payments to individuals in the form of rents received on property, royalties from contracts, dividends paid by corporations, and corporate profits. In Grant, manufacturing property income stands out as being relatively low, while property income from the mining sector is remarkably high. Indirect business taxes include excise taxes, property taxes, fees, licenses, and sales taxes paid by businesses. These taxes occur during the normal operation of businesses but do not include taxes on profit or income. Indirect business taxes are typically the smallest components of value added. In Grant, the mining sector followed by the trade sector contributed the most to this component of value added.

Table 16 includes the same information found in Table 15, except the information is in dollar figures and refers to the top 10 industries in the county in terms of employment. The information in this table clearly highlights the importance of the copper mining industry as well as the government sector in terms of value added in Grant County. What is particularly notable here is the total output as well as the value added from the copper ores and the primary copper industries in the county. It is clear from these figures that copper mining and smelting adds a tremendous amount of value added to Grant's local economy, accounting for close to 40 percent of the total value added in the county. Considering the extent of this value added, it is easy to see how the loss of copper-related jobs could have a dramatic effect upon Grant's economy.

The industry to industry impact of economic activity can be determined by examining production relationships in the region. The benefit of examining such relationships 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.²¹ This information is commonly presented in what is known as direct requirements tables (Table 17 and 18).²²

The direct requirements tables in this analysis should only be read down. Each column essentially represents a “production recipe” for one dollar of output for the purchasing sector at the column head.²³ 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, as is indicated in Table 17, every dollar of output from the agricultural sector in Grant requires an additional 3 cents worth of output from the agricultural sector, 3 cents from the manufacturing sector, and so on. Given this example, an additional dollar of output by the agricultural sector leads to the purchase of a total of 10 cents from other firms located in the region.²⁴ The remaining requirements for a dollar of output are either obtained from institutions (i.e. households) within the region or are imported. The purchase of only 10 cents from other firms located in the region is exceptionally low, indicating limited linkages between firms in the agricultural sector in the county. On the other hand, these values are somewhat high for the manufacturing sector, indicating the relationship between copper mining and processing in the county. In sum, assessing direct requirements as they relate to how they are met from within and outside the region gives a sense for the level of industry and inter-industry self-sufficiency of a region. The greater the need for external intermediate inputs and supplies means that a local economy has a greater dependency on the outside world and that there is a large degree of leakages from the economy. Moreover, as dependency increases, a local economy becomes in many ways more susceptible to exogenous factors of change.

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 Table 18, a one dollar unit change in demand for primary copper manufacturing output results in an additional 33 cents worth of demand from the copper ores sector, 35 cents from the primary copper sector, and an additional \$1.12 from other

²¹ This is done by dividing the dollar value of inputs purchases from each sector by total expenditures.

²² 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.

²³ 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).

²⁴ Sums may not be exact due to rounding.

sectors. Therefore, the direct effect of a one dollar change in demand for primary copper manufacturing would be 280 cents (the initial change plus the direct effect).

Table 17. Direct Requirements Table; All Sectors; Grant, NM; 1998

Purchasing / Processing Sectors	Agri-culture	Mining	Const-ruktion	Manu-facturing	TCPU	Trade	FIRE	Service	Government
Agriculture	0.03	0.00	0.01	0.05	0.00	0.00	0.01	0.00	0.00
Mining	0.00	0.07	0.01	0.04	0.04	0.00	0.00	0.00	0.00
Construction	0.00	0.06	0.00	0.01	0.02	0.00	0.03	0.01	0.02
Manufacturing	0.03	0.03	0.35	0.49	0.04	0.06	0.01	0.08	0.01
TCPU	0.01	0.02	0.04	0.07	0.13	0.03	0.02	0.04	0.01
Trade	0.01	0.01	0.10	0.10	0.02	0.03	0.00	0.02	0.00
FIRE	0.01	0.02	0.02	0.03	0.02	0.04	0.14	0.07	0.00
Services	0.01	0.01	0.13	0.10	0.09	0.12	0.06	0.22	0.01
Government	0.00	0.00	0.00	0.00	0.00	0.01	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
TOTAL	0.10	0.22	0.66	0.90	0.36	0.30	0.27	0.46	0.06

Table 18. Direct Requirements Table; Selected Sectors; Grant, NM; 1998

Purchasing / Processing Sectors	Copper Ores	Prim NF Metals	Iron Ores	Copper Roll/Draw	Prim Copper
Copper Ores	0.01	0.00	0.00	0.00	0.33
Primary Nonferous Metals	0.00	0.00	0.00	0.02	0.02
Iron Ores	0.00	0.00	0.00	0.00	0.00
Copper Rolling/Drawing	0.00	0.00	0.00	0.08	0.00
Primary Copper	0.00	0.00	0.00	0.30	0.35
Total*	0.44	0.00	0.00	1.68	1.80

*Total is total direct requirements from all sectors

However, as previously mentioned in relation to multiplier effects, the indirect effects must then be estimated by carrying those changes through the impacted sectors. In other words, the 180 cents worth of new demand on all other sectors 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 region-wide economic impact. Moreover, the cycle of effects does not stop after just two rounds. The process continues until the level of indirect effects becomes insignificant – until the multiplier process has completely run its course.

IMPLAN calculates the sum of these effects, which are referred to as total requirements and are presented in Table 19 for the aggregated sectors in Grant County.²⁵ 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.²⁶ For example, the first element in the manufacturing column (.02) indicates the total dollar increase in agricultural sector production that results from a one dollar increase in final demand for manufacturing products. The second element indicates the total increase in mining output (.04) due to that same one-dollar increase in final demand for manufacturing products. The one-dollar effect across industries continues to be captured down the row, totaling an industry-wide effect of 1.26 times the original change to the manufacturing industry.

Table 19. Total Requirements Table; All Sectors; Grant, NM; 1998

Purchasing / Processing Sectors	Ag, Fishing, Forestry	Mining	Const- ruction	Manu- facturing	TCPU	Trade	FIRE	Services	Govern- ment	Other
Agriculture	1.01	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00
Mining	0.00	1.06	0.01	0.04	0.04	0.00	0.00	0.00	0.00	0.00
Construction	0.00	0.07	1.00	0.01	0.02	0.01	0.04	0.01	0.02	0.00
Manufacturing	0.00	0.00	0.01	1.01	0.01	0.01	0.00	0.01	0.00	0.00
TCPU	0.00	0.01	0.03	0.04	1.07	0.02	0.01	0.03	0.01	0.00
Trade	0.01	0.01	0.06	0.06	0.01	1.02	0.00	0.02	0.00	0.00
FIRE	0.01	0.01	0.01	0.02	0.01	0.02	1.06	0.04	0.00	0.00
Services	0.00	0.01	0.06	0.05	0.04	0.05	0.03	1.10	0.00	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
Total	1.04	1.18	1.19	1.26	1.22	1.13	1.16	1.21	1.04	1.00

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 that must rely on imports and therefore have leakages. The degree of linkage or openness of the Grant economy can be obtained by reviewing the off-diagonal values

²⁵ The total requirements table is also referred to as the Leontief inverse table.

²⁶ Total requirements are representative of inter-industry effects only (i.e. direct plus indirect), therefore induced effects are not included in the measure.

in the total requirements table.²⁷ 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 16 and 17).

Figures 16 and 17 show the multiplier or ripple effect of a one hundred dollar unit change in final demand for mining and government output, respectively. The smaller graph on the left begins with round 0, the initial change; therefore, the small graphs in both figures 16 and 17 are similar scales and can be directly compared. Round 0 is dropped in each of the larger graphs so that the changes are visually more apparent. Clearly, the industry-wide direct effect of the change to mining is somewhat greater than that for government, as the impact of the unit change is barely detectable in the smaller figure for government. In addition, the scale of effects in the larger graph is approximately four times greater for mining than it is for government. These graphs basically indicate that the economic impacts related to a change in mining activities in Grant are greater than they are for a change in government. Nonetheless, as the larger graphs reveal, the backward linkages of the both sectors are similar in terms of the sectors with which they are related. The initial 100 dollars circulates through approximately the same number of rounds of economic activity for both the government and mining sectors, although a greater percentage of the 100 dollars leaks out of the economy in the first round when applied to the government sector.

From a policy perspective, the preferred sectoral change would depend on the desired outcome. Nonetheless, these results indicate that a one hundred unit change in the mining sector would result in a fairly diversified outcome throughout the economy, impacting a variety of sectors, including the manufacturing, services, construction, and trade sectors. There would also be greater dollar returns from a one hundred unit change in the mining sector. However, it is also important to note that the scales of the large graphs are quite small, and compared to other counties of a similar nature, it appears as though there are less local linkages in Grant than one might expect to find elsewhere, indicating a lack of self-sufficiency in the local economy.

²⁷ Off-diagonal values are those that are less than one.

Figure 16. Ripple Effect; One Hundred Mining Units; Grant, NM; 1998

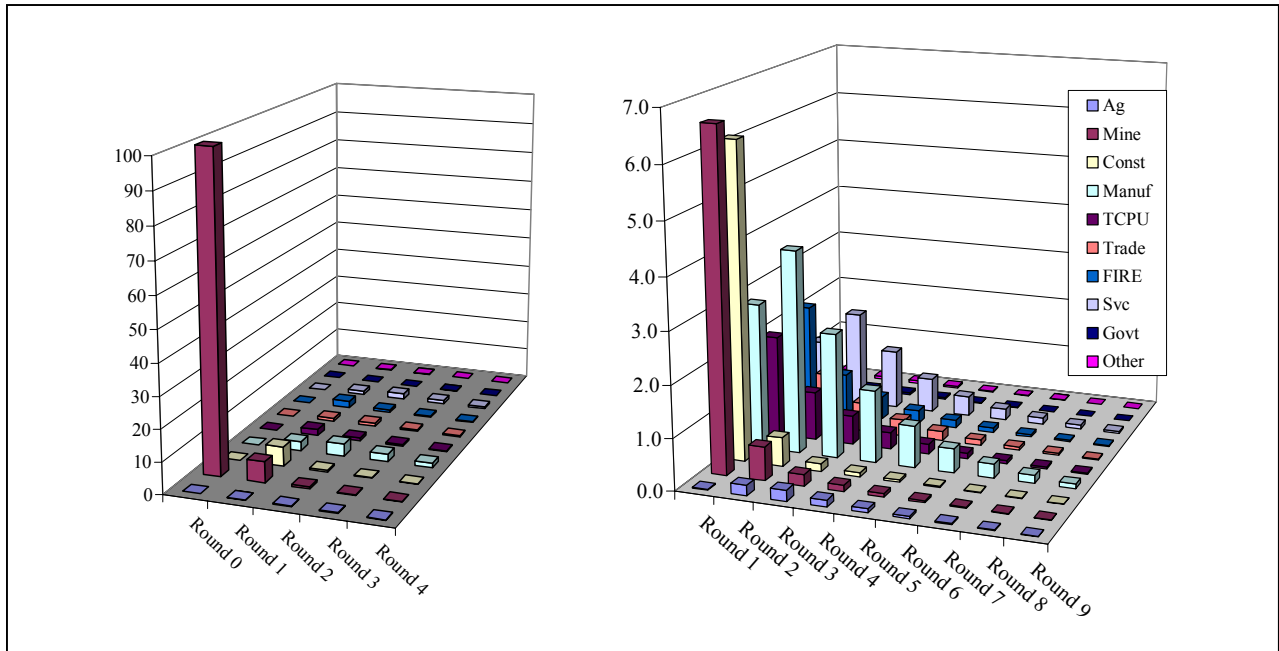
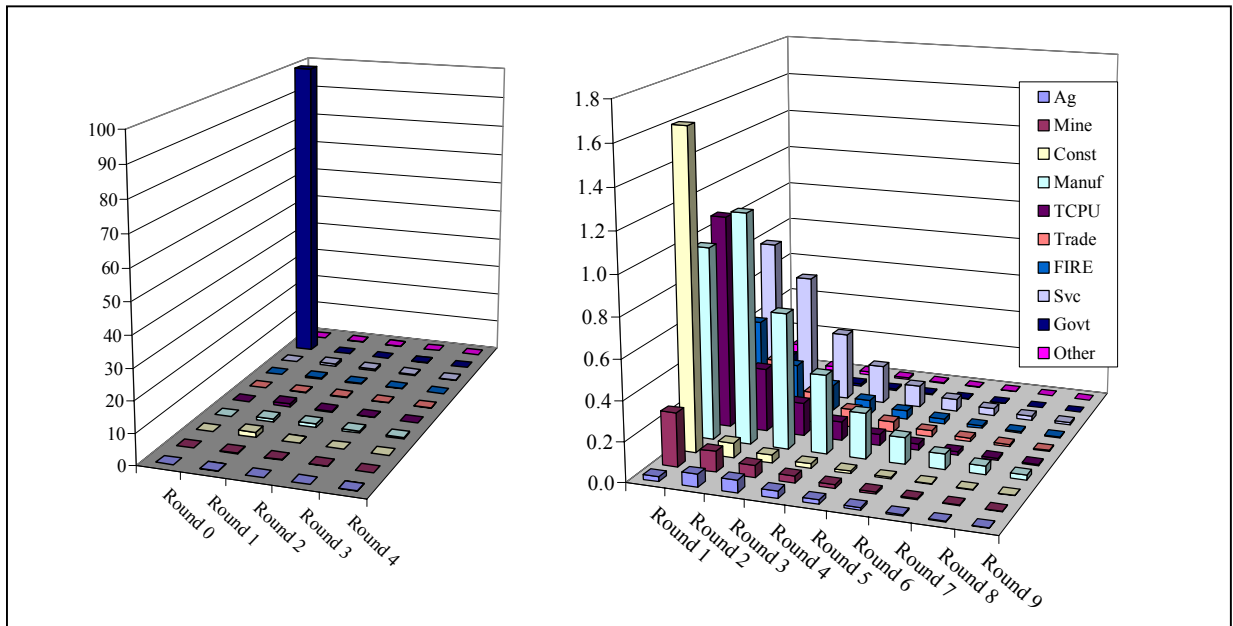


Figure 17. Ripple Effect; 100 Government Units; Grant, NM; 1998



Conclusion

The input-output analysis of Grant County has revealed the county's continued dependence on natural resources, particularly copper. Copper mining and copper-related manufacturing activity, primarily smelting, are clearly Grant's economic base, as a large percentage of the commodities produced by the copper industry are exported from the county. In short, copper mining is a major contributor to Grant's economy through the export of raw materials as well as through the provision of such materials to local smelters which then export from the region. A problem for counties that are highly dependent upon natural resources, especially the mining of raw materials, is that there are few opportunities for backward and forward linkages to develop with other industries in the region. Raw materials such as copper are often mined and processed, or simply just mined, and then shipped out of rural regions; as a primary industry, there are few inputs necessary for the extraction of such resources.

The recent trend within Grant County has been one of decline in copper and copper-related industries. This trend does not bode well for the future of the local economy. While there has been a growth of service sector activity in the county, many of the service jobs are low-paying, as is reflected in the recent precipitous decline in the county's per capita income relative to the national average. In short, high-paying mining jobs are being replaced by low-paying service sector jobs in Grant. For the economy of the county to strengthen and remain strong in the future, Grant will likely have to develop and seize a new comparative advantage: the days of copper supporting the local economy, if not over already, seemingly soon will be.

To suggest that the county should set goals towards attracting timber harvesting or forestry-related manufacturing industries to the region, especially in light of recent environmental concerns in the Gila National Forest, could be unreasonable. At one time, the U.S. government, and particularly the Forest Service, was primarily interested in receiving sustained timber yields from federal forestlands. This has somewhat changed recently, as the need to protect endangered species, promote biodiversity, and support recreational activities has constrained timber harvests. Federal policy regarding forests is indeed representative of conflicting interests related to forest use, and such policies have already had at least a limited impact upon the Grant economy and will likely continue to do so in the future.

On the other hand, considering the natural scenery and opportunities for recreational activities in the area, there seems to be prospects for the region to capitalize on its natural amenities to draw residents and tourists to the region. In this respect, tourism-related services is seemingly an area where the local economy could grow and diversify. This suggestion is supported by trends indicating that Grant County is at least partially a tourist destination and is increasingly becoming a destination for retirees. Much of the interest for tourists as well as retirees is undoubtedly related to the natural scenery, and hence, at least in part, the forests of the region. Thus, the sustainability of the forests seems critical to the county's future economic vitality. Many of the forests in the county are currently considered unhealthy. There are also extended periods of low precipitation, and timber management techniques, including a history of fire exclusion, have left many of the forests vulnerable to extreme fires. Sustaining and regenerating the forests in Grant County should be an important concern for the community.

In sum, areas of growth as indicated in the analysis are in the FIRE, services, trade, and manufacturing sectors. All of these sectors have excess demand in comparison to both local and domestic supply and each sector is currently a source of leakage from the local economy. This is particularly the case for the service and manufacturing sectors. Thus, there appears to be a number of viable alternatives by which the Grant economy could diversify. Though tourism and the immigration of retirees has seemingly somewhat helped the economy over the past few years, there is little indication that these activities, at least at this time, are occurring to the degree necessary so that they can be understood as the future of Grant County's economic base. However, this could change.

In conclusion, this analysis suggests that Grant County faces future economic challenges. However, issues such as the quality of life in the county, the relatively high rates of educational attainment amongst the citizens of Grant, and even the rich ethnic diversity of the county could seemingly be the basis through which Grant could, and perhaps should, attempt to reinvent itself. If the county can not retain and expand the current export base – and indeed it looks likely that it will not be able to – it should attempt to diversify its economy. Diversification is a key to promoting the health of almost any rural economy. Most importantly, however, it seems as though Grant should seize what is seemingly becoming the region's comparative advantage: a natural resource base and quality of life that can attract residents, visitors, and perhaps even industries from outside the region.

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