NORTHERN ARIZONA UNIVERSITY
The W. A. Franke College of Business

The Arizona Cardinals NFL Training Camp, 2010: Economic Impact on Coconino County

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Executive Summary

- This study estimates the economic impact of the Cardinals' Training Camp on the economy of Coconino County in 2010. This impact resulted from spending by the Cardinals team on the campus of Northern Arizona University and from the spending by their out-of-town fans.

- The input/output model IMPLAN was used to calculate the economic impact. This widely-used model calculated how spending related to the training camp increased the level of economic activity in the county economy. These injected dollars are the direct impact. In 2010, this direct impact totaled $6,711,600.

- Local businesses then spent a portion of this additional revenue in the form of local taxes and wages; they also purchased supplies from other local businesses, which in turn spent a portion of their revenue locally – a process which continues in a series of rounds each of which is smaller and some of which flows out of the local economy. This series results in a number that represents the total additional sales in the county, known as the output impact or economic multiplier.

- Total sales in the county economy increased by $9,706,800. The ratio of total economic impact to direct impact is known as the output multiplier. For the 2010 camp, this multiplier equaled 1.45; that is, each dollar injected by a party from outside the community ultimately generated an additional 45 cents in local sales. Subtracting the direct impact from the total output impact isolates the effect of the output multiplier: it added $2,995,200 to total output.

- The model also identified other important economic variables affected by this increased local spending. These variables include Employment (jobs), Value Added, and its components, which include Personal Income and Indirect Business Taxes (e.g., sales taxes).

- Total Value Added in Coconino County increased $2,116,800. Personal Income received by households and business proprietors in the county increased $1,984,200 due to the Cardinals' Training Camp. Indirect Business Taxes increased $132,600.

- This additional income was responsible for the creation of 122 direct jobs (annual, full-time). Spending by the Cardinals in the county accounted for 12 of these jobs. Spending by visitors accounted for another 110 jobs.

- Overall government revenues increased $1,482,300, including $769,900 federal and $712,400 state or local revenue.

- A total of 38,200 persons watched the training camp practices or attended the Red and White scrimmage. Of these, 81% (30,800) were out-of-town visitors to Flagstaff. Just over 58% of these (18,000) stayed overnight, spending an average $254 per-person per-day during an average stay of three days. Day visitors spent an average of $67 per-person per-day.

- The average number of visitors per party was three (3.0) persons. Overnight parties stayed an average of three (3.0) nights. These fans used a variety of accommodations: 67% stayed in hotels; 14% stayed with friends or relatives; 7% stayed in a vacation or second home; 6% stayed in a campground or RV park; and 5% stayed in a condo or timeshare.

- Visitors were asked to state the main purpose of their visit to Flagstaff: 93% came to see the Cardinals; 12% to get out of the heat; 9% to visit friends & relatives; 7% for outdoor recreation; 3% each for business or shopping; and 6% for some other reason.

- Personal Income includes Labor Income and Other Property Income. Labor Income increased $3,710,800; this includes Employee Compensation and Proprietors' Income. The training camp increased these totals by $3,353,600 and $357,200 respectively. Other Property Income increased $1,493,200.

The Impact of the Arizona Cardinals' Training Camp on the Coconino County in the Year 2010

Impact Type	Direct Effect	Indirect Effect	Induced Effect	Total Effect
Output	$6,711,600	$626,500	$2,368,700	$9,706,800
Employment	90	5	27	122
Labor Income	$2,291,000	$211,000	$1,208,800	$3,710,800
Indirect Business Taxes	$513,800	$28,000	$104,600	$646,400

The Arizona Cardinals NFL Training Camp, 2010: Economic Impact on Coconino County

Introduction

This study was designed to measure the economic contribution of the Arizona Cardinals' Training Camp on the economy of Coconino County in 2010. The economic impact in 2010 is the result of spending by the Cardinals team and by their out-of-town fans. This study quantified the overall impacts of expenditures related to the training camp and found that they greatly exceed the initial impact of the direct visitor spending. Due to circulation of funds within the community, dollars are spent and re-spent many times, creating a multiplier effect which generates additional dollars in the regional economy. Thus, two sets of impacts are provided – initial or direct impacts and total or overall impacts.

Another economic contribution of the training camp is difficult to quantify, and consists of the dollar value of the publicity that Flagstaff receives as a result of hosting this highly-rated training camp. *Sports Illustrated* ranked Cardinals' Training Camp the third best NFL camp in the nation, for its picturesque setting in the cool pines of northern Arizona and the up-close fan access to players and coaches.[1] The camp also received considerable coverage from a wide variety of media outlets, including Phoenix stations that provided daily TV coverage of the camp and national coverage when the ESPN bus visited campus on its tour of NFL training camps. The strategic importance of the camp to the Flagstaff community resulted in a new three-year contract to keep it in Flagstaff through the 2012 season.

The Arizona Cardinals professional football team has held its annual training camp on the campus of Northern Arizona University for 22 years, since 1988 when the team moved to Arizona. (The only exception was 2005 when an outbreak of the Norwalk Virus on the NAU campus caused the Cardinals to move the camp to Prescott for a single summer.) Thus, Cardinals' Training Camp is a summer tourist attraction for Flagstaff that has drawn larger crowds as the Cardinals have experienced greater success in the league. In 2010, the Arizona Cardinals trained in Flagstaff for a three-week period from July 31 to August 21. Most practices were open to the public and were held on campus athletic fields or in the NAU Skydome. The out-of-town fans, largely from Greater Phoenix, who attended the 2010 training camp are the focus of this study. A similar economic impact study of visitors was conducted in 2003 by the Bank One Center for Business Outreach in the NAU College of Business; it found that training camp visitors contributed $55 dollars per-party per-day to the local economy, for a combined total economic impact of $2.0 million.

Locally, little disagreement exists that the Cardinals' Training Camp brings many visitors to Flagstaff every August; questions have been raised in recent years, however, about the boost they provide the local economy.[2] In 2009, the Cardinals appeared in Superbowl XLIII vs. the Pittsburgh Steelers, and the camp appeared to break all attendance records. Yet, despite expectations, City of Flagstaff BBB (bed, board, beverage) tax collections for August 2009 declined 4.0% from August 2008, prompting questions about the camp's economic effects. Overall, city tax collections across *all* taxable sales categories declined 6.0% in August 2009 over the same month the previous year, doubtless due largely to the economy sinking into the deepest recession since the Great Depression of the 1930s, reflecting a general lack of consumer confidence and decline in spending.

In 2010, to encourage Cardinal fans to stay longer and spend more in the community, the City of Flagstaff teamed up with local restaurateurs and outside promoters to host a Craft Beer and Music Festival – the Big Red Pour. Did this and other local efforts have the desired effect?

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[1] See (http://sportsillustrated.cnn.com/2005/writers/peter_king/07/06/training.camps/1.html.
[2] Joe Ferguson, Flag sales not in Cards, *Arizona Daily Sun*, October 29, 2010, p. 1.

It turns out that overall taxable sales in the City of Flagstaff declined 6.0% in August 2010 over August 2009, a figure identical to the monthly August 2009 decline. In 2010, however, BBB taxable sales in August were flat (vs. the 2009 -4% decline). Furthermore, within the hospitality tax group, hotel sales increased +7.0%, occupancy rates increased +9.0%, and REVPar (revenue per available room) rose +6.3% over the same month in 2009.[3] While August is high season for tourist activity in Flagstaff, Cardinals training camp can be credited, at least in part, with helping to produce this positive boost in hotel sales and occupancy.

Another hospitality tax category – Restaurant sales – deserves mention as well. While restaurant sales had a -2.0% decline in August 2010 compared to August 2009, it must be recognized that several factors were at work, the most significant of which is that restaurant sales are made largely to local residents – not visitors. The National Restaurant Association attributes 25% of restaurant sales nationally to tourists and 75% to locals; in Flagstaff, given its location at the nexus of two interstate freeways, its proximity to the Grand Canyon, and its role as the hub for tourist activity throughout northern Arizona – the percentage of restaurant sales to visitors is higher than the national average, especially in a high season tourism month such as August. If we assume that 50% of August restaurant sales were to visitors and 50% to locals, a spending decline by recession-strapped residents is still sufficient to explain the -2.0% decline in total sales.

Given the depth and seriousness of the 2009-10 recession, a -2.0% August decline in restaurant sales is not so surprising – it is certainly better than it would have been without the impact of spending by Cardinals fans. After all, Cardinals fans constitute a relatively small percentage of overall August tourist activity – probably somewhere in the neighborhood of ten percent. Thus, while visitors to the Cardinals' Training Camp are not able to "lift all boats," or in this case all taxable sales, their spending undoubtedly contributed to improved BBB sales in August 2010, sales that would otherwise have been lower.

Another way of viewing the economic impact of the training camp is to ask how many jobs and how many dollars would be lost to the community if the camp were discontinued. In other words, for every job attributable to the camp the same number would be lost in its absence; likewise, every dollar attributable to the camp would be lost if it were discontinued. The remainder of this report details the economic contributions of fans who visited the Cardinals' Training Camp.

Methods

The Arizona Hospitality Research & Resource Center and the Arizona Rural Policy Institute – units of the Center for Business Outreach in The W. A Franke College of Business – surveyed fans at the 2010 practice venues. A total of 636 surveys were obtained during the three-week period of the training camp. Student survey workers contacted fans during all open practices, at both morning and afternoon practices at the athletic fields, and in the Skydome. About one-fifth of fans surveyed (19%) self-identified as locals, residing within 50 miles of Flagstaff, including Williams, Parks, and Winslow. The remainder – 81% of fans surveyed – were from outside the Flagstaff area. It is these fans who provided the bulk of the information for this report.

Visitors to the Cardinals practices were asked whether they were local or from out-of-town, their ZIPCode, the size of their travel party, the purpose of their visit to Flagstaff, whether they planned to stay overnight in Flagstaff, and if so, where and how long they stayed. Finally, respondents were asked about their expenditures during the visit. These expenditures included lodging, restaurant and bar purchases, grocery and convenience store goods, entertainment, gasoline and other shopping purchases. This expenditure data was used to model the economic impact of visitors to the training camp. Only the non-local spending of those

[3] Smith Travel Research, Inc., *Trend Flagstaff*, August 2010

residing outside the Flagstaff area was used to calculate the economic impact. The only information collected from locals was party size, as local expenditures could not be directly tied to a visit to see the Cardinals practice. (Complete survey results and a copy of the survey form are presented in Appendix A.)

An estimate of the total fan population at the Cardinals' Training Camp games is required to determine economic impact. Determining the number of fans attending the practices was difficult since there was no gate and all practices were free and on unfenced fields. When practices took place in the Skydome the situation was no easier, since no tickets were required and the turnstiles were not used. Three methods, therefore, were used to estimate total attendance. A census of all parking spaces around the Skydome and practice fields was made, and the average number of vacant spaces was subtracted; the resulting occupied spaces were multiplied by the average party size to yield one estimate of visitors. A second observation-based method actually counted individuals as they arrived at the fields. This method required that an observer be in place at least one hour before practices to ensure that early bird fans were counted. The third method employed at the Skydome was to count seats in the numbered seating blocks and estimate the percentage of that specific block that contained fans. This method was used for the occasions when practices were held indoors because of the rain and at the Red and White scrimmage, a traditionally busy autographing session. These three methods were used to triangulate the visitor population estimate. The method yields a reasonable but conservative estimate of visitors who attended the Cardinals' Training Camp. Employing these three methods, it is estimated that 38,200 fans attended the 2010 Arizona Cardinals' Training Camp. The portion of this number that represented out-of-town visitors (80.7% or 30,800) was used to develop the economic impact of the Arizona Cardinals' Training Camp on the Coconino County economy.

Economic Impact of the Arizona Cardinals' Training Camp on the Economy of Coconino County

This portion of the study was designed to measure the economic contribution of the Arizona Cardinals' Training Camp on the county economy in the year 2010. Only the impact of spending by the Cardinals' out-of-town fans is analyzed. In this study, the quantifiable impacts of fan expenditures related to the training camp are isolated. The overall impact of the training camp on the economy greatly exceeds the initial impact of fans' expenditures. Due to circulation of funds within the community, dollars are spent and re-spent many times, creating a multiplier effect which generates additional dollars to the local economy. Therefore, two sets of impacts are provided – the direct or initial visitor spending impacts, and the total or overall impacts. Impacts are also calculated to estimate the number of jobs created in the economy as well as the amount of wages, salaries and personal income generated as a result of these activities in 2010.

Thus, this study is confined to examining the monetary effects of dollars spent by out-of-town Cardinals' fans who visited the Flagstaff training camp. This study does not include:

1) Spending by local residents. Flagstaff residents also attended the practices and scrimmages at the camp, however this spending is typically not included as economic impact because these are not "new dollars" to the economy; locals would have spent their money on some other entertainment or activity.
2) Intangible benefits. The intangible impact of the training camp is probably larger than the tangible impacts. The study does not attempt to estimate the ad dollar value of the publicity that NAU receives as a result of its association with the Arizona Cardinals.
3) Costs of hosting the training camp. The Cardinals' Training Camp produces not only benefits for Flagstaff and NAU, but costs as well. Costs to the University and the local community – related to traffic congestion, extra policing, and other costs – are not addressed in this analysis.

The Arizona Cardinals' Training Camp Operations Impact

This analysis of the impact of the training camp focuses on the spending of out-of-town fans visiting Flagstaff for the training camp. This includes expenditures for lodging, dining, shopping and other activities. The impact of visitor activities are discussed and presented in the following sections of this report. The following measures are used to gauge the impact of the training camp on the county economy. Information is presented and analyzed for each of the following variables:

- Employment
- Personal Income
- Total Value Added
- Output

The operation of the training camp generated an increase in demand for workers and materials in Coconino County. The figures are shown in Table 1. Direct employment, not including employees of the Cardinals organization, was 9.6 full-time workers. This, in turn, stimulated additional employment within the region that added an additional 0.6 jobs. The increase in household incomes that resulted from more persons being employed in both the direct and indirect sectors created an additional 1.6 jobs in the induced sector.

Similar reasoning was used to measure the personal income generated in the county. Local business owners and their employees earned an additional $208,000 in 2010 due to the operations of the camp. This resulted in an increase in personal income of $306,600 in the county. Similarly, the total value directly added by the training camp was $222,500. After all subsequent rounds of re-spending, value added increased $383,000. Total output, or sales increased $809,100. The figures in the table have been rounded to the nearest hundred dollars. For this reason, the separate impact may not sum to the total shown.

Table 1. The Countywide Impact of Training Camp Operations for the year 2010

Impact	Direct	Indirect	Induced	Total
Employees	9.6	0.6	1.6	11.9
Personal Income	$208,000	$27,000	$71,700	$306,600
Total Value Added*	$222,500	$48,200	$112,300	$383,000
Output (Sales)	$558,700	$92,200	$158,200	$809,100

**Value added is the income (profits and wages) generated by a firm's operations. Value added is computed as the value of a firm's output minus the value of that firm's inputs (e.g., raw materials, but not labor). The tables show the increase in value added (employee compensation, property income and indirect business taxes) as a result of the spending by NAU and associated parties.

The largest portion of the direct impact resulted from the Cardinals' direct payments to Northern Arizona University for the use of its facilities, and for housing the players and the team personnel. The university collected fees for the use of its practice fields, the use of its dormitories and for meals it served. The total of Cardinals' direct expenditures in Flagstaff was $558,705. Cardinals' players and staff also frequented Flagstaff businesses; their spending, however, was not estimated for this study.

Visitor Impact of the Cardinals' Training Camp

Before outlining the economic impacts of Cardinals' fans, the calculations used in the model need to be addressed. As pointed out earlier, only non-local or out-of-town visitor expenditures are used to calculate the economic impact. It was estimated that 38,200 visitors attended the scrimmage and practices during the 2010 training camp. Four-fifth of all visitors (80.7%) were classified as out-of-town visitors, reducing the 38,200

visitors to an estimated total population of 30,800 out-of-town visitors. Overnight visitors (18,000) accounted for more than half (59%) of all non-local visitors, while day visitors accounted for 41 percent of non-local visitors (12,800). The total non-local visitor count for the economic impact is 30,800 visitor days, where one visitor in one day equals a visitor day. This base number is then applied to the proportion of visitors with expenditures for the various spending categories for both day and overnight visitors. See Table 2.

Based upon these calculations, overnight visitors had average expenditures of $133 per-person per-day, while day visitors had average expenditures of $40 per-person per-day. The total spending by category is then entered into the I-O model. Overnight visitors, who comprised the majority of visitors in the sample, had the largest spending levels and were responsible for $6.3 million in direct spending. The largest spending category for overnight visitors was restaurant and bar ($2.6 million), followed by lodging/camping ($2.1 million) and gasoline sales ($727,000). Day visitors, on the other hand, had lower rates of direct spending, totaling $416,000 – no surprise since overnight visitors stayed longer in the community and had lodging expenditures, not captured for day visitors. The largest areas of spending for day visitors were in the categories of restaurant/bar ($250,000) and gasoline sales ($110,000).

When spending for both overnight and day visitors is summed, total direct spending is $6.3 million. The total spending outputs are inserted into the IMPLAN model by sector and yield the total economic impact outlined on the following pages.

Table 2. Per-Person Per-day Expenditures by Overnight and Day Visitors to yield Total Spending

	Overnight Visitors				Day Visitors				
Per- Person Expenditures	Per-Person per-day	% pop with spending	Population with expenditures	Direct Spending	Per-Person per- day	% pop with spending	Population with expenditures	Direct Spending	Total Spending
Lodging/Camping	$48	81%	14,545	$2,076,008	$0				$2,076,008
Restaurant/Bar	$50	94%	17,048	$2,544,584	$22	88%	11,266	$250,255	$2,794,840
Grocery & Convenience Store	$7	56%	10,134	$208,355	$2	44%	5,603	$13,858	$222,213
Entertainment (movies, museum etc.)	$3	43%	7,749	$80,667	$1	37%	4,769	$3,694	$84,361
Gasoline	$14	97%	17,466	$727,459	$10	94%	11,982	$110,075	$847,279
Shopping or purchases	$11	43%	7,809	$264,335	$5	45%	5,782	$28,158	$292,493
Total per-person spending	**$133**			**$5,901,408**	**$40**			**$415,786**	**$6,317,194**

The direct increase in the demand for visitor services, and the resulting increases in indirect and induced impacts are shown in Table 3. Overall, the number of full time jobs supported by the demands of these visitors was 109.7. The additional income paid to these workers or received by their employees exceeded $4.8 million, value added was $5.4 million and output increased to $8.9 million.

Table 3. The Countywide Impact of Visitors in the Year 2010

Impact Type	Direct	Indirect	Induced	Total
Employment	80.1	4.7	24.8	109.7
Personal Income	$3,000,700	$272,200	$1,563,400	$4,836,300
Value Added	$3,511,000	$296,400	$1,659,900	$5,467,300
Output	$6,152,900	$534,300	$2,210,500	$8,897,700

Visitors constitute the significant portion of the overall impact of the training camp in the county. A majority of the visitors traveled from outside the county and the majority spent an average of three nights in the community. In addition to purchasing souvenirs directly from the Cardinals, these visitors also spent dollars for lodging, food, gasoline, entertainment and other items.

Overall Combined Impact of the Training Camp

The overall impact of the training camp on Coconino County can now be estimated by combining the impacts of visitor spending with the impact generated by the camp's operations. The combined impact is shown in Table 4. The figures in the table have been rounded to the nearest hundred dollars. For this reason, the separate impact may not sum to the total shown.

The table shows direct employment was 83.0 workers and that an additional 31.8 persons were employed in other sectors throughout the county as a result of the indirect and induced linkages. Therefore, 122 workers (full-time equivalent) in the county can trace their employment to the training camp. The employment multiplier is 1.35, or for every person employed in the sectors receiving the direct impact, 0.35 jobs were created elsewhere in the county in the indirect and induced sectors.

The direct impact increased Personal Income $3,219,800. This includes labor income (employee compensation and proprietors' income), and other property income (the incomes of proprietors is a mixture of wages and property income). Labor income includes all wages and salaries paid to student workers at the training camp as well as employees in the sectors that were initially impacted by visitors and the Cardinals. As these dollars were spent and re-spent in the region, they generated additional dollars in the area. The multiplier effect of this activity on personal income is 1.61. When the direct, indirect and induced activity is summed, the personal activity in the county increased to $5,204,000. As shown by the indented rows in Table 4, Personal Income includes Labor Income and Other Property Income. Labor Income increased $3,710,800; this includes Employee Compensation and Proprietors' Income. The training camp increased these totals by $3,353,600 and $357,200, respectively. Other property Income increased $1,493,200.

A similar analysis was completed to measure the change in value added. Value added includes Personal Income and Indirect Business Taxes. Personal Income is discussed above. Indirect Business Taxes increased $646,400. Value added in the directly affected sectors was $3,733,500 in 2010. The average value-added multiplier incorporated into the IMPLAN model was 1.56. The initial spending combined with the multiplier effect increased Value Added to $5,850,300.

Total output in the county was increased by $9,760,800. Direct spending for all parties accounted for $6,711,600. Multiplier effects added $2,995,200.

Table 4. The Combined Impact of the Training Camp Operations and Visitor Spending on Coconino County in the Year 2010

Impact Type	Direct	Indirect	Induced	Total
Employees	89.7	5.3	26.5	121.5
Total Value Added	$3,733,500	$344,600	$1,772,200	$5,850,300
• **Personal**	$3,219,800	$316,600	$1,667,600	$5,204,000
▪ **Labor income**	$2,291,000	$211,000	$1,208,800	$3,710,800
o **Employee Compensation**	$2,030,500	$172,600	$1,150,500	$3,353,600
o **Proprietors Income**	$260,500	$38,400	$58,300	$357,200
▪ **Other Property Income**	$928,700	$105,600	$458,800	$1,493,200
• **Indirect Business Tax**	$513,800	$28,000	$104,600	$646,400
Output (Sales)	$6,711,600	$626,500	$2,368,700	$9,706,800

Fiscal Impacts

The IMPLAN model also provides a means to calculate the impact that the training camp has on government revenues. The direct, Indirect and Induced Spending generated tax and other government revenues. Estimates are calculated separately for the federal government and for state and local governments.

- Corporate profits tax: Federal and state corporate income taxes.
- Dividends: Corporate dividends paid on stock held by government entities including employee retirement funds or trust accounts.
- Indirect Business Taxes: These taxes exist at all levels of government and include sales taxes, excise taxes (e.g., gasoline), estate and gift taxes. Non-taxes include fees, forfeitures and fines.
- Personal taxes: Personal taxes are primarily levied against income and property, motor vehicles, and customs duties.
- Personal non-taxes include user fees (e.g., hunting and fishing licenses), and other fees, forfeitures and fines.
- Payroll Tax: This is the Social Security program and includes employee and employer contributions as well as other social insurance taxes (Medicare, unemployment).

Combined fiscal impacts from all activities – Table 5 (following page) provided information on the fiscal impacts on all levels of government that result from the training camp operations as well as spending by visitors. The figures in the table have been rounded to the nearest hundred dollars. For this reason, the separate impact may not sum to the total shown. The revenues received by Arizona's governments were $712,400. Payments to the U.S. government were an additional $769,900. These amounts represent the gross benefit to these governments. The net benefits may be less due to the increased demand for services provided by government. Although some services are funded by user fees (municipal sewer and water) most services are funded from taxes.

Table 5: Fiscal Impacts of the Training Camp Operations and Visitor Spending on Coconino County in the Year 2010

Description	Employee Compensation	Proprietor Income	Indirect Business Tax	Households	Corporations	Total
Dividends					$27,000	$27,000
Social Ins Tax- Employee Contribution	$3,300					$3,300
Social Ins Tax- Employer Contribution	$14,400					$14,400
Indirect Bus Tax: Sales Tax			$315,600			$315,600
Indirect Bus Tax: Property Tax			$216,800			$216,800
Indirect Bus Tax: Motor Vehicle Lic			$2,700			$2,700
Indirect Bus Tax: Severance Tax			$2,600			$2,600
Indirect Bus Tax: Other Taxes			$19,700			$19,700
Indirect Bus Tax: S/L NonTaxes			$22,900			$22,900
Corporate Profits Tax					$16,800	$16,800
Personal Tax: Income Tax				$45,500		$45,500
Personal Tax: NonTaxes (Fines- Fees				$20,400		$20,400
Personal Tax: Motor Vehicle License				$1,900		$1,900
Personal Tax: Property Taxes				$1,700		$1,700
Personal Tax: Other Tax (Fish/Hunt)				$1,200		$1,200
Total State and Local Tax	**$17,700**		**$580,200**	**$70,700**	**$43,800**	**$712,400**
Description	**Employee Compensation**	**Proprietor Income**	**Indirect Business Tax**	**Households**	**Corporations**	**Total**
Social Ins Tax- Employee Contribution	$188,700	$27,100				$215,800
Social Ins Tax- Employer Contribution	$190,800					$190,800
Indirect Bus Tax: Excise Taxes			$29,600			$29,600
Indirect Bus Tax: Custom Duty			$13,800			$13,800
Indirect Bus Tax: Fed NonTaxes			$22,800			$22,800
Corporate Profits Tax					$72,000	$72,000
Personal Tax: Income Tax				$225,200		$225,200
Total Federal Tax	$379,400	$27,100	$66,100	$225,200	$72,000	$769,900
Total	**$397,100**	**$27,100**	**$646,400**	**$295,900**	**$115,800**	**$1,482,300**

Discussion

In August of 2010, the Arizona Cardinals organization and visitors to the Cardinals' Training Camp injected significant output to businesses in the Coconino County economy. Approximately $6.7 million of direct regional purchases were made by out-of-town visitors, contributing to a total economic output of $9.7 million for Flagstaff and Coconino County. This economic activity supported some 122 full-time equivalent (FTE) jobs. The total economic impact of Arizona Cardinals' Training Camp on Flagstaff and NAU is therefore considerable, and makes a significant contribution to the regional economy.

APPENDIX

A. Survey Results: The Arizona Cardinals' Training Camp, 2010

    1. Survey Form

B. Aggregated Impact Results

C. An Introduction to Input/Output Modeling

APPENDIX A
Survey Results: The Arizona Cardinals NFL Training Camp, 2010

Geographic Origin of Visitors to the Arizona Cardinals' Training Camp

The overwhelming majority (81%) of all respondents reported that they were from out-of-town. The remaining visitors (19%) indicated they were from the Flagstaff area, defined as within 50 miles of the City of Flagstaff, including the communities of Parks, Williams and Winslow. See Table 1.

Table 1. Arizona Cardinals Camp Visitors - Are you from the Flagstaff area?

	Count	Percent of total
Yes	123	19%
No	513	81%
Total	**636**	**100%**

Almost all fans – fully 95.0% – visiting the 2010 Arizona Cardinals' Training Camp were Arizona residents. A small percentage of fans did come from California, Nevada, New Mexico and other states, which are listed in full in Table 2. Only respondents who indicated that they were in Flagstaff to see the Cardinals are included in Table 2.

Table 2. Arizona Cardinals Camp Visitors - State of origin?

State of origin	Count	Percent of total
Arizona	456	95.0%
Nevada	8	1.7%
California	7	1.5%
New Mexico	2	.4%
Texas	2	.4%
West Virginia	2	.4%
Wyoming	1	.2%
Illinois	1	.2%
Michigan	1	.2%
Total	**480**	**100.0%**

In addition to originating largely within Arizona, the vast majority (83%) of visitors to the Cardinals' Training Camp were from the Greater Phoenix metropolitan area. The remainder of visitors hailed from towns throughout the state, such as Prescott, Sedona and the Verde Valley. The list of in-state visitor origins for those who were in Flagstaff only because of the Cardinals is in Table 3.

Table 3. Arizona City of origin for visitors to Arizona Cardinals Camp

Arizona Community of Origin	Count	Percent of total
Phoenix	92	21%
Scottsdale	49	11%
Mesa	34	8%
Peoria	30	7%
Glendale	29	6%
Gilbert	25	6%
Chandler	20	4%
Surprise	15	3%
Sun City	11	2%
Tempe	10	2%
Other Arizona	132	30%
Total	**447**	**100%**

Party Size of Visitors to the Arizona Cardinals' Training Camp

Out-of-town visitors had *average* party sizes that were slightly larger (3.0 persons) than parties from the Flagstaff area (2.9 persons). In terms of *median* party size, a measure less affected by extreme values, both local and out-of-town visitors had median party sizes of two persons. When comparing party sizes, Flagstaff area visitors comprised the majority (62.2%) of two-person visitor parties, while two-member parties comprised only 52.5 percent of out-of-town visitors. On the other hand, out-of-town visitors dominated those traveling with more than two persons (34.3%) compared to those from the Flagstaff area (25.2%). This may reflect larger family or affinity groups traveling to the camp from southern Arizona. See Table 4.

Table 4. How many people are in your party including yourself?

Number in Party	Count	Percent of Total
1	78	16.4%
2	175	36.8%
3	60	12.6%
4	86	18.1%
5	32	6.7%
6	23	4.8%
7	6	1.3%
8	6	1.3%
9	4	.8%
10	1	.2%
11	1	.2%
12	2	.4%
13	1	.2%
Total	**475**	**100.0%**

Out-of-town visitors here only for the Cardinals: Mean = 3.0

The report from this point forward reflects only information obtained from out-of-town visitors who indicated that they were in for the purpose of attending Flagstaff the Cardinals' Training Camp.

What is the purpose of your visit to Flagstaff today?

Out-of-town visitors were asked about the purpose of their trip to Flagstaff, and could select from a variety of choices, which included: to visit friends and relatives, outdoor recreation, entertainment (movies, museum visits, etc.), to get out of the heat, to see the Cardinals, business-related, shopping and "other" reasons. Overwhelmingly, out-of-town visitors (93.2%) indicated that they were in Flagstaff to see the Cardinals' Training Camp. A further 12 percent indicated that they were in Flagstaff to get out of the heat, followed by 9 percent who were visiting friends and relatives. Outdoor recreation was the trip purpose for 7 percent of respondents, followed closely by other reasons at 6 percent. These other reasons included attending the Big Red Beer Pour, driving through town, and going to the Grand Canyon, among others. [put in the appendix?] Clearly, this information confirms that those who were attending the Cardinals' Training Camp came to Flagstaff for that express purpose. See Table 5.

Table 5. Arizona Cardinals Camp –Purpose of Visit

Purpose of visit	Count	Percent of Total*
To see the Cardinals	480	93 %
To get out of the heat	60	12%
Visiting friends or relatives	47	9%
Outdoor Recreation	36	7%
Other reason	30	6%
Business related	15	3%
Shopping	15	3%
Entertainment (movies, museum etc.)	2	.4%

* Multiple responses allowed

Do you plan to stay overnight in Flagstaff before returning home?

A majority (58%) of out-of-town visitors surveyed indicated that they were planning to stay overnight in Flagstaff on this trip. The remaining 42 percent, therefore, can be regarded as day visitors who have a somewhat lesser impact on the local economy. See Table 6.

Table 6. Arizona Cardinals Camp – Do you plan to stay overnight in Flagstaff before returning home?

	Count	Percent of Total
Yes	277	58%
No	202	42%
Total	**479**	**100.0%**

How many nights do you plan to spend in Flagstaff?

On average, out-of-town visitors stayed three nights in the community. This included a cohort of 11 percent who spent between five and seven nights in the community; of this group, half stayed with friends and relatives, or in time shares or condos in the community. See Table 7.

Table 7. Arizona Cardinals Camp – Number of Nights in Flagstaff

Number of Nights	Count	Percent of Total
1 Night	99	33%
2 Nights	89	30%
3 Nights	49	16%
4 Nights	24	8%
5 - 7 Nights	33	11%
More than 7 nights	7	2%
Total	**301**	**100%**

Mean = 3 nights
Median = 2 nights

Where are you planning to stay in Flagstaff?

Respondents were given a variety of accommodation choices in Flagstaff, including: Hotel/Motel, Campground/RV park, Bed and Breakfast, Timeshare/Condo, staying with Friends or Relatives, or staying in a Vacation/Second home. Two-thirds of all respondents (67%) indicated that they stayed in a hotel/motel in Flagstaff. The August bed tax collections for the City of Flagstaff bear this out; average occupancy rates increased by +9.0% and REVPar (revenue per average room) rose by +6.3% over the same month in 2009 (Source: Smith Travel Research, Inc., *Trend Flagstaff*, August 2010).

Staying with friends and relatives (14%) was the next most popular lodging choice, followed by staying in a vacation or second home (7%). Staying in a campground RV park accounted for 6.0 percent of overnight accommodation, with timeshares/condos (5%) accounting for the remainder of overnight stays. No respondents surveyed indicated that they stayed at a bed and breakfast inn during their trip. See Table 8.

Table 8. Arizona Cardinals Camp – Type of Lodging

Type of Lodging	Count	Percent of Total
Hotel/Motel	200	67%
Campground/RV Park	17	6%
Bed & Breakfast	0	.0%
Timeshare/Condo	16	5%
Friends or Relatives	43	14%
Vacation/Second Home	22	7%
Total	**298**	**100%**

Which accommodation types accounted for the longest stays by out-of-town visitors? Based on the mean or average length of stay, which tends to be inflated by extreme values, visitors staying in

timeshare/condos (9.6 nights) had the longest average number of nights in Flagstaff. However, it should be noted that timeshare/condo visitors accounted for only 5.4 percent of out-of-town visitors. Visitors staying in campgrounds/RV parks (5.8 nights) had the next longest overnight stays in the community, followed by those staying in vacation or second homes (3.2 nights). Those staying with friends or relatives stayed 2.9 nights on average, while two-thirds of visitors (67%) who stayed in hotels had an average stay of 2.3 nights. The median values reflect visitor nights that are not biased by greater than average lengths of stay; once again, timeshare/condos and staying with friends and relatives accounted for the highest median nights (3.5 and 3.0 respectively). See Table 9.

Table 9. Arizona Cardinals Camp – Mean and Median Number of Nights

	Number of Nights	
	Mean	Median
Hotel/Motel	2.3	2.0
Campground/RV Park	5.8	2.0
Bed & Breakfast	0.0	0.0
Timeshare/Condo	9.6	3.5
Friends or Relatives	2.9	3.0
Vacation/Second Home	3.2	2.5

Out-of-town visitor spending

Visitors were asked to estimate as closely as possible the amount of money their travel party was likely to spend in Flagstaff during their visit. Expenditure data was reported for the following standard categories: Lodging/Camping; Restaurant/Bar; Grocery and convenience store; Entertainment (movies, museum, etc.); Gasoline; Automotive service, parts or repairs in Flagstaff; and Other shopping purchases. Only expenditures for out-of-town visitors who were in Flagstaff specifically to attend the 2010 Arizona Cardinals' Training Camp are included. Almost all visitors (92%) indicated that they were in Flagstaff for the Cardinals' Training Camp, accounting for 28,722 visitors. All expenditures reported in this section are specifically those of visitors in Flagstaff for the camp, whose origins were outside of Coconino County.

Visitors reported purchasing goods and services in all categories, with the exception of automotive services, parts and repairs. Since no expenditures were reported in this category it was dropped from all tables and analysis. Conversely, almost all out-of-town visitors (96%) reported expenditures for gasoline, followed closely by expenditures in the restaurant/bar category (93%). About two-thirds (63%) reported lodging/camping expenditures, while more than half (52%) reported spending at grocery and convenience stores. Other shopping (44%) and entertainment expenses (37%) rounded out visitor expenditures by category. The high incidence of expenditures for restaurant/bar (93%) is a good indicator that even day visitors had a significant impact on the local economy.

Since expenditures were only collected for out-of-town visitors, the question about visitor lengths of stay needs to be addressed. More than half (59%) of visitors indicated that they would be staying overnight in Flagstaff on this trip, while the remainder (41%) were day visitors. Overnight visitors' most *common* expenditures were for gasoline (reported by 98%), followed by restaurant/bar (93%) and lodging/camping (82%). Likewise, day visitors' most common expenditures were for gasoline (94%), restaurant/bar (88%), and shopping (45%).

Overnight visitors' *highest* expenditures were in the restaurant/bar category ($149 per-party, reported by 96% of overnight visitors). The second highest average expenditure ($143) was in the lodging/camping category (82% reported expenditures in this category). The remaining categories accounted for much lower average expenditures per-party: shopping ($34), gasoline ($42), grocery, convenience store purchases ($21) and entertainment ($10). Overnight visitors had average *trip* expenditures of $398, or $133 per-day based on an average three-day trip. Similarly, day visitors had their highest expenditures for restaurant/bar ($67), followed by gasoline ($30), and shopping ($15). Day visitors had average *trip* (one day expenditures) of $119. See Table 10 for overnight and day visitor expenditures.

Table 10. Arizona Cardinals Camp – Per-Party Mean and Median expenditures in Flagstaff

	Overnight visitors			Day visitors		
Per-party Mean and Median expenditures	**Mean**	**Median**	**% with expense**	**Mean**	**Median**	**% with expense**
Lodging/Camping	$143	$100	82%	$0	$0	0%
Restaurant/Bar	$149	$100	96%	$67	$50	88%
Grocery & Convenience Store	$21	$0	56%	$7	$0	44%
Entertainment (movies, museum etc.)	$10	$0	43%	$2	$0	37%
Gasoline	$42	$40	98%	$30	$27	94%
Shopping or purchases	$34	$3	43%	$15	$0	45%
Per-Party, Per-trip total expenditures	**$398**	**$243**	**70%**	**$119**	**$85**	**58%**
Per-Party, Per-day total expenditures	**$133**	**$81**		**$119**	**$85**	

Survey Form

2010 Arizona Cardinals Training Camp

Date ☐☐ / ☐☐ / ☐☐ AM/PM/SC ☐☐ Surveyor initials ☐☐

1. How many people in your party including yourself? ☐☐

2. Are you from the Flagstaff area (within 50 miles of Flagstaff, including Parks, Williams, & Winslow) or do you own a second home in the Flagstaff area? ○ Yes ○ No

---

3. What is your Zip Code? ☐☐☐☐☐

4. What is the purpose of your visit to Flagstaff today? **(please mark all that apply)**

- ○ Visiting friends or relatives
- ○ Outdoor recreation
- ○ Entertainment (movies, museum etc.)
- ○ To get out of the heat
- ○ To see the Cardinals
- ○ Business related
- ○ Shopping
- ○ Other (please describe)

☐

5. Do you plan to stay overnight in Flagstaff before returning home?

○ No ○ Yes

If YES
How many nights do you plan to spend? ☐☐

Where are you planning to stay? Please check one:

- ○ Hotel/Motel
- ○ Bed and Breakfast
- ○ Friends or Relatives
- ○ Campground/RV Park
- ○ Timeshare/Condo
- ○ Vacation/Second home

6. Please estimate as closely as possible the amount of money that your travel party is likely to spend in Flagstaff during this visit, in the following categories.

Lodging/camping $ ☐☐☐☐

Restaurant & Bar $ ☐☐☐☐

Grocery & convenience store $ ☐☐☐☐

Entertainment (movies, museum etc.) $ ☐☐☐☐

Gasoline $ ☐☐☐☐

Automotive services, parts or repairs in Flagstaff $ ☐☐☐☐

How much will you spend on all other shopping or purchases $ ☐☐☐☐

Thank you for participating in our survey.
Enjoy the practice/game!

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Appendix B:
Aggregated Impact Results

IMPLAN generates some very large tables as part of the economic impact analysis. These tables are too large to include in this report; however, the tables have been aggregated along one-digit SIC code and summary information from the aggregated tables presented in the body of the report. The aggregated tables are included here as Appendix A. The figures presented in the tables have been rounded to the nearest whole job or the nearest whole dollar. For this reason, the individual rows may not sum to the total shown. The totals shown are accurate.

Definitions of specific terms that appear below are given here:

- *Final Demand* - the dollar value of goods and services purchased by their ultimate consumer. The tables show the change in final demand (in millions of dollars per year) due to one of the following sources of direct spending: the operations of NAU, spending by employees, students, visitors, retirees and alumni.
- *Employee Compensation Impact*- additional wages and salaries generated by NAU operations, and spending by employees, students, visitors, retirees and alumni.
- *Employment Impact* - the increase in the number of full-time jobs due to NAU operations, and spending by employees, students, visitors, retirees and alumni.
- *Indirect Business Taxes Impact* - the increase in indirect business taxes (sales and excise taxes, property taxes, etc.) due to NAU's presence and spending activity by associated parties.
- *Other Property Type Income Impact* - the increase other property-type income (e.g., rent, interest, corporate profits, surplus of government enterprises) due to NAU operations, and spending by associated parties.
- *Output Impact* - (also known as Total Industry Output, TIO) the dollar value of goods and services sold by an industry. Some of an industry's output is sold to its ultimate consumer (final demand), and some is sold to other industries for use in their production operations. The tables show how much additional output has been generated by each of the sources of direct spending analyzed in the study.
- *Proprietors' Income Impact* - the increase in proprietors' and other property owners' incomes. Since NAU is a non-profit organization, there is no direct increase in proprietors' income from its operation. However, spending by the associated parties described in the model creates additional proprietors' income.
- *Personal Income Impact* - Employee compensation plus proprietors' income and other property income.
- *Total Value Added* - value added is the income (profits and wages) generated by a firm's operations. Value added is computed as the value of a firm's output minus the value of that firm's inputs (e.g., raw materials, but not labor). The tables show the increase in value added (employee compensation, property income and indirect business taxes) as a result of the spending by NAU and associated parties.

Most of the sectors listed, such as agriculture, are commonly understood. However, the government sector is sometimes misinterpreted - it represents government spending rather than increases in taxes. This spending is a measure of what is necessary to support additional infrastructure and services created by the activities associated with NAU. The tables use abbreviations for some of the longer sector names. These abbreviations are listed below:

- *TCPU* - Transportation, Communications and Public Utilities. A sector of the economy, an aggregation of industries thought to have similar characteristics.
- *FIRE* - Finance, Insurance and Real Estate. A sector of the economy.
- *AGG* - aggregated. For purposes of reporting, the 528 sectors have been summed to these ten broad sectors: Agriculture, Mining, Construction, Manufacturing, TCPU, Trade, FIRE, Services, Government, Other.

Appendix C:
An Introduction to I-O Modeling[4]

Historical Development

Input-output analysis is a branch of economic statistics, specifically, econometrics. The recent emergence of input-output analysis as a useful branch of economics dates from the development by Wassily Leontief in the 1930's of a general theory of production based on the economic interdependence of producing industries of the economy.

Early economists, notably Adam Smith, were concerned with the functioning of national economies or economies as a whole. Smith and other classical economists laid the groundwork for what is now referred to as macroeconomics. Much later, Alfred Marshall and his followers focused on the economics of the household and the firm. The method of these neoclassical economists, the founders of modern microeconomics, involved partial equilibrium analysis, that is, looking at "one thing at a time." John Maynard Keynes drew upon the work of both the classical and neoclassical economists in reviving interest in aggregative economics. While the neoclassical economists had concentrated on price theory -- examination of the forces that determine prices under given market conditions -- the Keynesians were concerned with the national economic forces that determined income and employment. Keynesians were concerned with the broad aggregates of total employment, total consumption, total investment, and national income. Neither Keynes nor the neoclassical economists was directly concerned with economic interdependence, or the way individual producing industries are knitted together in the structure that is the national economy.

Any developed economy, whether national, regional, or local, is characterized by a high degree of interdependence among producing industries of the economy. Each economic industry not only produces goods or services, but is also a consumer itself, purchasing other goods and services for use in the production process. Interindustry relations were recognized long before Leontief's time. Francois Quesnay's "Tableau Economique" of 1758 developed circular flow and general equilibrium concepts. The next major economist to focus on interindustry relationships was Leon Walras, who, in the 1870's, like his neoclassical contemporaries was interested in price determination. Unlike them, however, he was interested in the simultaneous determination of all prices in the economy, that is, general equilibrium analysis rather than partial equilibrium analysis. Walras examined both the interdependence of producing industries, and what each producing industry needed from other industries to produce a unit of a finished good. Walras believed his general equilibrium model to be a purely theoretical one; the model's computational problems were formidable. Further, the kind of national economic statistics needed for the model's database were rudimentary or nonexistent in his time.

The first empirical application of the input-output model in the Anglo-American world dates from 1936, when Wassily Leontief published an input-output system of the U.S. economy. Leontief simplified Walras' generalized model so that the model's equations could be estimated empirically. He used two simplifying assumptions. First, the large number of *commodities* in the Walrasian model was aggregated into relatively few outputs, one for each *industry*[5]. Second, the supply

[4] Appendix C is quoted, with permission, from Micro IMPLAN User's Guide: Version 91-F, pages G-1 through G-15.

[5] All terms that appear in italics in the text are defined in a short glossary at the end of this appendix.

equation for labor and the demand equations for final consumption were abandoned, and the remaining production equations were expressed in the simplest linear form.

These simplifying assumptions define a sharp difference between input-output and most other conventional economic models. The assumption of linearity does not allow factor substitution or economies of scale. Time is missing, yet the purchase of inputs by one industry to make goods to sell to other industries implies a period analysis. In the "real world," the prevalence of joint products and multiproduct plants makes it impossible to aggregate only those plants with similar output and input structures; yet, the model assumes a single homogeneous output generated from the same inputs for each producing industry.

Given these assumptions, the model is starkly simple. Its key variables are the outputs of industrial categories ("industries") into which the economy is divided. Each industry's output consists of summing its sales to all other industries and to *final demand,* i.e., to ultimate consumers rather than other producing industries. The amount of each product consumed in each industry depends only on the level of output for that industry. *Equilibrium* in the economy is attained when each industry's output equals its total purchases, which are in turn determined by the output of all other industries.

Because of these simplifying assumptions, the model is empirically tractable. The implausible assumptions for the production function do not appear to restrict the model too badly. Technology changes are slow enough so that the input coefficient matrix of one year seems to be good for several years. Even out-of-date tables are useful in that they can show the maximum input requirement for each industry. Perhaps most important of all, input-output models pass the critical test: for many purposes, they predict reasonably well.

The Basic Input-Output Model

The key to input-output analysis is the construction of the input-output or transactions table, which shows the flow of commodities from each of a number of producing industries to all consuming industries and final demand. From these flows between economic industries, two other structural tables can be developed: (1) A table of technical coefficients or direct requirements (terms used interchangeably here) and (2) a table of direct and indirect coefficients or total requirements (also interchangeable terms). Each of these three tables and their significance is discussed below.

The Transactions Table

Given that many industries produce more than one commodity, production information is often tabulated on an industry (I) by commodity (C) basis;

1) A *Make Matrix* (CxI) contains the value of commodities produced by the different industries. Note that one particular industry may produce a variety of commodities. Normally, it is assumed that the production of multiple commodities takes the form of one principal product and one or more byproducts.

2) A *Use Matrix* (IxC) contains the value of commodities and imports used by each industry in the production process. Note that one particular type of commodity may be used by a variety of different industries.

A traditional I-0 transactions table, however, is on an industry by industry (IxI) basis. It is therefore necessary to combine the Use and Make matrices in such a way that each industry is shown buying

and selling from other industries. The "Industry-Technology Assumption" presumes that any by-products of an industrial process are technically related to the main production process, so that all commodities produced by an industry are produced with the same input structure. Therefore, since industries are classified/named based on their principal output, all individual producers within a particular industry are assumed to have the same input mix regardless of their output product mix. Thus, demand for an industry's output is in effect demand for a bundle of goods -- the principal output plus any joint production generated by the industry. This one-to-one correspondence between an industry and its "bundle of goods" output, enables the Use and Make matrices to be combined into an IxI transactions table.

Table A depicts a highly simplified, aggregated version of a transactions table in which all producing industries have been aggregated into three "super-industries:" agriculture, manufacturing, and services. A transactions table portrays the dollar flows of goods and services among industries in an economy for a given accounting period. In this table, sales and purchase transactions within the economy are set forth in a matrix of rows and columns. Each row shows the output sold by each industry shown along the left-hand side of the table to each industry shown across the top of the table. Each column shows the purchases made by each industry shown along the top of the table from the industries along the left-hand side. Because this is a square table, one row corresponds to each column. The entry in each cell represents a purchase for the column industry and a sale for the row industry.

Table C-1
Illustrative Transactions Table

	Purchasing Industries				
Producing Industries	**Agriculture**	**Manufacturing**	**Services**	**Final Demand**	**Total Output**
Agriculture	10	6	2	18	36
Manufacturing	4	4	3	26	37
Services	6	2	1	35	44
Primary Inputs	16	25	38	0	79
Total Outlay	36	37	44	79	196

Thus, the entries in the first column show agriculture purchasing $10 worth of output from itself, $4 worth of output from manufacturing, $6 from services, and $16 from primary inputs (e.g. labor), summing to a total outlay of $36. Reading along the row, agriculture sells $10 worth of output to itself, $6 to manufacturing, $2 to services, and $18 to final demand. Summing the sales results in a total output value of $36.

The distinction commonly made in economic analysis between the production of goods and services and their final disposition is reflected by dividing the industries of the transactions table into four groups or "quadrants", each representing either intermediate transactions, primary inputs, or final demand. Figure I presents a theoretical table with the four divisions.

Quadrant I shows the intermediate transactions, that is, the flow of goods and services which are both produced and consumed in the process of current production. This quadrant can have as many or as few industries as desired. Limitations in data and processing equipment often restrict the number of industries included in a model to 100 or fewer, but some national models have well over 400 industries.

Final demand, or the ultimate consumers' purchases from the producing industries, is recorded in the second quadrant. (To distinguish them from the industries in Quadrant 1, the components of final demand are called "Institutions".) The third quadrant represents the primary inputs of production. Here again, the decision as to the amount of detail to include is left to the model builder. Table A has only one industry in Quadrants II and III, whereas Figure 1 shows both final demand and primary inputs broken down into four industries each, i.e., the main industries of the national accounting system.

The fourth quadrant is sometimes omitted from published input-output tables, but it should be included if portrayal of a complete economy is desired. Quadrant IV records the primary inputs into final demand institutions, including such typical entries as income of government employees (HG in Figure 1) and imports consumed directly by households (MC in Figure 1). Note that in input-output terms, Quadrant I is endogenous to the model, while Quadrants II, III, and IV are exogenous.

Figure C-1
Structure of an Input-Output Transactions Table

		Purchasing Sectors							
		Intermediate Demand			Final Demand				Total
		Agriculture	**Manufacturing**	**Services**	**Household Consumption**	**Government Purchases**	**Capital Formation**	**Exports**	**Gross Output**
Producing Sectors		I. Intermediate Production and Consumption			II. Final Outputs of Producing Sectors				
Intermediate Inputs	Agriculture	X_{11}	X_{1j}	X_{1n}	C_1	G_1	I_1	E_1	X_1
	Manufacturing	X_{i1}	X_{ij}	X_{in}	C_i	G_i	I_i	E_i	X_i
	Services	X_{n1}	X_{nj}	X_{nn}	C_n	G_n	I_n	E_n	X_n
Primary Inputs	Payments to:	III. Primary Inputs to Production			IV. Primary Inputs to Final Demand				
	Households	H_1	H_j	H_n	H_C	H_G	H_I	H_E	H
	Government	T_1	T_j	T_n	T_C	T_G	T_I	T_E	T
	Depreciation	D_1	D_j	D_n	D_C	D_G	D_I	D_E	D
	Imports	M_1	M_j	M_n	M_C	M_G	M_I	M_E	M
Total Gross Outlays		**X_1**	**X_j**	**X_n**	**C**	**G**	**I**	**E**	**X**

In addition to summarizing basic consumption and production patterns, a transactions table can be used to describe other economic factors. For example, the following can be calculated from Figure 1:

Summing across a row, intermediate demand plus final demand measures the Total Gross Output of industry "i". Thus, in an "n"-industry model[6]:

$$X_i = \sum_{j=1}^{n} X_{ij} + (C_i+G_i+I_i+E_i)$$

Where: X_i = Total Gross Output of Industry j
$\sum X_{ij}$ = Intermediate Demand for the output of Industry i
$(C_i+G_i+I_i+E_i$ = Final Demand for the output of Industry i

Summing down a column, intermediate inputs plus primary inputs yields the Total Gross Outlays of industry j. Thus:

$$X_j = \sum_{ij=1}^{n} X_{ij} + (H_j+T_j+D_j+M_j)$$

Where: X_j = Total Gross Outlays of Industry j
$\sum X_{ij}$ = Intermediate Inputs for Industry j
$(H_j+T_j+D_j+M_j)$ = Primary Inputs for Industry j

We may also sum across the totals row or down the totals column to obtain the economy's Total Gross Output:

$$X = \sum_{i=1}^{n} X_i + (H+T+D+M)$$

$$X = \sum_{j=1}^{n} X_j + (C+G+I+E)$$

Now, since in equilibrium,

$$\sum_{i=1}^{n} X_i = \sum_{j=1}^{n} X_j$$

all intermediate flows cancel out. We then have:

(H + T + D) + M = C + G + I + E

or: Value Added + Imports = Final Demand.

[6] The definitions of C, G, etc can be found by reading Figure 1.

Transferring imports to the right-hand side of the equation gives the traditional social accounting identity of Gross Regional Income (allocations approach) and Gross Regional Product (expenditures approach)[7] that is:

$$H + T + D = C + G + I + E - M$$

or: Gross Regional Income = Gross Regional Product[8]

Thus, Gross Regional Product can be calculated both by the traditional income allocations approach and by the expenditures approach from an input-output model transactions table.

The Technical Coefficients, or Direct Requirements Table

Table B is a table of direct requirements or technical coefficients for the illustrative transactions table, Table A. The entries in this table are to be interpreted as the minimal requirements from each of the producing industries at the left of the table in order for each industry at the top to produce one dollar's worth of output for final demand. The word "minimal" is important. If it takes 2 tons of ore to yield 1 ton of iron, no doubt the same iron could be produced from even more ore, but as long as iron ore has value, no one would be foolish enough to use more than the absolutely required 2 tons.

Table C-2
Direct Requirements Table*

	Purchasing Industries		
Producing Industries	**Agriculture**	**Manufacturing**	**Services**
Agriculture	.278	.162	.045
Manufacturing	.111	.108	.068
Services	.167	.054	.023
Primary Inputs	.444	.676	.864

* Each entry represents the inputs that the column industry requires from the row industry to produce a dollar's worth of output.

These direct requirements or technical coefficients are determined by dividing the column entries for agriculture, manufacturing, and services in the illustrative transactions table (Table A) by the total outlay of the respective column. In this example, the manufacturing industry requires 16.2 cents worth of input from agriculture ($6/$37), 10.8 cents from manufacturing industries, and 5.4 cents from services in order to produce one dollar of output. In other words, the 16.2 cents would be interpreted as the "dollar's worth of inputs from agriculture per dollar's worth of output from manufacturing. " The remaining inputs to the manufacturing industry come from the exogenous or primary inputs part of the model.

Using standard notation (as in Figure 1), the technical coefficients, aij, shown in Table B are computed as follows:

$$a_{ij} = X_{ij}/X_j \qquad i, j = 1..... n$$

[7] Where the "expenditures approach" tracks purchases by an industry, while the "allocations approach" tracks sales.
[8] "Regional" refers to any functional economic unit, from national to local. The "region" is defined by the model builder.

where Xij is the sales by industry i to industry j, and Xj is the total purchases of industry j. By definition, Xj = Xi for all endogenous industries, i.e., all producing industries within the technical coefficients matrix of Quadrant I. The computation of aij for all cells in the first quadrant of the transactions table results in a matrix of aij's or a "direct coefficients" table. Each column of aij represents a production function for that industry. Economists define the production function as the physical relation between the value of resource inputs and the value of the output of goods and services.

The direct coefficients embody most of the simplifying assumptions of input-output analysis. Input-output economics assumes that fixed proportions exist in all production processes; thus, the direct coefficients are constants. Once the coefficients have been developed, they remain constant for as long as the model is used. Further, when output is to be increased n times, all inputs must also be increased n times. This property, called constant returns to scale, means that average cost in real terms is the same at all output levels. Once an optimal combination of input factors is chosen, any level of output is obtainable simply by adjusting all inputs proportionately to the new output level. In addition, constant coefficients imply no substitution among inputs. A third condition implied by constant coefficients is production by each industry of a single, unvarying output. An aggregated industry is assumed to continue to produce the same average or homogeneous product it did at the time the model was developed.

These conditions, in defiance of many other economic models and theory, may not be unreasonable when one examines reality. There are many ways of producing any good. Each method uses some set of fixed proportions among inputs. Among all the possible ways, one is best at any given moment; that is the method which firms use. In this case, one may think of input-output tables as reflecting the set of "best" processes existing at that moment. That is, once a production method is adopted, it will be retained for a certain period, and it may be used to attain all possible output levels. The process may well change over time; therefore, the technical coefficients in an input-output system should be reviewed from year to year.[9]

The Direct and Indirect Coefficients or Total Requirements Table

One of the most important applications of the input-output model is to calculate the equilibrium output levels in each industry of the economy. Output is in equilibrium if it is just equal to the quantity demanded for all purposes, such as inputs for production, consumption, investment, and exports. Once the transactions table is balanced (Xi's equal Xj's; i=j) and aggregate final demand equals aggregate primary inputs, an equilibrium exists.

Now suppose that someone, probably in a final demand institution, would like to buy more. This starts a chain reaction of increasing production everywhere. Using the table of technical coefficients (Table B) and given a lot of time, it is possible to calculate by hand the reaction as it ripples through all industries in the economy.

For example, suppose a foreign country would like to purchase $1 more from the agriculture industry. Using Table B, one can trace through the results. In order to sell an additional dollar's worth of output to final demand (in this case, exports), the agriculture industry must purchase 27.8 cents of output from itself, 11.1 cents output of output from the manufacturing industry, and 16.7 cents of output from the services industry.

[9] Economists usually assume that when output increases, the input requirements may increase more or less in direct proportion to the increase in output. However, statistical evidence suggests that the average cost of goods is independent of the scale of output in a great many cases. Thus, although not totally defensible theoretically, the assumptions brought about by constant coefficients in the input-output system may not be too much out of line with available facts. The important point is that if one is willing to accept the input-output assumptions, one can present the inter-industrial technical relations of the entire economy very neatly in a single input-output table. Such a table can be made and used, whereas without such simplifying assumptions, model estimation is not possible.

This is the first round. Now for agriculture to sell 27.8 cents to itself, it must again purchase 7.7 cents more output ($.278 times $.278) from itself and 3.1 cents ($.278 times $. 111) from manufacturing and 4.6 cents ($.278 times $.167) from services. The second round is not finished, because for manufacturing to sell 11.1 cents to agriculture, it must buy 1.8 cents ($.111 times $.162) from agriculture, 1.2 cents ($.111 times $.108) from itself, and 0.6 cents ($.111 times $.054) from services. Services must also purchase 0.8 cents (16.7 cents times .045) from agriculture, 1.1 cents (16.7 cents times .068) from manufacturing, and 0.4 cents (16.7 cents times .023) from itself to sell 16.7 cents to agriculture. In just the first two rounds, agriculture has produced $1 for export, 27.8 cents plus 7.7 cents for itself, 1.8 cents for manufacturing, and 0.8 cents for services, totaling $1.38. Now, if one were to follow this process ad infinitum, the total amount each industry would be required to produce could be calculated.

Leontief devised a much simpler method of determining the total output requirements resulting from a final demand change using matrix algebra techniques. The Leontief method determines total industry requirements directly. (If one desires the round-by-round effects, the cumbersome method described above would have to be used).

The Leontief method can be demonstrated using the information on final demands and total outputs from Table A combined with the information contained in Table B. From this information, the following system of equations can be developed:

$$X_1 = .278\,X_1 + .162\,X_2 + .045\,X_3 + Y_1$$
$$X_2 = .111\,X_1 + .108\,X_2 + .068\,X_3 + Y_2$$
$$X_3 = .167\,X_1 + .054\,X_2 + .023\,X_3 + Y_3$$

where X1, X2, and X3 are the total outputs of the three endogenous industries, while Yl, Y2, and Y3 are the respective processing industries' sales to final demand, and the coefficients are the entries in the direct requirements table (Table B).

In matrix notation, the system becomes:

$$\begin{bmatrix} X_1 \\ X_2 \\ X_3 \end{bmatrix} = \begin{bmatrix} .278 & .162 & .045 \\ .111 & .108 & .068 \\ .167 & .054 & .023 \end{bmatrix} \cdot \begin{bmatrix} X_1 \\ X_2 \\ X_3 \end{bmatrix} + \begin{bmatrix} Y_1 \\ Y_2 \\ Y_3 \end{bmatrix}$$

or more simply stated:

$$\mathbf{X = AX + Y}$$

where X is the vector of total outputs, A is the matrix of direct coefficients, and Y is the vector of final demands.

The above may also be written:

$$X_1 - .278\,X_1 - .162\,X_2 - .045\,X_3 = Y_1$$
$$X_2 - .111\,X_1 - .108\,X_2 - .068\,X_3 = Y_2$$
$$X_3 - .167\,X_1 - .054\,X_2 - .023\,X_3 = Y_3$$

or:

$(1 - .278)\ X_1 - .162\ X_2 - .045\ X_3 = Y_1$
$-.111\ X_1 + (1 - .108)\ X_2 - .068\ X_3 = Y_2$
$-.167\ X_1 - .054\ X_2 + (1 - .023)\ X_3 = Y_3$

Again, in matrix notation:

$$\begin{bmatrix} (1-.278) & .162 & .045 \\ .111 & (1-.108) & .068 \\ .167 & .054 & (1-.023) \end{bmatrix} \cdot \begin{bmatrix} X_1 \\ X_2 \\ X_3 \end{bmatrix} = \begin{bmatrix} Y_1 \\ Y_2 \\ Y_3 \end{bmatrix}$$

which may also be written:

$$\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} - \begin{bmatrix} .278 & .162 & .045 \\ .111 & .108 & .068 \\ .167 & .054 & .023 \end{bmatrix} \cdot \begin{bmatrix} X_1 \\ X_2 \\ X_3 \end{bmatrix} = \begin{bmatrix} Y_1 \\ Y_2 \\ Y_3 \end{bmatrix}$$

and may be reduced to:

$$\mathbf{(I - A)\ X = Y}$$

where I is the identity matrix, (I - A) is called the Leontief matrix, and A, X, Y are as defined previously.

The coefficients are now in the proper form to solve the Leontief system and find the vector of outputs required to sustain a given vector of final demands. The mechanical process is first to find the Leontief inverse or the inverse of the Leontief (I-A) matrix. Inversion techniques are available in many math books, so they will not be dwelt on here. The Leontief inverse $(I - A)^{-1}$ is defined as the total requirements matrix and is presented in Table C.

Table C-3
Direct Requirements Table*

	Purchasing Industries		
Producing Industries	**Agriculture**	**Manufacturing**	**Services**
Agriculture	1.4459	.2678	.0852
Manufacturing	.1996	1.1628	.0901
Services	.2582	.1100	1.0431
Primary Inputs	1.91	1.54	1.22

* Each entry represents the output required both directly and indirectly from the row industry per dollar of deliveries to final demand by the column industry

To develop a solution, we must pre-multiply both sides of the above equation by the Leontief inverse, as follows:

$$\mathbf{(I - A)^{-1}(I - A)\ X = (I - A)^{-1}\ Y}$$

which reduces to:

$$\mathbf{X = (I - A)^{-1} Y}$$

Using the information in table form and the above matrix, we can develop the following system of equations:

$$X_1 = 1.4459\ Y_1 + 0.2678\ Y_2 + 0.0852\ Y_3$$
$$X_2 = 0.1996\ Y_1 + 1.1628\ Y_2 + 0.0901\ Y_3$$
$$X_3 = 0.2582\ Y_1 + 0.1100\ Y_2 + 1.0431\ Y_3$$

Returning to our example, when a foreign country (or final demand institution outside of the model "region") wants to purchase $1 more from the agriculture industry, we would like to determine the total increase in output resulting from this $1 increase in final demand.

Using the above system of equations and looking at the $1 increase only, agriculture sales to final demand (Y1) would equal 1, and manufacturing (Y2) and services (Y3) sales to final demand would be zero. After multiplying through, agriculture total output (X1) equals $1.4459 (1 times the coefficient associated with Y1), manufacturing output (X2) equals $.1996, and services output (X3) equals $.2582. Summing the three outputs, we find the total increase in output resulting from a $1 increase in final demand of the agriculture industry to be $1.91. We have found the total output, both direct and indirect, that this hypothetical economy is required to produce in order for the agriculture industry to sell one more dollar of output to a final demand industry. The total output requirement divided by the output sold to the final demand industry is designated as the "output multiplier. " The output multiplier is calculated by summing the appropriate column of the Leontief inverse. As presented in the total requirements table (Table C), by summing each column the output multipliers are 1.91, 1.54, and 1.22 for the agriculture, manufacturing, and service industries, respectively.

Multipliers

We have seen how input-output analysis is developed to tell us the effect on total output resulting from a given change in the amount of output purchased by a final demand institution. The answer is straightforward and involves only an interpretation of the Leontief inverse. The output directly sold to final demand is exogenous to the model, i.e., it must be determined outside the model. Once this "direct" change is determined, the direct and indirect outputs by industry can be calculated by premultiplying by the Leontief inverse.

The output multiplier developed in the previous subsection relates an increment of direct or final output to the resulting increment of total output -- direct and indirect combined. Although the output multiplier represents total requirements per unit of final output, it is not a particularly useful concept except as an indicator of the degree of structural interdependence between each industry and the rest of the economy. There are, however, many other multipliers that can be developed with input-output analysis, depending on the purpose of the economic study. Income and employment are the multipliers of interest in most studies, although, in recent years, water and pollution multipliers have also been frequently used. A multiplier can be developed for most any input or factor that has a determinable relationship with a industry's output. For more information, see Appendix E of the Micro IMPLAN User's Guide - "Multipliers".

IMPLAN's Glossary of Terms

Byproducts: During the production process, an industry may produce more than one output. The industry is classified according to the primary product, while secondary products are termed "*byproducts*."

Commodities: The goods and services produced by industries are classified in terms of one or more product types, or "*commodities*."

Direct and Indirect Coefficients (see also Total Requirements): The amount of output from industry i required (both directly and indirectly) to deliver one dollar's worth of industry j's output to final demand.

Direct Requirements (see also Technical Coefficients): The dollar value of industry i's output required by industry j to produce one dollar's worth of output.

Equilibrium: In the I-0 sense, equilibrium occurs when Total Gross Output equals Total Gross Outlays.

Final Demand: The ultimate consumers of commodities (goods and services).

Industry: The manufacturer or provider of goods and/or services. Industries are categorized on the basis of their primary product, though they may produce a range of commodities.

Make Matrix: The values of commodities (columns) produced by the different industries (rows). The sum of each row is that industry's Total Industry Output. The sum of each column is that commodity's Gross Commodity Production.

Technical Coefficients (see also Direct Requirements): The dollar value of industry i's production required by industry j to produce one dollar's worth of output.

Total Requirements Matrix (see also Direct and Indirect Coefficients): The amount of output from industry i required (both directly and indirectly) to deliver one dollar's worth of industry j's output to final demand.

Transactions Table: The flow of commodities from each of a number of producing industries to all consuming industries and final demand. This flow is expressed in terms of the dollar value of the commodities traded.

Use Matrix: The values of commodities and imports (rows) used in production by each industry (columns). The sum of each column is that industry's Gross Industry Commodity Demand. The sum of each row is the Intermediate Demand for that commodity.

Value Added. The difference between an industry's or an establishments total output and the cost of its intermediate inputs. It equals gross output (sales or receipts and other operating income, plus inventory change) minus intermediate inputs (consumption of goods and services purchased from other industries or imported). Value added consists of compensation of employees, taxes on production and imports less subsidies (formerly indirect business taxes and nontax payments), and gross operating surplus (formerly "other value added"). (BEA); Gross value added is the value of output less the value of intermediate consumption; it is a measure of the contribution to GDP made by an individual producer, industry or sector; gross value added is the source from which the primary incomes of the SNA are generated and is therefore carried forward into the primary distribution of income account. (SNA).