The Employment Impact of Irrigated Agriculture in Grant and Stevens Counties, KS

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Introduction and Overview

This study estimated the employment associated with irrigated agriculture in Grant and Stevens Counties in southwestern Kansas. The analysis proceeded in two steps. The first step involved allocating value of current crop production into that associated with irrigated agriculture versus dry land farming for 1995. Estimates were then made of the value of dry land production on lands currently irrigated. The difference in the farm value of crops under a dry land only scenario versus dry land/irrigation was assumed the direct value due to irrigation.

The second step involved the calculation of input-output models for Grant and Stevens counties. Input-output is an accounting system charting the flow of dollars between production sectors in the county economy during the year of the analysis. This permits estimates of how spending in one area "ripples" throughout the economy to affect other businesses and household income. The model was current to 1995, the most recent year for which needed published data was available.

Total employment associated with crop production was taken from the input-output models. Total employment was apportioned to irrigated and dry land agriculture based on the proportions calculated in step one. Employment multipliers were then generated from the input-output models and multiplied by direct irrigation employment. This estimated the total employment impact to the counties after taking into account the "ripple effect" associated with the interconnections between production sectors as well as household spending. Total irrigation employment was then divided by the number of irrigation wells in the counties to generate an estimate of employment per irrigation well.

An Introduction to Input-Output Analysis

This study used input-output (I-O) analysis to project the employment impacts of irrigated agriculture in Grant and Stevens counties. I-O analysis builds a "computerized spreadsheet" of the regional economy, showing the flow of dollars between local business sectors, households, government, and other non-local consumers of locally produced goods and services. Input-output creates a "snapshot" of the regional economy at a point in time, usually one year. I-O analysis enables estimates of how spending in one area of the economy "ripples" through the economy to other sectors as businesses buy and sell to one another and generate income for local labor and proprietors. To do this, a number of simplifying assumptions are necessary.[1] Therefore, the impacts identified in this report must be considered general estimates to be used in conjunction with other information for decision-making related to investments and local policy.

Economic impacts arise in several ways. The impact directly associated with an activity is

termed the direct effect. If a firm, for example, employs 30 people and pays $1 million in wages, these values would be counted as the direct effects. Impacts also arise indirectly, as the firm purchases goods and services to support its operations and as the employees spend their wage income for household purchases. These are termed the indirect effects. Direct and indirect economic impacts can be reported for sales, income or employment.

Local officials and the public are generally interested in the economic impacts occurring in the local economy. Rural economies, however, tend to be quite "open." Given business purchasing relationships, consumer shopping behavior, and regional commuting patterns, the true economic impact will extend beyond a single county's borders.[2] In this case, the indirect employment assumed associated with irrigated agriculture is not necessarily confined to within the counties' boundaries.

Estimating Irrigation Values

The information used to estimate irrigated and dry land farm production values was obtained for the 1995 analysis year from *Kansas 1996 Farm Facts*. The first step was to calculate crop prices based on production data and farm values contained in the report. To the extent 1995 was not a typical year for farm production or prices, the assumed relationships may be in error.[3] Table 1 includes the worksheet used to estimate prices by crop category for 1995.

Farm Facts reported county acreage and yield information for irrigated and dry land crops. Using crop prices, total irrigated and dry land farm values were calculated and reported in Tables 2 and 3. The value associated with irrigated agriculture is a "gross" value of production from an impact analysis perspective. To get at a more accurate view of the impact requires considering what might exist in the absence of irrigation. In this case, the land would not be idled to no productive use, but would likely revert to dry land production.

To estimate the values associated with converting irrigated to dry land production, it was assumed the converted acreage would be used in a similar way existing dry land acreage.[4] Table 4 shows the distribution of dry land acres by crop.

The dry land cropping patterns were applied to the irrigated acres. Dry land production performance and price information was used to estimate a total farm value for these converted acres. Table 5 estimates the values that might have been produced in 1995 had irrigation not been available.

The net difference in farm values associated with irrigation is shown in Table 6. The actual reported farm values under a irrigated/dry production regime are first shown. The assumed farm values of production under a dry land only regime are then deducted to obtain the increment that might be considered the "value" of irrigated agriculture. For Grant County, the increment

was about $19.1 million in total farm value associated with crop production, while the increment was about $30.5 million for Stevens County. When compared to the actual reported farm values, it could be said irrigation contributed about 43% of the total farm value of crops in Grant County and about 50% in Stevens County.

Estimating Employment Impacts

The IMPLAN input-output modeling system was used to estimate the employment impacts associated with irrigated agriculture. IMPLAN provides estimates of agricultural employment and calculates economic multipliers.

I-O models were created for Grant and Stevens County as well as for the combined counties. As shown in Table 7, estimated direct employment associated with crop production was 180 jobs in Grant County and 327 jobs in Stevens County.[5] The percentage increment associated with irrigated agriculture was applied to these total employment estimates. Thus, about 77 jobs were assumed directly associated with irrigated agriculture in Grant County and about 163 jobs in Stevens County.

It is known, however, the economy is interconnected in many important ways. Industries buy and sell to one another. Workers use their income to make household purchases. Thus, a better indication of the economic impact of an activity takes these relationships into account. One way of doing this is through the use of an economic multiplier.

Employment multipliers were calculated for the crop production sectors in Grant and Stevens Counties.[6] The multiplier is referred to as a Type II multiplier, meaning that it considers both the direct and the indirect employment associated with that activity. The employment multiplier of 1.81 for Grant County, for example, is interpreted as indicating that for every one job in a crops production sector, there are an additional 0.81 jobs spread throughout the remainder of the economy that are connected to the one job in a very important way.[7]

The total employment impact associated with irrigation is obtained by multiplying the direct irrigation employment by the county crops production employment multiplier. Thus, it could be said that about 140 jobs across the Grant County economy are connected in some fashion to irrigated agriculture as are about 290 in Stevens County. Dividing the total direct and indirect employment by the number of irrigation wells suggests that on average about 0.3 jobs were associated with each irrigation well across the two counties.

Table 1. Production and Nominal Farm Value by Crop in Grant and Stevens Counties, 1995

	Farm Value, $	Production, bushels	$ per bushel
Wheat			
Grant	9,466,500	2,118,000	4.47
Stevens	7,602,700	1,701,000	4.47
Sorghum			
Grant	5,029,900	1,559,900	3.22
Stevens	10,368,600	3,219,100	3.22
Corn			
Grant	24,044,400	7,167,000	3.35
Stevens	38,473,700	11,468,000	3.35
Soybeans			
Grant	121,100	18,000	6.73
Stevens	107,600	16,000	6.73
	Farm Value, $	Acres Harvested	Farm Value per Acre, $
All Hay			
Grant	4,128,500	10,500	393.19
Stevens	3,094,500	8,400	368.39
Sunflowers			
Grant	234,800	2,800	83.86
Stevens	689,000	5,200	123.50

Table 2. Nominal Farm Value of Dry Land Crops by Crop in Grant and Stevens Counties, 1995

	Dry Land Acres	Bushels per Acre	Farm Value per Bushel, $	Total Farm Value, $
Wheat				
Grant	43,000	20	4.47	3,844,200
Stevens	35,000	14	4.47	2,190,300
Sorghum				
Grant	24,100	30	3.22	2,328,060
Stevens	63,100	40	3.22	8,127,280
Corn				
Grant	2,500	47	3.35	393,625
Stevens	600	30	3.35	60,300
		Farm Value per Acre, $		
All Hay				
Grant	10,500		393.19	4,128,495
Stevens	8,400		368.39	3,094,476
Sunflowers				
Grant	2,800		83.86	234,808
Stevens	5,200		132.50	689,000
TOTAL				
Grant				10,929,188
Stevens				14,161,356

Table 3. Nominal Farm Value of Irrigated Crops by Crop in Grant and Stevens Counties, 1995

	Irrigated Acres	Bushels per Acre	Value per Bushel, $	Total Crop Farm Value, $
Wheat				
Grant	47,000	31	4.47	6,512,790
Stevens	48,000	27	4.47	5,793,120
Sorghum				
Grant	12,500	71	3.22	2,857,750
Stevens	8,900	79	3.22	2,263,982
Corn				
Grant	49,400	145	3.35	23,996,050
Stevens	69,300	165	3.35	38,305,575
Soybeans				
Grant	400	45	6.73	121,140
Stevens	400	40	6.73	107,680
TOTAL				
Grant				33,487,730
Stevens				46,470,357

Table 4. Irrigated and Dry Land Farm Acres by Crop in Grant and Stevens Counties, 1995

	Irrigated Acres	Dry Land Acres	Percent of Total Dry Land Acres	Total Acres
Wheat				
Grant	47,000	43,000	51.9	90,000
Stevens	48,000	35,000	31.2	83,000
Sorghum				
Grant	12,500	24,100	29.1	36,600
Stevens	8,900	63,100	56.2	72,000
Corn				
Grant	49,400	2,500	3.0	51,900
Stevens	69,300	600	0.5	69,900
Soybeans				
Grant	400	0	0.0	400
Stevens	400	0	0.0	400
All Hay				
Grant	0	10,500	12.7	10,500
Stevens	0	8,400	7.5	8,400
Sunflowers				
Grant	0	2,800	3.4	2,800
Stevens	0	5,200	4.6	5,200
TOTAL				
Grant	109,300	82,900	100.0	10,929,188
Stevens	126,600	112,300	100.0	14,161,356

Table 5. Distribution of Irrigated Acres and Projected Nominal Farm Value of Dry Land Crops by Crop in Grant and Stevens Counties, 1995

	Irrigated to Dry Land Acres	Bushels per Acre	Farm Value per Bushel, $	Total Farm Value, $
Wheat				
Grant	56,289	20	4.47	5,032,237
Stevens	39,499	14	4.47	2,471,847
Sorghum				
Grant	31,588	30	3.22	3,051,401
Stevens	71,149	40	3.22	9,163,991
Corn				
Grant	3,279	47	3.35	516,279
Stevens	633	30	3.35	63,616
		Farm Value per Acre, $		
All Hay				
Grant	13,772	393.19		5,415,013
Stevens	9,495	368.39		3,497,863
Sunflowers				
Grant	3,716	83.86		311,624
Stevens	5,824	132.50		771,680
TOTAL				
Grant				14,326,554
Stevens				15,968,997

Table 6. Comparison of Estimated Nominal Dry Land, Irrigated and Net Farm Values Associated with Conversion to Dry Land Farming Systems in Grant and Stevens Counties, 1995

	Dry Land Farm Value, $	Irrigated Farm Value, $	Total Farm Value, $
Dry/Irrigated Acreage			
Grant	10,929,188	33,487,730	44,416,918
Stevens	14,161,356	46,470,357	60,631,713
Dry Land Acreage Only			
Grant	10,929,188	14,326,554	25,255,742
Stevens	14,161,356	15,968,997	30,130,353
Net Farm Value Due to Irrigation			
Grant			19,161,176
Stevens			30,501,360

	Estimated Direct Crop Employment	Estimated Increment of Farm Value Due to Irrigation, %	County Type II Employment Multiplier	and Indirect Employment Associated with Irrigation	Number of Irrigation Wells	Estimated Total Jobs per Irrigation Well
Grant	180	43.14	1.81	140.5	700	0.201
Stevens	327	50.31	1.78	292.8	746	0.393
Grant/Stevens	507	47.28	1.77	424.3	1,446	0.293

Endnotes

1. The impacts projected here must be considered in light of analysis limitations. Many of the limitations relate to the simplifying assumptions inherent in input-output analysis. Several of the important limiting assumptions are identified.

(A) The first assumption is that each firm uses a fixed "production recipe." All of the production, sales, employment, inter-industry trading, and income relationships are assumed to remain constant according to the patterns identified at the time the accounts were constructed. Any increase or decrease in the level of production is therefore assumed to follow a linear (proportionate) process. Changing the level of production creates no economies or diseconomies of scale, and there is no substitution of production inputs (such as reducing employment by adding more efficient equipment). This assumption has the general effect of over-estimating the projected impacts because it fails to recognize the adjustments that firms and individuals make in response to changes in prices, shortages of inputs, etc.

(B) All resources necessary for production (including labor) are assumed to be unlimited. Similarly, there are no unused or under-used local resources. This means all local businesses are currently at full capacity and there is never a shortage of new labor as it is needed. Any increase (decrease) in demand requires new hiring (firing) of employees. Unused capacity in firms and labor is not recognized. This assumption also tends to inflate impact estimates.

(C) Given that all economic relationships are assumed to remain constant, the best that the analysis can offer is a "snapshot" view of change. This means the impact estimates are most reliable for the short-term, for activities that are similar to what already exists in the economy, and for relatively small changes.

2. In general, a reasonable approximation of an economic impact area is the commuter-shed for the workers employed at a place of work or the trade area in which workers shop for household goods and services. This is because rural economies are quite "open," meaning that labor and trade readily cross county boundaries. Depending on the availability of goods and services, households and businesses typically travel to regional trading centers. The result is that the economic impacts quickly "leak" from a single county. A more realistic conception of economic impact must consider the larger region.

3. According to *Kansas 1996 Farm Facts*, 1995 was a year where both the yields and value of crop and hay/pasture production were down from the previous year. The assumption here is the overall magnitude of the relationship between dry land and irrigated agriculture farm values remains constant regardless of production levels or prices. This, of course, is unrealistic, especially in drought years. An alternative would have been to use three year price and

production averages.

4. This assumption was confirmed by the area crops specialist at the Southwest Area Extension Office.

5. The "job" referred to is an "average" job in the crops production sectors. It could be full-time or part-time, minimum wage or a highly paid job. No indication of "quality" is implied in the estimate.

6. Crop production sectors were defined as feed grains, food grains, and hay and pasture. In estimating the economic multipliers, crop producing sectors were aggregated and their regional purchase coefficients, which govern interregional trade relationships, were set to zero. This forced the model to import the maximum allowable quantities of these commodities to meet local demand rather than meeting demand through inter-industry sales. The implication of this is that it eliminates the problem of double counting the influence of aggregated economic sectors.

7. In the type of analysis used here, however, the indirect employment effects are likely to be exaggerated somewhat. The indirect impact consists of the cumulative effects of small "pieces" of jobs added across many firms and sectors. The analysis technique automatically assumes any increase in demand will require new employment when, in fact, many employers have the capacity to respond to new demand without hiring new employees.