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Agriculture and New Agricultural Policies in the Great Plains

The Great Plains will be affected by the 1996 farm legislation in important ways. The transition to the new law could increase demands for farm inputs and services in the Great Plains by $1.2 to $1.4 billion per year (3.8 to 4.6 percent)—enough to make the difference between decline and growth for many farm-related sectors. The residual returns to the farm sector may decline under the 1996 law if demands for agricultural products continue to grow at their historical rates. But residual returns to the sector could increase if demands grow at slightly more than their historical rates, as is likely with the progressive implementation of the North American Free Trade Agreement and World Trade Organization pacts liberalizing trade in agricultural products. Increasing the rate of growth of farm product demands by an average of 1.4 percent per year over less than 4 years would restore longrun net returns to the favorable levels of the 1995 base year.

The Great Plains, stretching from Texas to the Canadian border and the 98th meridian to the Front Range, is the region of the United States that depends most on agriculture and agricultural programs. The Federal Agricultural Improvement and Reform Act of 1996 (1996 farm legislation) redesigned Federal agricultural programs so that they rely less on partial Federal control and production subsidization of many commodities and more on a "freedom-to-farm" philosophy and increased market orientation. How these changes in the 1996 law may affect the agriculture and farm-related sectors of this important agricultural region is a major concern for the continued development of the Great Plains economy. Using a model of the Great Plains agricultural economy, this article projects the impact and longer term adjustments resulting from the 1996 law on (1) the level and composition of farm incomes, (2) commodity production adjustments, and (3) demands for purchased inputs, hired labor, land rent, interest, and capital replacement investments. Quantitative estimates of each of these measures can help gauge the role of agriculture and agricultural policy in the future of the Great Plains economy, and indicate further adjustments in Great Plains agriculture.

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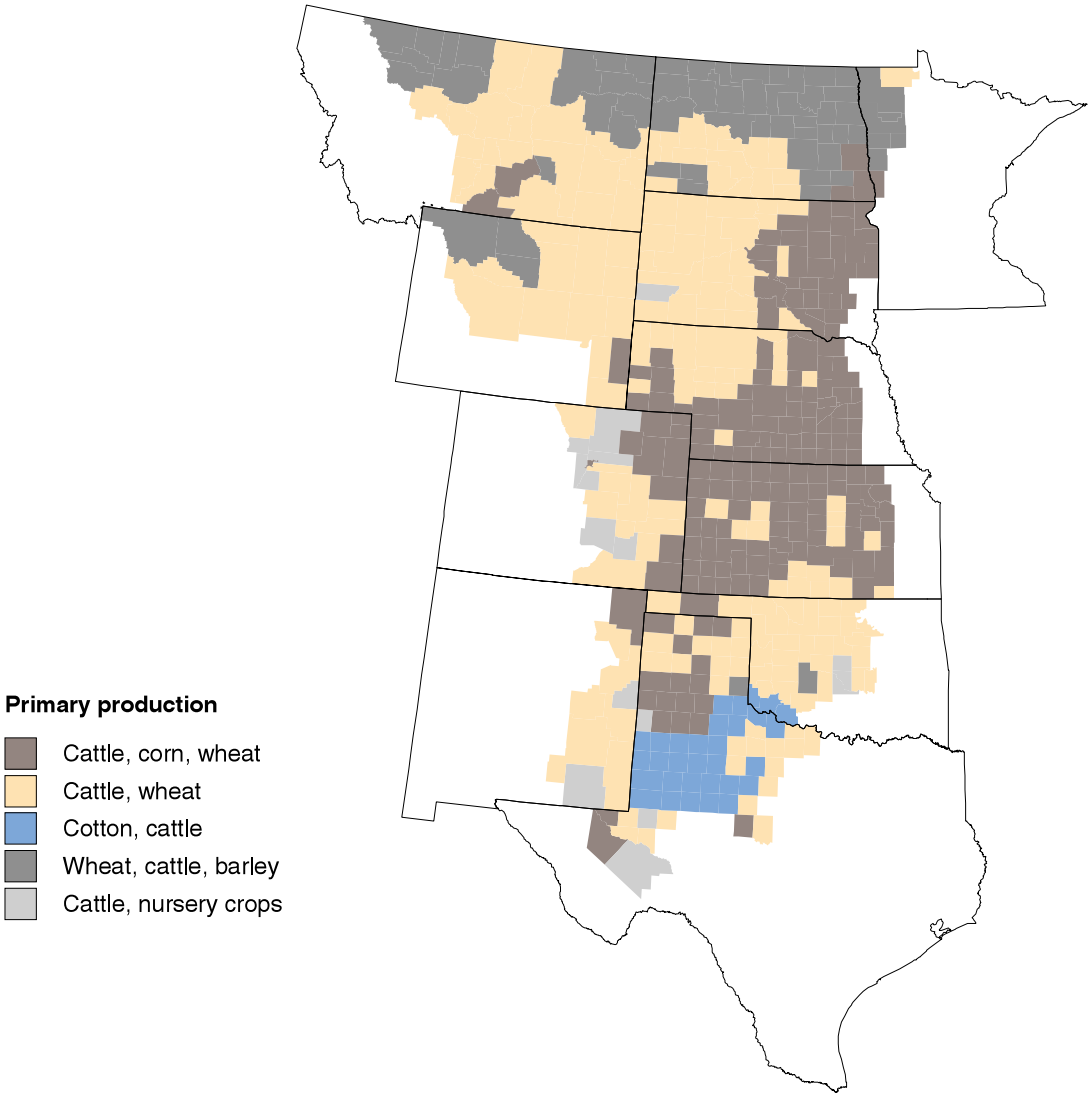
Great Plains Agriculture: Still "Home on the Range" but More Grain Crops

The Great Plains study region is delineated primarily along land resource and climatic zones to include the native mixed- and short-grass prairies. It is composed of 478 counties in 11 States. This region is the most agriculturally dependent in the United States; 58 percent of its counties are farm-dependent in the ERS county typology (where farming contributes at least 20 percent of labor and proprietors' income for the county; see fig. 2, p. 4). Fifty percent of all farm-dependent counties in the United States are in the Great Plains study area. The study area includes only 40 metro counties out of 478, or 8 percent. Many of these are on the western fringe of the study area, where the Great Plains meets the Front Range. In contrast, the rest of the United States has 795 metro counties out of 1,838, or 43 percent metro. For the seven States with the majority of their land area in the Great Plains region, agriculture makes up 5.5 percent of the gross domestic product (GDP) originating in the region—over three times as much as for the United States as a whole. State dependence on agriculture is highest in North

Figure 1

Farm production subregions of the Great Plains, 1992

The new Great Plains delineation includes 478 counties in 11 States; the five clusters are based on shares of sales of 20 commodities



Source: Calculated by USDA/Economic Research Service using data from the 1992 Census of Agriculture.

Dakota and South Dakota, at 10 percent of gross State product, and Nebraska, at over 8 percent of gross State product. The region leads in the production of beef and wheat. Beef production is primarily for the domestic market, but wheat is important in international trade, with 55 percent exported.

Historically, cattle ranching played a larger role in the Great Plains. It was the "Wild West," the home of cowboys, ranching, and open ranging. The rise of irrigated grain and cotton production, center-pivot systems and irrigation based on water from the Ogalala Aquifer, is a post-World War II phenomenon. As the nonfarm economy of the Great Plains has expanded, agricultural GDP has remained roughly constant, resulting in less dependence on agriculture than earlier in this century.

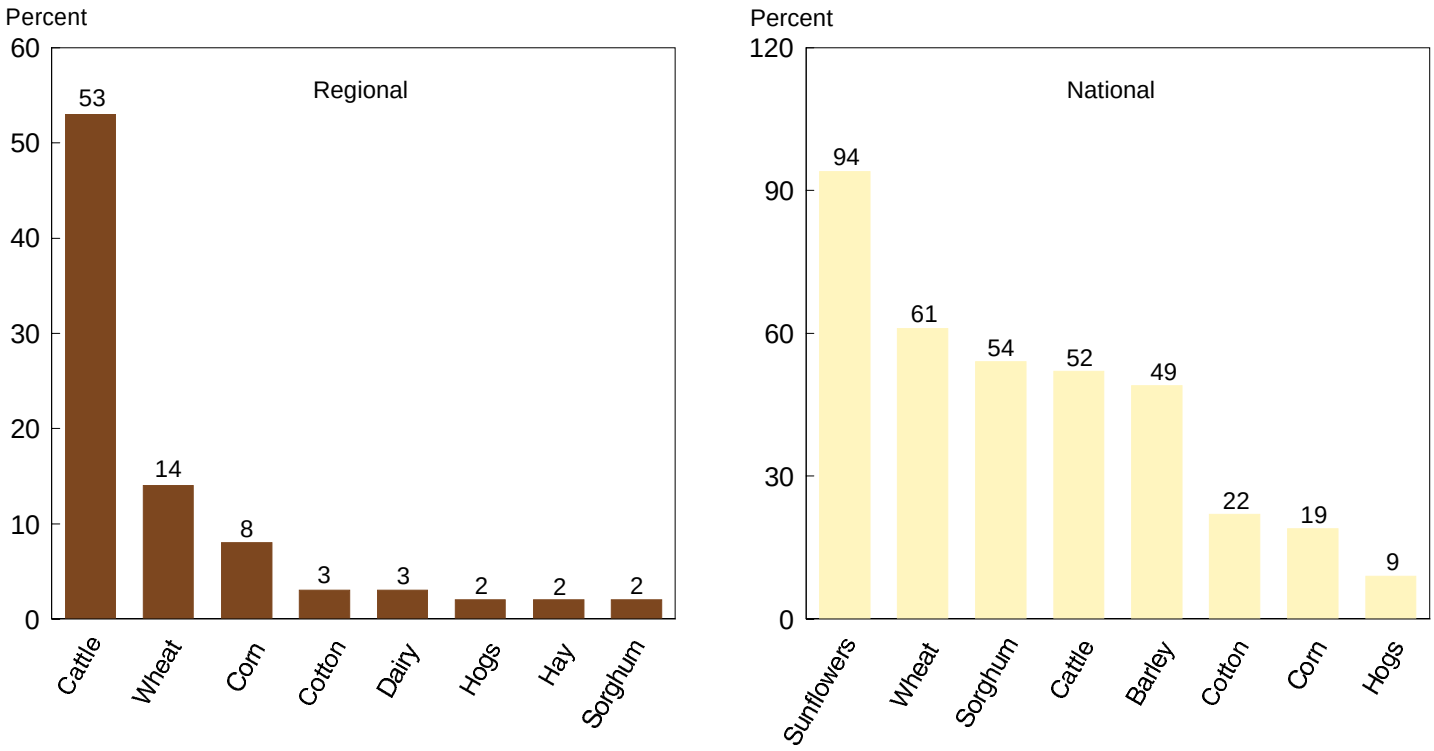
Agricultural development of the mixed-grass and shortgrass native cover zones has led to five subregions where different mixes of commodities predominate. Cluster analysis of county-level commodity production data from the 1992 Census of Agriculture reveals these five dominant commodity areas (fig. 1):

- ***Cattle, Corn, Wheat.*** This subregion contains most of the irrigated corn acreage. Its eastern edges can be thought of as the western fringes of the Corn Belt.
- ***Cattle, Wheat***. The southern cattle-wheat areas of Kansas and Oklahoma and the northern range cattle-

Figure 2

Great Plains commodity production, 1995

Cattle, wheat, and corn lead in production; sunflowers, grain, and cattle lead in national shares



Source: Calculated by ERS using data from the 1995 Farm Costs and Returns Survey.

wheat areas of the Dakotas, Montana, and Wyoming are different climatic regions within this cluster.

- ***Cotton, Cattle.*** In the Texas High Plains and the Edwards Plateau, cotton and cattle are the predominant commodities.
- ***Wheat, Cattle, Barley.*** The northern tier of three to four counties along the Canadian border is an area where wheat and barley are raised in fallow rotations. Range cattle are the primary livestock commodity.
- ***Cattle, Nursery Crops.*** In certain counties bordering metro areas, nursery crops become important adjuncts to range cattle and cattle feeding enterprises.

There are 254,000 farms in the study region, operating 348 million acres. Cropland comprises 160 million acres, pastured cropland another 28 million acres, and rangeland a further 160 million acres, exclusive of grazing land rented by animal unit months (AUM land). Few commodities are well-adapted to growing in the Great Plains. As a percentage of the value of regional production, cattle and calves rank first, at 53 percent; wheat is second, at 14 percent; corn third at, 8 percent; and all other commodities are less than 3 percent of the regional value of production. Nevertheless, this region accounts for the largest share of U.S. production of many commodities that are adapted to the Great Plains climates. It produces 61 percent of the value of national wheat production (fig. 2). Great Plains production of cattle and calves accounts for 52 percent of U.S. production. Other national production shares of important commodities include sunflowers (94 percent), sorghum (54 percent), barley (49 percent), cotton, (22 percent), and corn (19 percent).

Thirty-four percent of direct government commodity payments go to farms in the Great Plains study region. Dependence on direct government payments reaches its highest level in the Great Plains. Over 30 percent of gross farm income originates from direct government payments in parts of the northern Great Plains (where wheat and barley production are important) and in the High Plains of Texas and New Mexico (where cotton, corn, and sorghum are important). Clearly, the effects of the 1996 law will be felt most strongly in these areas.

The 1996 Farm Legislation: More Flexible Production

Among many changes made in the 1996 law, those most affecting the study region are the following:

- Decoupling most production decisions from program payments. Under previous legislation, deficiency payments were made to participating farmers when prices for supported commodities (corn, grain sorghum, wheat, barley, oats, rice, and cotton) fell below target prices. Under the 1996 law, the effective prices for these commodities

dropped from target price levels to market price levels—typically 6 to 15 percent lower.

- Eliminating authority for the government to control the supply of these commodities through limiting acreage. Under previous legislation, producers typically had to "set aside" a portion of their historical base production acreage to qualify for payments. Set-aside requirements varied between 0 and 15 percent depending on the commodity and year. Both bases and set-asides were eliminated under the 1996 law.
- Setting fixed Federal income support payments to farmers by applying payment schedules that decline over the life of the law to the farmer's historical base production. Farmers and landlords can share these "production flexibility contract" (PFC) payments, regardless of what commodities they produce, if any.
- Phasing down dairy price supports from $10.35 per hundredweight to $9.90 in 1999. Thereafter, they will be eliminated and a loan-storage program at the equivalent of $9.90 per hundredweight will be instituted for butter, nonfat dry milk, and cheese. These loans are to help processors manage inventories and stabilize farm-level demand for milk. They will accrue interest and must be repaid as commodities are drawn out of storage.
- Reauthorizing the Conservation Reserve Program (CRP) for up to 36 million acres of environmentally fragile lands. Under both the 1996 law and the previous legislation, farmers could enter into long-term contracts paying them an annual rent for qualifying highly erodible lands put into conserving uses. The 1996 sign-up for the extended CRP maintained approximately the same number of acres (19.5 million acres in the study area) as previously in the CRP.

Other provisions of the 1996 law affecting trade may have an influence on international demands for Great Plains agricultural products. But the passage of the North American Free Trade Agreement (NAFTA) and the World Trade Organization (WTO, formerly GATT) agreement will have more influence on the markets for agricultural products. Many additional details on the implementation of the above broad policies are specified in the law, but they do not alter the major thrusts outlined here.

Effects of the 1996 Farm Legislation on the Great Plains: Output Expands and Land Owners Gain

Several questions arise about the effects of the 1996 law. (1) How will production and input use in the Great Plains adjust to the changed relative prices for formerly supported commodities? (2) How will the level and composition of farm incomes change with the change from deficiency payments to production flexibility contract (PFC) payments? (3) How will these changes affect agriculture's demands for goods and services from the nonfarm economy?

The Great Plains acreage and production of commodities for the 1995 base year, forecasts for 1996 and 1997, and projections for 2000 under two alternative demand growth scenarios are shown in table 1. The levels of direct government payments to the Great Plains agricultural sector (middle of table 2) show that government transfers to the sector change little over the life of the law. The production flexibility contract payments follow the pattern mandated in the law and are slightly higher in the initial years than the deficiency payments that would have been paid under the previous legislation. The Conservation Reserve Program continues unchanged over the 7 years, with the 19.5 million acres enrolled in the Great Plains accounting for $545 million of direct payments per year.

Incomes Under the 1996 Legislation: Balanced on a Knife Edge of Demand Growth

Since net incomes of farms and farm families largely determine the consumption and investment demands of the farm sector, we concentrate our analysis primarily on these measures, and the contribution of demand growth to them. The demands of the agricultural sector for inputs from the rest of the Great Plains economy can be assessed by changes in the income and expense components of the farm sector, our second focus.

These results are regional aggregates and averages. In the agricultural sector, incomes and rates of return vary widely based on sizes of farms, productivity of resources, off-farm opportunities, and skills of the operator family. A low average income or rate of return does not imply that all farms or families get that return. Those with more favorable resources, skills, or market positions can still be earning favorable incomes. Those with less favorable resources, skills, or market positions will find their incomes squeezed even at higher average levels of return. The aggregates and averages show tendencies, trends, and relationships—not absolute levels applicable to all farms or families.

Farm Net Incomes Will Depend on Demand Growth and Land Rental Costs

The two measures of farm income we use are (1) shortrun net cash farm income and (2) longrun residual returns to the farm sector. Shortrun net cash income measures the net cash incomes of farms after paying for annual purchased inputs, hired labor, land rent, and farm overhead expenses. It does not include nonmoney income sources, such as changes in farm inventories, the value of home-consumed products, or the implicit rental value of farm dwellings. It does not cover replacement of capital items as they depreciate because these expenses can be postponed in the short run.

Longrun residual returns to the farm sector shift the focus from farm operators to the farm sector. The nonmoney income sources are included in residual returns to give a full accounting of the returns to all factors of production. Shifting the focus to the long run means that capital replacement costs (depreciation) must be covered in addition to the shortrun expense items. While land rental payments are an expense from the operator's point of view, these payments are part of the residual return to all assets used in the farm sector and are added back into the sector returns.

The 1996 levels of farm net income are not greatly changed from those of 1995 (table 2). Both were years of favorable prices, and revenues, including 1996 PFC payments, were only slightly larger than revenues would have been if the previous legislation had been continued. Aggregate shortrun net cash incomes for the Great Plains increased slightly less than 3 percent, from $5.65 billion to $5.80 billion. For the average Great Plains farm operator, this amounted to an increase from $22,188 to $22,809. The longrun residual returns to the sector increased nearly 14 percent.

In the 1997 forecast, net cash incomes of farm operators decline almost 15 percent while residual returns to the farm sector decline over 5 percent. These results reflect the increased production and lower prices for wheat, corn, and soybeans currently forecast for 1997.

For the longrun, normal-price scenario with average demand growth and average PFC payments of 1998 through 2002, shortrun net cash incomes of farm operators decline 29 percent while longrun residual returns to the sector decline 18 percent. On a per farm operator basis, this implies a very restricted average net cash farm income of $15,855 per year—significantly less than historical averages. With increased rates of demand growth for agricultural products, shortrun net cash incomes still decline nearly 11 percent while longrun residual returns to the sector remain constant. The reduction in net cash farm income with increased demand growth is equal to the increase in rent paid, implying that the increased land rents are coming at the expense of decreased returns to farm operators. In the future, rental contracts may be further renegotiated to restore the historical balance by returning more income to operators and less to landlords. These results show the agricultural sector's critical need for market growth. The difference between prosperity and recession for the farm sector rests on whether demand expands slightly faster than output growth, or the other way around.

Household Net Incomes May Decline, Even with Increased Demand Growth

Farm household incomes are measured by (1) shortrun household net cash-flow and (2) longrun household net income. Shortrun household net cash-flow starts with the shortrun net cash farm income of operators, adjusts for income paid to nonfarm households, adds the off-farm income of operators, and subtracts an estimate of their actual household living expenses. This creates a measure of the cash available to operator families in a given year to cover capital replacement, savings, and investment. It differs from the standard ERS measure of household income in that it does not allow for depreciation and it substracts estimated household living expenses. Because of multiple-operator farms, there are on average 1.1 operators per farm. Longrun household net income follows the methods used in the U.S. Department of Commerce's Current Population Survey and the ERS farm household income series. It starts with net cash farm business income, subtracts depreciation and income paid to other households, adds the household's farm-related earnings (wages paid to household members and income received from other farms), and adds the off-farm income of operators and household members. This creates a measure of longrun returns to farm families after paying for factors supplied from outside the household. This is a measure of the returns to the land, labor, and capital resources supplied by the farm household—whether used on or off the farm.

Shortrun household net cash-flow remained very stable in the transition from the previous legislation to the 1996 legislation, averaging over $16,000 per household in 1996, for total household cash-flow of nearly $4.5 billion for the Great Plains region. However, in the 1997 forecast, household net cash-flow declines 20 percent from the 1995 base, reflecting more normal household income prospects. Under the average-demand growth scenario for the remainder of the 1996 law, regional aggregate household net cash-flow drops 38 percent, from $4.4 billion to $2.7 billion. Household net cash-flows are depressed to an average of $9,650 per household. Such a low level would imply little cash available for capital replacement or investment, restricted current consumption, and very limited purchases of consumer durables. Even with increased demand growth to 2000, shortrun household net cash-flows remain depressed 14 percent below their 1995 levels.

1996 is a more favorable year than the 1995 base year in levels of longrun household net income. Longrun household net income increases under the 1996 law because it makes larger direct payments to the agricultural sector in the early years than would have been paid under the previous legislation. The forecast for 1997 shows longrun household net income dropping 7 percent to levels less

Table 1

Commodity production adjustments: Great Plains, forecast 1996 and 1997, and projected 2000 with average and increased demand growth

Commodity production generally increased in response to higher prices and reduced set-asides

Item	Base 1995	Under 1996 law: Forecast 1996	Change from 1995	Forecast 1997	Change from 1995
	Million acres		Percent	Million acres	Percent
Commodity acreage:					
Corn	11.14	12.10	8.62	11.55	3.68
Soybeans	5.02	5.42	7.97	5.63	12.15
Wheat	43.67	45.91	5.13	43.81	.32
Barley	3.88	4.52	16.49	4.24	9.28
Oats	.30	.46	53.33	0.71	136.67
Sorghum	5.21	5.88	12.86	5.53	6.14
Cotton	4.55	4.10	-9.89	3.71	-18.46
Sugar beets	.54	.54	0	.55	1.85
Potatoes	.04	.04	0	.07	75.00
Dry beans	.84	.84	0	.84	0
Sunflower	2.32	2.34	.86	3.19	37.50
Canola	.50	.51	2.00	.36	-28.00
Hay	23.81	23.98	.71	18.39	-22.76
Crops NEC	3.11	3.11	0	3.15	1.29
Fallow	32.32	32.53	.65	33.19	2.69
Set-aside acreage	5.01	0	-100.00	0	-100.00
CRP land	19.56	19.56	0	19.56	0
Total land in crops	161.82	161.84	.01	154.48	-4.54
Pasture	26.20	26.20	0	33.52	27.94
Range	160.00	160.00	0	160.00	0
			Million head		
Livestock production:					
Cow-calf	23.57	23.40	-.72	23.37	-.85
			Million hundredweight		
Fed beef	194.70	193.22	-.76	193.03	-.86
Hogs	21.53	21.20	-1.53	21.52	-.05
Dairy	83.84	81.82	-2.41	83.11	-.87
			Million dollars		
Sheep, lambs, wool	315.75	313.95	-.57	282.04	-10.68
Livestock NEC	246.33	246.31	-.01	246.31	-.01

See notes at end of table.

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buoyant than those of 1995 and 1996. The average-demand growth scenario for 2000 shows longrun household net income depressed by nearly 14 percent, while the increased growth scenario shows a reduction of 11 percent from the 1995 base. These levels continue to show that farm household net incomes will be somewhat squeezed by the increased land rental payments landlords have achieved under the 1996 law.

Income available for household living expenses is less than off-farm income sources, implying that, on average, the off-farm income sources are providing not only the cash living needs of the household but also a cash infusion to the farm business. The cash infusions to the farm business from off-farm sources increase when production or market conditions are unfavorable and decrease when they are favorable.

Table 1

Commodity production adjustments: Great Plains, forecast 1996 and 1997, and projected 2000 with average and increased demand growth—Continued

Mix of commodities produced returns to historical patterns under average or increased demand growth

Item	Base 1995	Under 1996 law: Projected 2000 with average demand growth	Change from 1995	Projected 2000 with increased demand growth	Change from 1995
	Million acres		Percent	Million acres	Percent
Commodity acreage:					
Corn	11.14	10.93	-1.89	11.23	.81
Soybeans	5.02	5.22	3.98	5.22	3.98
Wheat	43.67	45.54	4.28	45.57	4.35
Barley	3.88	4.15	6.96	4.09	5.41
Oats	.30	.50	66.33	.40	33.33
Sorghum	5.21	5.38	3.26	5.38	3.26
Cotton	4.55	4.04	-11.21	4.78	5.05
Sugar beets	.54	.55	.93	.55	1.85
Potatoes	.04	.05	12.50	.05	25.00
Dry beans	.84	.84	0	.84	0
Sunflower	2.32	2.38	2.59	2.38	2.59
Canola	.50	.55	9.20	.55	10.00
Hay	23.81	25.21	5.88	25.21	5.88
Crops NEC	3.11	3.14	.96	3.14	.96
Fallow	32.32	33.79	4.55	32.88	1.73
Set-aside acreage	5.01	0	-100.00	0	-100.00
CRP land	19.56	19.56	0	19.56	0
Total land in crops	161.82	161.82	0	161.83	0
Pasture	26.20	0	26.20	0	
Range	160.00	0	160.00	0	
		Million head			
Livestock production:					
Cow-calf	23.57	23.69	.51	23.70	.55
		Million hundredweight			
Fed beef	194.70	195.71	.52	195.73	.53
Hogs	21.53	21.58	.23	21.58	.23
Dairy	3.84	84.63	.94	84.65	.97
		Million dollars			
Sheep, lambs, wool	315.75	317.17	.45	316.32	.18
Livestock NEC	246.33	246.31	-.01	200.69	-18.53

NEC = Not elsewhere classified.
Source: Calculated by ERS using data from the 1995 Farm Costs and Returns Survey.

Input Usage: The Law Will Increase Demands for Goods and Services

Regional expenditures for inputs indicate the changes in demands for agricultural inputs entailed in the adjustments to the 1996 law. The aggregate change in all agricultural inputs and services is an increase of $1.2 to $1.4 billion, or 3.8 to 4.6 percent, for the region. Many of the expenditure components appear to change relatively little over the course of the law (1 to 3 percent) because the aggregate level of input use changes relatively little as farms substitute one commodity for another to adjust to the changed relative prices. Great Plains farm gross revenue would decrease only 0.75 percent by 2000 under the average growth scenario and would increase only 2.7 percent under the increased growth scenario. Nevertheless, the aggregate change represents a significant addition to

Table 2

Great Plains adjustments to the 1996 farm law: Income and input usage

1996 continued favorable conditions of 1995; 1997 incomes declined despite increased input use

Item	Base 1995	Under 1996 law: 1996 actual	Change from 1995	1997 forecast	Change from 1995
Farm net income measures:					
Shortrun net cash farm income	$5,648M	$5,805M	2.78%	$4,807M	-14.89%
Average per farm	$22,188	$22,809	na	$18,884	na
Longrun sector residual returns	$5,486M	$6,239M	13.73%	$5,188M	-5.43%
Average per farm	$21,552	$24,510	na	$20,381	na
Household net income measures:					
Shortrun household net cash-flow	$4,372M	$4,485M	2.58%	$3,500	-19.95%
Average per operator household	$15,648	$16,052	na	$12,527	na
Longrun household net income	$10,494M	$10,854M	3.43%	$9,809M	-6.53%
Average per operator household	$37,559	$38,848	na	$35,107	na
Direct government payments:					
Total direct payments	$1,864M	$2,057M	8.62%	$1,994M	5.82%
Deficiency/PFC payments	$1,319	$1,512	11.40%	$1,449	7.70%
Average per farm	$5,182	$5,953	na	$5,705	na
CRP payments	$545M	$545M	0%	$545M	0%
Average per farm	2,142	2,147	na	2,147	na
Expense components:					
Hired labor	$1,500M	$1,507M	.47%	$1,480M	-1.33%
Average per farm	$5,893	$5,920	na	$5,814	na
Purchased variable inputs	$16,784M	$17,040	1.53%	$17,044M	1.55%
Average per farm	$65,936	$66,942	na	$66,957	na
Capital replacement purchases	$2,767M	$2,852M	3.07%	$2,905M	4.99%
Average per farm	$10,870	$11,204	na	$11,412	na
Rent paid	$1,835M	$2,516M	37.11%	$2,516M	37.11%
Average per farm	$7,209	$9,884	na	$9,884	na
Fixed expenses paid	$5,437M	$5,506M	1.27%	$5,677M	3.11%
Average per farm	$21,359	$21,630	na	$22,302	na
Interest on borrowed capital	$1,991M	$2,042M	2.56%	$2,084M	4.67%
Average per farm	$7,822	$8,039	na	$8,187	na
Total: All expense components	$30,314M	$31,463M	na	$31,706M	na
Absolute change from base	na	$1,149M	3.79%	$1,392M	4.59%
Off-farm income	$7,705M	$7,640M	-.84%	$7,658M	-.61%
Average per operator household	$27,577	$27,344	na	$27,409	na

See notes at end of table.

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demands for agricultural inputs as a result of the 1996 law. The projected increases in demand for agricultural inputs and services counteract the declines of the last 10 years in total input use in Great Plains agriculture and can spell the difference between decline and growth in many agricultural input supplying sectors.

One expenditure category that increased significantly over the course of the law is land rent (37 percent). Land rent increases because the increased share of cash PFC payments won by landlords is included in this expenditure category. Landlords apparently have been more successful in capturing a greater proportion of the cash PFC payments than they had been in capturing the less concrete returns under the target price and deficiency payment system of the previous legislation.

Hired Labor. Hired labor demands increased slightly in 1996 in response to reduced set-aside acres and increased production of all crops, except cotton. In 1997, hired labor demand is forecast to decline slightly from its 1996 levels, due to less labor-intensive crops being substituted for more labor-intensive crops as their relative prices change. In 2000, hired labor demands again increase by 1.5 to 1.7 percent. A 1-percent increase in hired labor rep-

Table 2

Great Plains adjustments to the 1996 farm law: Income and input usage—Continued

Incomes fall significantly under average demand growth

Item	Under previous legislation	Under 1996 law: Projected 2000 with average demand growth		Under 1996 law: Projected 2000 with increased demand growth	
	Base 1995	Level	Change from 1995	Level	Change from 1995
Farm net income measures:					
Shortrun net cash farm income	$5,648M	$4,036M	-28.54%	$5,043M	-10.71%
Average per farm	$22,188	$15,855	na	$19,811	na
Longrun sector residual returns	$5,486M	$4,488M	-18.18%	$5,486M	0%
Average per farm	$21,552	$24,510	na	$20,381	
Household net income measures:					
Shortrun household net cash-flow	$4,372M	$2,695M	-38.36%	$3,752M	-14.18%
Average per operator household	$15,648	$9,646	na	$13,429	na
Longrun household net income	$10,494M	$9,077M	-13.50%	$9,325M	-11.14%
Average per operator household	$37,559	$32,487	na	$33,375	na
Direct government payments:					
Total direct payments	$1,864M	$1,864M	0%	$1,864M	0%
Deficiency/PFC payments	$1,319M	$1,319M	0%	$1,319M	0%
Average per farm	$5,182	$5,193	na	$5,193	na
CRP payments	$545M	$545M	0%	$545M	0%
Average per farm	$2,142	$2,142	na	$2,142	na
Expense components:					
Hired labor	$1,500M	$1,523M	1.53%	$1,525M	1.67%
Average per farm	$5,893	$5,983	na	$5,991	na
Purchased variable inputs	$16,784M	$16,984M	1.19%	$17,062M	1.66%
Average per farm	$65,936	$66,722	na	$67,028	na
Capital replacement purchases	$2,767M	$2,835M	2.46%	$2,844M	2.78%
Average per farm	$10,870	$11,137	na	$11,173	na
Rent paid	$1,835M	$2,516M	37.11%	$2,516M	37.11%
Average per farm	$7,209	$9,884	na	$9,884	na
Fixed expenses paid	$5,437M	$5,533M	1.77%	$5,677M	1.78%
Average per farm	$21,359	$21,736	na	$21,740	na
Interest on borrowed capital	$1,991M	$2,084M	4.67%	$2,084M	4.67%
Average per farm	$7,822	$8,187	na	$8,187	na
Total: All expense components	$30,314M	$31,475M	na	$31,565M	na
Absolute change from base	$1,161M	na	3.83%	$1,251M	4.13%
Off-farm income	$7,705M	$7,606M	-1.28%	$6,853M	-11.06%
Average per operator household	$27,577	$27,344	na	$27,409	na

na = Not applicable.

Source: Calculated by ERS using data from the 1995 Farm Costs and Returns Survey.

resents a $17.6-million addition to the farm labor demands in the Great Plains.

Annual Purchased Inputs. The largest component of expenditures is purchases of annual production inputs. These amount to around $17 billion or $66,000 per farm each year. A 1-percent increase in purchased inputs represents $170 million per year to the region. Under each scenario, purchased inputs increase by 1.2 to 1.7 percent, due to using formerly set-aside acres and substituting more input-intensive crops for less input-intensive crops.

Capital Replacement Purchases. Replacement of capital items to offset annual depreciation of machinery and equipment represents an additional $2.8 to $2.9 billion to the Great Plains economy and a cost of $11,000 dollars to the average farm. Capital replacement purchases increase 3.1 to 5.0 percent in the transition to the 1996 law.

Analytic Methods

This analysis employs new extensions of techniques for modeling economic adjustments and supply response, building upon positive mathematical programming methods. In simplified form, the analyst constructs a model of the production, onfarm use, and demand for each agricultural product in the study region to produce a regional income and expenditure statement. Survey data from ERS's Farm Costs and Returns Surveys for 1995 provide a description of the farms and their production of various commodities. ERS's cost of production accounting systems are used to specify the 1995 average costs and input usage for each of these commodities. The resulting model is calibrated to accurately reproduce the base year production, demands, prices, and incomes. It is then solved for scenarios representing the changes in prices and policies. All prices and quantities and incomes and expenditures adjust simultaneously to a new solution. Comparing model results and operating statements of the various scenarios to the base year shows how the agricultural economy would likely adjust production, input use, prices, incomes, and expenditures.

Model Validation: Tracking USDA Forecasts

Calibration of the model to the 1995 base year under the previous legislation is accurate to a value-weighted mean error of 0.87 percent. Major commodities, such as cow-calf, fed beef, wheat, corn, and soybeans have calibration errors of less than 2 percent. Calibration errors among minor commodities range to over 50 percent, but the total land involved in these errors is less than a million acres. Hay production has a calibration error of nearly 23 percent, resulting from using slightly more land in hay production for greater than actual regional exports of hay.

We conducted three validation tests on the model: (1) forecasting the 1996 actual commodity adjustments of the region under the 1996 law, (2) tracking the 1997 USDA forecast, and (3) tracking the 2000 USDA baseline projection. The model performed well on all three tests, giving value-weighted mean forecast errors of 0.41 percent, 1.10 percent, and -1.44 percent. Forecast errors for major commodities remained below 4 percent and minor commodity errors centered near zero over all validation tests for each minor commodity for which a USDA forecast was available. This forecasting performance matches or exceeds the reliability of national econometric forecasting models, such as USDA's FAPSIM Model, or the University of Missouri's FAPRI Model.

Replacement of capital items is usually a periodic event, undertaken when revenues are favorable and suspended when revenues are unfavorable. Because of this, expenditures for capital replacement are highly volatile, being severely depressed in unfavorable times and buoyant in favorable times.

Land Rent. Land rental payments, in cash and shares of crops, total $1.8 billion or $7,200 per farm in the base year. With the shift to cash PFC payments, landlords have renegotiated rental contracts to increase their share of the PFC payments. Land rent paid increased by more than 37 percent with the introduction of PFC payments in the 1996 law. Part of this may be attributable to the fact that both 1996 and forecast 1997 were relatively favorable years. By 2000 under both the average growth and the increased demand growth scenarios, the increase in land rent comes at the expense of diminished operator net cash income. Thus, there is likely to be another round of renegotiating of rental contracts to reduce them to nearer the historic split of income between landlords and operators.

Fixed Expenses Paid. Fixed farm overhead expenses, such as insurance, taxes, general farm supplies, repairs, and services, represent another $5.5-billion demand for goods and services by the farm sector, or $21,000 to $22,000 for the average farm (table 2). Demands for goods and services in the fixed-expense-category increase 1.3 to 3.1 percent under the 1996 law.

Interest on Borrowed Capital. Interest on borrowed capital amounts to approximately $1.9 billion in the 1995 base year, or $7,800 for the average farm. This level of interest cost is consistent with about $100,000 of debt per farm, and a debt/asset ratio of 18 percent—approximately the average for the Great Plains. The transition to the 1996 law increases interest paid by 2.6 to 4.7 percent.

Changes in demand for some expenditure components are not strong in the adjustment to the 1996 law. However, the law was enacted at a time when only a relatively few acres were idled in the Great Plains—5 million acres. Had the acreage of land idled been large in 1995, the effects of the law on input demand would have been much stronger. Policies restricting land use (such as set asides and the CRP) restrict the throughput of the sector and significantly affect the demands for goods and services by the farm sector.

Off-Farm Incomes Decline Slightly; Household Consumption Expenditures Squeezed

Off-farm incomes decline slightly because more operator and household labor is needed to operate the 5 million acres of cropland set aside under previous legislation but freed up for production under the 1996 law. The unresponsiveness of off-farm incomes to the 1996 law indicates that taking additional off-farm employment that is competitive with fully operating existing farm resources is generally uneconomic. In reality, off-farm employment would probably respond positively to the squeezed household incomes, but only when it could do so without diminishing the operator and household labor committed to farming.

Table 3

Demand shifts necessary to restore longrun residual returns

Less than 4 years at a high-demand growth rate will restore the favorable conditions of 1995

Item	Under 1996 law		
	Demand shift needed	1980-94 growth rate	Time needed at doubled growth rate
	Percent		Years
Commodity:			
Corn	5.25	2.00	2.58
Soybeans	3.93	2.32	1.70
Wheat	8.24	2.00	4.00
Barley	5.26	2.00	2.59
Oats	5.26	2.00	2.59
Sorghum	5.26	2.00	2.59
Cotton	6.44	3.93	1.62
Sugar beets	.44	1.72	.26
Potatoes	-.45	2.86	na
Dry beans	1.00	2.32	.43
Sunflower	2.73	2.32	1.16
Canola	5.74	2.32	2.43
Hay	9.24	2.00	4.46
Crops NEC	.42	2.25	.20
Livestock production:			
Fed beef (million hundredweight)	1.39	.38	3.64
Hogs (million hundredweight)	.55	.38	1.45
Dairy (million hundredweight)	2.02	1.16	.74
Sheep, lambs, wool (million dollars)	.76	.38	2.00
Livestock NEC (million dollars)	-1.26	1.38	na
Value-weighted demand shift (percent)	3.23	na	na
Average demand growth, 1980-94	na	1.38	na
Value-weighted average years to attain growth	na	na	3.26

na = Not applicable.
NEC = Not elsewhere classified.
Source: Calculated by ERS using data from the 1995 Farm Costs and Returns Survey.

Income available for household consumption, investment, and savings (the income side of family net cash-flow) is severely squeezed if anticipated demand growth to 2000 does not materialize. Even under the increased growth scenario, the income side of family net cash-flow declines by the amount of increased land rental payments. Farm families typically increase consumption expenditures in favorable times and cut back considerably in unfavorable times, making sales of household consumption goods quite responsive to changes in income available for household consumption.

How Much Growth Is Needed To Offset Declining Net Returns?

Over recent years, effective demands for agricultural commodities have tended to increase at average rates near 1.5 percent per year. However, with the concluding of the NAFTA and WTO trade agreements, the 1996 law was predicated on increased demand growth due to greater access to international markets. The question arises: How much demand growth would be necessary to compensate for the policy changes in the 1996 law? Table 3 shows the percentage demand shifts needed, by commodity, to restore the 1995 base level of longrun residual returns to the sector at historic relative prices. At these relative prices, no commodity or subregion is at an advantage or disadvantage relative to the base year. To compensate for the shift from the previous legislation to the 1996 law, demands for major crops would have to increase by amounts ranging from 9 percent (hay), to 8 percent (wheat), to 6 percent (cotton). Corn, sorghum, barley, and oats would have to increase by 5 percent; and demands for other crops would have to increase less than 5 percent. Livestock commodities would need much smaller demand shifts—1.4 percent for beef, 0.6 percent for hogs, 2.0 percent for dairy, and 0.76 percent for sheep, lambs, and wool. The value-weighted average growth rate needed is 3.23 percent (table 3).

Complicating the needed increase in demand is the fact that agricultural output has historically grown at an average rate of 1.4 percent per year, due to productivity

growth. Increased productivity offsets the increased demand, historically requiring almost all of the annual growth in demand just to keep residual net returns to the farm sector from declining. Reaching the needed net demand growth for each commodity, after compensating for its historic output growth, would require doubling the rate of demand growth for each commodity for an average of 3.26 years. Hay, wheat, and beef would require longer periods; and grains and oilseeds would require shorter periods.

Conclusions

With the passage of the 1996 farm law, traditional methods of supporting agricultural prices and incomes continued their transition towards more market orientation and less government control of commodity production. The law was passed at a time when agricultural prices and incomes were relatively favorable and prospects for growth in demand for agricultural commodities were buoyant because new international trade agreements, WTO and NAFTA, were being implemented. The effects of the 1996 law on the Great Plains agricultural economy will be to increase demands for farm inputs and services by $1.2 to $1.4 billion per year (3.8 to 4.6 percent) as the land formerly idled to comply with production control programs comes back into production and farmers adjust their enterprise mixes to the changed relative prices for formerly supported commodities.

With the change from target prices and deficiency payments under the previous legislation to fixed cash production flexibility contract payments under the 1996 law, land owners have been successful in obtaining a larger share of government payments. The increase in rental payments seems to have come at the expense of decreased returns to farm operators

How the change in policy will affect farm incomes and farm household incomes crucially depends on the rate of growth of markets. If demands for agricultural commodities grow at their historical rates, farm and farm household incomes will decline by 28 to 38 percent over the duration of the law. If markets grow at double their historical rates, as appears likely with the new international trade agreements, residual returns to the farm sector can reach the relatively favorable levels of the 1995 base year in less than 4 years. Such a doubling of the historical growth rates for commodity demands requires a weighted average increase in growth rates of only 1.4 percentage points per year—well within the annual fluctuations in demand due to weather and market conditions.
However, unless land rental contracts are further renegotiated to restore a more traditional split of income between operators and landlords, net farm income and net household incomes will likely remain below 1995 levels.

For Further Reading . . .

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