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Paper Title: Economic Impact of Crop Insurance on the North Dakota State Economy

Abstract: An input-output model was used to estimate the direct and indirect economic effects of crop insurance on the North Dakota economy. Crop insurance indemnities paid to farmers result in an annual average increase (preservation) in business sales, personal income and GSP of \$211 million, \$94 million, and \$104 million, respectively.

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Economic Impact of Crop Insurance on the North Dakota State Economy

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An input-output model was used to estimate the direct and indirect economic effects of crop insurance on the North Dakota economy. Crop insurance indemnities paid to farmers result in an annual average increase (preservation) in business sales, personal income and GSP of \$211 million, \$94 million, and \$104 million, respectively.

Economic Impact of Crop Insurance on the North Dakota State Economy

Introduction

The Federal Agricultural Improvement and Reform (FAIR) Act of 1996 fundamentally redesigns farm income support programs. The legislation represents a sharp departure from the supply management and income support strategies that have characterized farm programs since the 1930s. The legislation decouples government farm subsidy payments from both price considerations and supply management. The most important features of the FAIR Act are the cut in governmental spending on farm price-income support, and the provision to allow farmers virtual production flexibility without limiting the type of crops that can be planted or requiring that acreage be idled.

U.S. agriculture is expected to be in transition to market-oriented production through the period specified in the FAIR Act. More risk is being transferred to farmers from the federal government. To smooth the transition, the legislation provides a pool of federal funds from which program participants can receive a fixed and declining annual transition payment. The intent of the law is to have farmers more dependent on the marketplace for income and risk management strategies.

Agriculture is an important industry, providing the economic base for many rural communities. Agriculture provides income and employment both directly and indirectly for millions of rural residents. As the FAIR Act is implemented, all residents and communities will be affected. With less government support, farmers will be operating in a more risky environment. Farmers will have greater flexibility in responding to market signals, thus leading to greater volatility in commodity production and prices. The

government will provide less protection from low commodity prices, and the likelihood that the government will provide disaster payments is also reduced. In fact, farmers in government programs who do not obtain Catastrophic Risk Protection must agree to waive any eligibility for emergency crop loss assistance on uninsured crops.

Crop insurance is an important risk management tool that can be used by producers to help mitigate the increased risk associated with the FAIR Act. The fact that Congress did not eliminate crop insurance programs suggests they expect crop insurance to play a vital role in the future. It is important to understand how farmer participation in crop insurance will help rural communities adjust to the reduced government support to agriculture.

Changes in farm program benefits may directly affect agribusiness firms, transportation, processing and marketing firms in a rural community and surrounding areas. Local retail trade and services may also be affected, either directly or indirectly, by changes in the agricultural community. These changes are multiplied throughout an entire regional economy, particularly in areas that are highly dependent on agriculture. Rural communities benefit directly and indirectly from the infusion of crop insurance money. This is particularly valuable because it helps cover bad income years in agriculture. Also, producers benefit from crop insurance payments indirectly. Many farmers depend on off-farm income to supplement farm income. In general, a strong local economy provides more opportunities for farm families to supplement their income.

This study investigates the impact crop insurance has on the North Dakota state economy. Yearly crop insurance premiums and indemnities are obtained from the

National Crop Insurance Council. This information is summarized within the state over the last 10 years. The computer-based, input-output model, IMPLAN (IMpact Analysis for PLANning) will be used to estimate the direct and indirect economic effects of crop insurance. In particular, the focus is on the link between the crop insurance payments received by agriculture firms and the other business sectors within the region. The strength of this linkage is reflected in estimates of the total state value of business sales, state employment, and personal income. These effects are expressed as coefficients and referred to as economic multipliers. Multipliers showing the total effects on sales, income and employment are used to translate crop insurance payments into state economic impacts.

Multiple Peril Crop Insurance

Coble provides an in-depth summary of the history and structure of crop insurance in the United States. In the early 1900s several attempts were made to privately underwrite multiple peril crop insurance. Multiple peril crop insurance provides coverage of all forms of yield risk. These programs were limited. A federally underwritten crop insurance program was incorporated into the Agricultural Adjustment Act of 1938. This legislation led to the creation of the Federal Crop Insurance Corporation (FCIC). The FCIC was authorized to insure one crop, wheat, against all unavoidable losses. The program has expanded and evolved since that time.

The multiple peril crop insurance program was substantially revised by the Federal Crop Insurance Act reported in the 1980 Farm Bill. The intent of policy makers was to make the crop insurance program the centerpiece of federal crop disaster relief and to eliminate the need for disaster relief programs. Consistent with this intent, the number of

crops and the geographical regions covered were expanded. In 1979 the FCIC had 4063 county crop programs in effect. In a next decade, the number of county crop programs increased more than five fold to 21,373 programs in 1991 (GAO, 1992).

Producers are offered a standard insurance contract with various options they may select. The basic insurance agreement may be written as

$$Indemnity = \phi \left[\left(\frac{APH}{Yield} \right) \left(\frac{Guaranteed}{Percentage} \right) - \left(\frac{Realized}{Yield} \right) \right] \left(\frac{Price}{Election} \right) \left(\frac{Planted}{Acres} \right) \left(\frac{Ownership}{Shares} \right)$$

The Approved Production History (APH) yield is the FCIC estimate of the expected yield. The guaranteed percentage (yield election) allows the producer to choose 50, 65, and 75 percent yield protection. Indemnities are paid if the yield for the acreage is less than the guaranteed yield ($\phi=1$ if *Realized Yield* < *Guaranteed Yield*, otherwise $\phi=0$). The price elections are set nationally for a crop each year. The producer may choose any price between 30 and 100 percent of the high price election. Producers may not insure more than their financial interest in the crop, thus they are restricted by the number of acres planted and ownership share.

Modeling Approach

Agricultural industries in any region are often classified as basic industries. This means they generally produce products for sale outside the region and in turn bring dollars into the local economy. The sales from agricultural units, along with their purchases, are generally referred to as direct economic effects. Indirect economic effects are generated as the agricultural units purchase input supplies from other regional industries. Money from agricultural sales entering the economy from outside the region generates additional

economic activity within the region as goods and services are purchased in the agricultural sector's production process. This demand for inputs stimulate production from the industries supplying the agricultural firms which causes them, in turn, to increase their demand for input into their own production processes. These indirect economic effects result in additional jobs, increased income for regional residents and greater tax revenues for community infrastructure development.

Farm income losses due to some yield decreasing event would have important direct and indirect economic impacts on regional and state economies. Indemnities paid to offset income losses due to low yields would help soften the loss in farm income. In this study, we treat indemnity payments as substitutes for gross farm income losses due to events causing abnormal low yields. This means we are assuming that the farmer has purchased and used all the inputs, hired labor and other production activities prior to the yield decreasing event. In some cases, a disaster could occur soon after planting, before the farmer has carried out all the activities of a production and harvesting season. In this case, the above estimates are likely overstated. However, without detailed farm information on specific loss events, no determination can be made about the extent of this possible error. Premiums paid to purchase crop insurance are assumed to be part of the normal production expenses and are not considered in this study as part of the direct or indirect effects of crop insurance on the economy.¹

Indemnity information was obtained from the National Crop Insurance Council to determine the direct economic impact of crop insurance. However, estimation of the indirect economic effects of crop insurance on the state economy requires the use of an

input-output model. IMPLAN, a well known input-output economic modeling tool for regional economic impact analysis was used to estimate the direct and indirect economic effects of crop insurance (MIG, Inc.). IMPLAN reflects the 1990 county level industrial activity and the 1982 Bureau of Economic Analysis' accounting of industrial linkages. It also uses the United States Department of Agriculture's 1987 Census of Agriculture data in structuring the agricultural sectors of the economy.

IMPLAN was used in this study to estimate the economic interrelationships among major business sectors in North Dakota. The focus was on the linking between crop insurance indemnities and the other business sectors within the state. This study estimates the impact that crop insurance indemnities has on the total state value of business sales, personal income, state employment, and Gross State Product (GSP).

Business Sales are the estimated total business sales generated in North Dakota by the payment of indemnities in the specified time period. These business sales include all sales of agricultural crops (of which an indemnity is considered a substitute for the sale value of products that would have occurred without the sale reducing event that caused the indemnity). Beyond the sales of agricultural crops or indemnities, this value also includes all sales of related businesses such as input suppliers, agricultural services, first stage processing services, as well as sales of consumer goods and services that result as farm and farm worker households make consumption expenditures. All secondary, tertiary and beyond sales impacts are included. Most of the impacts would be expected to reside in farming areas of North Dakota and surrounding communities. However, business sales would also be stimulated in remote urban areas.

Personal Income is an estimate of total income paid to individuals, including wages, salaries, profits, rent, and interest that occurs as a result of the indemnities which substitute for business sales. This income is paid by all businesses and governmental agencies related to the farming sectors receiving indemnities.

Employment is the total number of jobs supported (or in this case preserved) as a result of the indemnity payments by all sectors, including agriculture, and agribusiness support sectors. GSP is the total value of all goods and services produced in the time period as a result of the payment of indemnities. This value is comparable to Gross Domestic Product as reported for the entire U.S. economy. It includes the personal income items as discussed above plus taxes and depreciation.

Results

Direct Economic Effects

The state of North Dakota has benefited greatly from crop insurance over this study period. Farmers in North Dakota received, on average, over \$91 million annually in crop insurance indemnities (Table 1). The least annual indemnity paid was in 1987 and it was over \$29 million (Table 1 & Figure 1). The low indemnity in 1987 was followed by the largest indemnity payment of over \$162 million in 1988. This coincided with the drought that affected much of the U.S. agriculture. Over the 10 years (1986-1995), the farmers in North Dakota received over \$912 million in indemnity payments. The four biggest years were 1988, 89, 93 and 95.

Participation in crop insurance was low until 1989. Premiums were less than \$35 million over this period (Figure 1). After the drought in 1988, premiums in crop insurance

rose to over \$67 million in 1989 and to \$84 million in 1990. Substantial increases in participation rate occurred in 1989 and 1990 because, in part, mandatory participation for producers who received disaster relief for 1988 and 1989 crop years. Participation, as measured in premiums paid, has risen to over \$101 million in 1995.

In this study we have assumed that insurance premiums were a normal cost of production agriculture. However, it is useful to observe the indemnities relative to the premiums. This is frequently reported as the loss ratio, indemnity divided by premium. Out of the 10 years in this study, the loss ratio was positive except for 1991, 92 and 94 (Figure 1). The highest loss ratio of 5.68 coincided with the highest indemnity in 1988. The loss ratio averaged 1.70. The lowest loss ratio of 0.58 was in 1992. Using a t-test, it was estimated that there is a 85.3% chance that farmers in North Dakota will receive more indemnities than premiums paid out (Table 1).

Indirect Economic Effects

The estimates of the coefficients and estimated economic contribution for direct and indirect effects of crop insurance indemnities on sales, personal income, employment and GSP are reported in Table 2. We chose to estimate the impacts of crop insurance for the years of lowest payments, highest payments, most recent payments, a 10-year average of payments and the sum of all payments over all years.

The total business sales effect coefficient (multiplier) of 2.3 would imply that a \$1 of crop insurance indemnity would result in an increase of \$2.30 in business sales that would be stimulated in the economy (Table 2). Crop insurance increased state business

sales ranging from a high of \$456 million to a low of \$67 million, from 1986-95. The total increase in business sales over this 10 year horizon was over \$2 billion.

The total personal income effect coefficient of 1.03 would imply that a \$1 of crop insurance indemnity would result in an increase \$1.03 of personal income in the state economy (Table 2). Crop insurance increased state personal income ranging from a high of \$203 million to a low of \$30 million. The total increase in personal income was \$937 million, from 1986-95.

The total employment effect coefficient of 51.6 would imply that a \$1 million increase in crop insurance indemnities would result in 51.6 jobs (Table 2). Crop insurance increased state employment ranging from a high of 10,194 jobs to a low of 1,504 jobs.

The total GSP effect coefficient of 1.14 would imply that a \$1 of crop insurance indemnity would result in a \$1.14 increase in GSP (Table 2). Crop insurance increased the GSP ranging from a high of \$225 million to a low of \$104 million. The total increase in GSP was \$1 billion, from 1986-95.

Conclusions

Risk management has always been an important function for farmers. As farmers are faced with more market-oriented production as prescribed by the FAIR Act, risk management becomes even more important. Crop insurance is an important risk management tool. Not only does crop insurance help stabilize farm income in periods yield reducing events, it also helps stabilize rural economies. Where crop insurance is subsidized by the Federal Government, it not only stabilizes farm income and rural economies, but can actually increase it. Moreover, the crop insurance indemnities are

multiplied throughout an entire rural economy which constitutes an indirect subsidy to rural communities from the Federal Treasury.

The North Dakota economy received a direct benefit from crop insurance indemnities averaging \$91.2 million per year from 1986-95. In addition, the state economy benefited from the indirect effects. The economic linkages among industries within the State economy were modeled using IMPLAN. The annual average increase in business sales, personal income and GSP was \$211 million, \$94 million, and \$104 million, respectively. Moreover, 4,710 jobs were maintained on average, because of crop insurance.

We conclude that a strong and broad federal crop insurance program can be important in protecting farmers and rural communities from the vagaries of weather and other disasters. This will be increasingly important as farmers lose the buffer provided by commodity programs prior to 1996. If farmers with crop insurance are able to pay their bills for production inputs even in years of disaster, a stabilizing force is provided for rural businesses that supports farmers and rural communities.

Endnote

¹Premiums paid by farmers could be viewed as money outflows from a region that would negatively impact the economy. However, we believe that premiums are not a substitute for other purchased production inputs. Hence, the only effect would be to reduce farmers' net income in a normal year. Moreover, a part of the premium payments accrue to local insurance companies so the outflow would be less than the premium amount. Sorting this out is beyond the scope of this paper.

References

Coble, Keith Harlan. "An Examination of the Existence and Consequences of Asymmetric Information in Multiple Peril Crop Insurance Programs." Unpublished Dissertation, Texas A&M University, August 1993.

MIG, Inc. "IMPLAN." Minnesota Implan Groups, Stillwater, Minnesota, 1990.

U.S. General Accounting Office. "Crop Insurance Program has not Fostered Significant Risk Sharing by Insurance Companies." Report to the Chairman, Committee on Agriculture, Nutrition, and Forestry, U.S. Senate. GAO/RCED-92-25. Washington D.C.: G.A.O., January, 1992.

Table 1. Descriptive Statistics of Insurance Premiums, Indemnities and Loss Ratios, Multiple Peril Crop Insurance in North Dakota, 1986-1995.

Variable	District	Mean	Minimum	Maximum	Coefficient of		Probability
					Variation	Total	(Loss Ratio>0)
Premium (\$)	STATE	62,084,892	23,516,898	101,897,536	0.410	620,848,922	n.a.
Indemnity (\$)	STATE	91,289,232	29,155,244	197,576,192	0.648	912,892,316	n.a.
Loss Ratio	STATE	1.70	0.58	5.68	0.898	1.47	85.3%

Table 2. Direct and Indirect Economic Impacts of Crop Insurance on the North Dakota Economy

Time Period	Direct Indemnity	Business Sales	Personal Income	Employment	Gross State Product
Multiplier	1.0	2.3	1.03	51.6 ^a	1.14
1995	\$118,392,363	\$273,091,717	\$121,549,493	6,109	\$134,967,294
10 Year High	\$197,576,196	\$455,742,425	\$202,844,895	10,194	\$225,236,863
10 Year Low	\$29,155,245	\$67,251,432	\$29,932,718	1,504	\$33,236,979
Average	\$91,289,232	\$210,573,829	\$93,723,612	4,710	\$104,069,725
Total	\$912,892,321	\$2,105,738,287	\$937,236,116	N/A	\$1,040,697,246

^a Per million dollars of crop indemnity.

Figure 1
History of Insurance Premiums, Indemnities and Loss Ratios,
Multiple Peril Crop Insurance, STATE, North Dakota

