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IMPACT OF CROP INSURANCE ON LAND VALUES

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INTRODUCTION

Federal crop insurance programs started in the 1930s in response to the Great Depression. The Federal Crop Insurance Corporation (FCIC) was created in 1938. Initially the program started as an experiment and crop insurance remained an experiment until the Federal Crop Insurance Act of 1980. See "History of the Crop Insurance Program" for a discussion of changes in the programs over time. (RMA)

Participation in the crop insurance remained sporadic and at a relatively low level for many years. See Table 1 for the participation levels in Iowa since 1989. In 1994 participation in crop insurance became mandatory if the producer wanted to receive deficiency payments and other federal farm program benefits. This mandatory participation requirement greatly increased participation. Even though the mandatory requirement was rescinded in 1996, participation levels have remained relatively high.

There have been a number of changes and additions to the crop insurance programs since the 1980 Act. The Risk Management Agency was created within the USDA to administer FCIC programs. In 2000 legislation was passed that greatly expanded the role of private industry in conducting research and creating new insurance products and features. This legislation expanded the options available to the producer and extended coverage available.

The current crop insurance programs involve a complex maze of subsidies, coverage levels, units, production history and other requirements and decisions. (Plastina, 2014; Johanns, 2015) Farmers chose among these options. The choice determines the level of coverage they acquire, the premium and the level of subsidy they receive.

This shift from direct payments to crop insurance has raised a question whether or not federally supported crop insurance programs impact land values. This paper will address this question and provide estimates of potential impacts of crop insurance.

GOVERNMENT PROGRAMS AND LAND VALUES

Direct agricultural payments to farmers have been shown to increase farmland values. The basic concept comes from the simple asset pricing model where the value of an asset held in perpetuity is the income divided by the discount rate. (Gloy, et. al., 2011, Edwards, 2015) The discount rate is also referred to as the expected rate of return from the investment. In farmland appraisal the discount rate is also called the capitalization rate. The capitalization rate is the average implied discount rate from comparable sales to a subject property.

The land value estimation is represented by: Value = Income/Discount rate

Income can be measured in different ways. It can be the income earned from farming the land, other income from the land or it could be the expected cash rent received from owning and renting the land. Again, the discount rate is also referred to as the capitalization rate, interest rate or the expected rate of return.

This is an extremely simplified version of the land value formula. Inflation, expectations, and other factors can all be included. But, for our purposes, this formula can be used to estimate the possible impact of crop insurance on land values.

The strength of the connection between direct payments and land values has been debated. Farm size, length of tenancy, and other factors have been included in the debate. But, for the most part, people accept the standard analysis that farm program payments do impact land values either directly, through increased income, or indirectly through decreasing risk and providing income stability. (Kuethe, 2015; article under review, 2015).

In spite of the increased discussions on the impact of crop insurance there are few papers directly examining crop insurance and the relationship with farmland values. Two papers identified came to different conclusions with respect to the impact of crop insurance on land values. The first paper examined the impact of crop insurance indemnity payments on cash rents and land values in Indiana. (Langemeier, 2013). This work examined the impacts of crop insurance on a representative Indiana farm. The conclusion was; “Predicted cash rents and land values were not impacted by crop insurance indemnity payments.”

A second paper examined the impact of pasture insurance on farmland values. This study developed a national data set that utilized data before, during and after the introduction of pasture land insurance programs. The authors reported; “We find that insurance availability is associated with an increase of at least 4 percent in pastureland values.” (Ifft, et al, 2014)

Although these two studies seem to produce conflicting results there are explanations for the differences. First the Langemeirer study examines crop insurance indemnity payments and not subsidies related to crop insurance. In this study land value impacts are estimated for crop insurance using a simulation approach.

The Ifft, et al study focuses on pastureland and uses a data set covering before and after the introduction of crop insurance. This study examines the impacts of crop insurance availability. A unique data set is used for the estimation.

These two studies show crop insurance does appear to impact land values, albeit in the case of Langemeirer, the impact is not statistically significant.

On a theoretical basis the current crop insurance program could have impacts on land values in one or all of the following ways. Crop insurance reduces the income risk from production. In essence crop insurance changes the shape of the income distribution by truncating the losses

at the insurance coverage level. Removing losses would effectively increase the expected value of the income from crop production. Increasing the return, ceteris paribus, would increase land values.

Another aspect of the current crop insurance program that could influence land values is the subsidization of the insurance premium. Basically if the crop insurance is priced correctly there would be an expected loss to the farmer. The loss would be in exchange for the production profitability risk reduction. Under the current federal crop insurance program the premiums the farmers pay are not the actuarially sound premiums but the premiums minus a subsidy from the government. The level of the subsidies depends upon the level of coverage the farmer chooses. (Plastina, 2015)

The impact of premium subsidies on the use of crop insurance has been the subject of many studies. (O’Donoghue, 2014; Babcock & Hart, 2005; Miao, Hennessy, & Feng, 2012) One of the findings was that subsidies don’t appear to cause new acreage to be enrolled but the subsidies do appear to effect the decision by farmers on level of coverage.

Does crop insurance affect farmland values is an on-going question that is receiving increased debate in the literature as the federal government shifts from direct payments to a crop insurance scheme. Ifft and Kuethe in discussing their work said, “... the financial benefits of publicly-subsidized insurance programs may be bid into farmland values in a manner similar to price supports or direct payments.” (2014)

Most people would not argue that risk reduction through subsidizing an insurance program would have a positive impact on land values through the change in expected value of the income generated. But, major differences would occur when trying to estimate the impact of the programs and/or subsidy on land values.

MEASURING IMPACTS

Premiums can be thought of as the expected value of loss in an insurance policy. An actuarially sound insurance policy from a private company would cover the expected value of the loss plus an administrator costs and profit for the company.

Federal crop insurance is more complicated than this. The premium the farmer pays with crop insurance is determined based on crop, level of coverage, area risk and other factors. The target for crop insurance is an actuarially fair premium before a subsidy. Once the premium is determined the federal government will subsidize the rate depending on the level of coverage, unit, and so forth. The subsidy varies from 38 percent to 80 percent of the premium. (Plastina, 2014)

If you assume the premiums are actuarially sound then the subsidy would represent the value of the crop insurance that flows back to the farmer. The premium is the value of the expected loss so in some years the farmer would buy insurance and receive no payments but in other years they would receive the value of the covered loss. The expectation to the farmer should be that the insurance would be revenue neutral over the long run. However, because the premiums are subsidized the amount paid by the farmer no longer represents the expected loss. The farmer is only paying some fraction of the cost. The premium subsidy is the benefit a farmer receives from the federal government.

Another benefit the farmer receives from crop insurance is the change in the risk due to crop or income failure. In the land value formula, risk reduction would represent a lowering of the discount rate. The discount rate is lowered by reducing future income uncertainty.

Measuring the value of risk reduction is not a simple matter. There are two predominant ways; Certainty Equivalents (CE) or Risk-Adjusted Discount Rates (RADR) (Web extension, 2015) The CE approach specifies how much money a decision maker "… must receive with certainty.." to make them "… indifferent between the riskless and the risky cash flows." (ibid) With the RADR the "…risk adjustment is made to the denominator of the NPV equation (the discount rate) rather than to the numerator." (ibid)

The federal crop insurance programs could influence land values by the value of the subsidy and by the reduction in risk. The value of these components will vary by the individual farmer but it is possible to estimate the impacts using data available from the USDA Risk Management Agency (RMA)

DATA AND ANALYSIS

The RMA provides detailed summaries of their business for the nation, by crop, by state and by year going back to 1989. (RMA, Summary of Business Reports and Data, 2015) We will use Iowa in this example.

Table 1 (see page 5) provides a summary of the pertinent crop insurance information for Iowa. The first column shows the insured acres in Iowa for the commodity year listed. The second column is the amount of subsidies paid that year. The third column is simply the subsidy per insured acre.

Not all acres are insured in any given year. In Table 1 the fourth column is the percent of cropland acres in Iowa that were insured. The insured acres (column one) are from the RMA. The acres of cropland is the amount reported in the most recent Census for the particular year. The fifth column in Table 1 shows the adjusted level of subsidies per acre. This reflects subsidies for all acres not just those with insurance.

Three different averages are presented in Table 1. The average for the entire data set, the average for 2000 to 2015 and the average for 2005 to 2015. Notice in Table 1 how the level of subsidy has increased over time. This reflects a variety of factors including changes in crop insurance and the value of the crop being insured.

Table 2 (see page 6) shows the Iowa farmland value per acre and the rent per acre as reported by the USDA. There are costs to land ownership. (Edwards, 2015) Taxes, insurance, maintenance and a management fee are examples of these costs. The third column in Table 2 estimates these costs at 14 percent of the rental income. The percentage costs to charge will vary by individual. In Iowa the average fee for a professional farm manager in 2012 was 8 percent (Duffy). Taxes vary between counties and assessed values. Analyzing recent Iowa auction results reported taxes are between .3 and .5 percent of the price per acre. Given these estimates and considering insurance and maintenance costs, 10 percent of income was used to represent ownership costs. The values in the third column are rounded to the closest dollar.

The fourth column in Table 2 is the rent net of expenses. The values in column five are the net rent to value for each year. This value is simply net return divided by the value.

The rent to value can be used as a proxy for the discount rate. Farmland appraisers will often use rent to value to calculate discount rates for properties comparable to the subject property. These comparable rates are then used in establishing an appraised value for the subject property. The net rent to value will be used as an approximation for the discount rate.

TABLE 1: CROP INSURANCE ACTIVITY IN IOWA

	Insured Acres	Subsidy	Subsidy per Insured Acre	Insured Acres as a Percent of Cropland Acres	Subsidy Value per Cropland Acre
1989	14,584,467	$ 24,593,711	$ 1.69	53%	$ 0.90
1990	12,059,630	$ 18,827,950	$ 1.56	44%	$ 0.69
1991	9,561,406	$ 15,979,319	$ 1.67	35%	$ 0.59
1992	9,547,734	$ 16,073,279	$ 1.68	35%	$ 0.59
1993	8,661,805	$ 13,909,913	$ 1.61	32%	$ 0.51
1994	12,063,432	$ 21,496,185	$ 1.78	44%	$ 0.79
1995	19,798,819	$ 46,184,383	$ 2.33	73%	$ 1.70
1996	19,420,487	$ 59,619,962	$ 3.07	71%	$ 2.19
1997	18,045,492	$ 49,662,002	$ 2.75	67%	$ 1.85
1998	18,218,468	$ 52,870,901	$ 2.90	68%	$ 1.97
1999	18,726,982	$ 46,677,389	$ 2.49	70%	$ 1.74
2000	19,425,077	$ 44,677,834	$ 2.30	72%	$ 1.67
2001	19,320,601	$ 123,683,837	$ 6.40	72%	$ 4.61
2002	19,367,341	$ 119,939,944	$ 6.19	71%	$ 4.42
2003	19,437,377	$ 134,958,068	$ 6.94	72%	$ 4.97
2004	19,726,036	$ 190,827,936	$ 9.67	73%	$ 7.03
2005	19,908,937	$ 166,447,222	$ 8.36	73%	$ 6.13
2006	20,173,529	$ 195,846,427	$ 9.71	74%	$ 7.21
2007	20,261,378	$ 321,181,001	$ 15.85	77%	$ 12.20
2008	20,601,566	$ 491,034,675	$ 23.83	78%	$ 18.66
2009	21,045,697	$ 423,516,062	$ 20.12	80%	$ 16.09
2010	21,141,028	$ 341,420,526	$ 16.15	80%	$ 12.97
2011	21,648,492	$ 586,846,825	$ 27.11	82%	$ 22.30
2012	21,716,764	$ 520,834,550	$ 23.98	83%	$ 19.84
2013	22,171,312	$ 507,913,129	$ 22.91	84%	$ 19.34
2014	22,226,284	$ 384,888,087	$ 17.32	85%	$ 14.66
2015	21,785,793	$ 371,624,156	$ 17.06	83%	$ 14.15
	Average	**1989**	$ 9.54		$ 7.40
	since	**2000**	$ 14.62		$ 11.64
		2005	$ 18.40		$ 14.87

Source: Risk Management Agency

TABLE 2: IOWA FARMLAND VALUES AND RENTS

	Land Value	Rent	10% Ownership Costs	Net Rent	Net rent to Value
1989	$ 1,095	$ 91	$ 9	$ 82	7.5%
1990	$ 1,090	$ 96	$ 10	$ 86	7.9%
1991	$ 1,139	$ 97	$ 10	$ 87	7.7%
1992	$ 1,153	$ 101	$ 10	$ 91	7.9%
1993	$ 1,212	$ 102	$ 10	$ 92	7.6%
1994	$ 1,280	$ 100	$ 10	$ 90	7.0%
1995	$ 1,350	$ 100	$ 10	$ 90	6.6%
1996	$ 1,450	$ 105	$ 11	$ 95	6.5%
1997	$ 1,700	$ 110	$ 11	$ 99	5.8%
1998	$ 1,860	$ 113	$ 11	$ 102	5.5%
1999	$ 1,930	$ 112	$ 11	$ 101	5.2%
2000	$ 1,890	$ 115	$ 12	$ 104	5.5%
2001	$ 1,980	$ 117	$ 12	$ 105	5.3%
2002	$ 2,040	$ 120	$ 12	$ 108	5.3%
2003	$ 2,120	$ 122	$ 12	$ 110	5.2%
2004	$ 2,320	$ 126	$ 13	$ 113	4.9%
2005	$ 2,650	$ 131	$ 13	$ 118	4.4%
2006	$ 3,100	$ 133	$ 13	$ 120	3.9%
2007	$ 3,600	$ 150	$ 15	$ 135	3.8%
2008	$ 4,260	$ 170	$ 17	$ 153	3.6%
2009	$ 4,050	$ 175	$ 18	$ 158	3.9%
2010	$ 4,600	$ 176	$ 18	$ 158	3.4%
2011	$ 5,600	$ 196	$ 20	$ 176	3.2%
2012	$ 6,810	$ 235	$ 24	$ 212	3.1%
2013	$ 8,000	$ 255	$ 26	$ 230	2.9%
2014	$ 8,750	$ 260	$ 26	$ 234	2.7%
2015	$ 8,200	$ 250	$ 25	$ 225	2.7%
			Average	**1989**	5.1%
			since	**2000**	4.0%
				2005	3.4%

Rent to value has been trending downward over the time period presented in Table 2. This has been a trend since rent to values peaked in the early 1980s. Rent to value is at the lowest level for which data is available, almost 100 years.

Table 3 (see page 8) shows the value of the subsidy as a percent of land values. The net subsidy per acre is the value presented in Table 1. The rent to value used in Table 3 is the net rent to value reported in Table 2.

The fourth column in Table 3 is the value of the net subsidy per acre. The value of the subsidy is determined using the land value formula discussed earlier. The income in the formula would be the net subsidy per acre and the discount rate would be the net rent to value. The values are rounded to the nearest dollar.

The fifth column in Table 3 shows the subsidy as a percent of the land value. Land values from 1989 to 1996 are farmland values per acre as reported by the USDA. Starting in 1997 the land values are the value of cropland, again, as reported by the USDA.

Table 4 shows the impact of adding a risk reduction component to the estimate of the impact of crop insurance on land values. The RADR method discussed earlier is used to estimate the impact of risk reduction. It is very difficult to determine the value of the reduction factor to use. It exists, but the value is individually determined.

Another difficulty in using the RADR method is the extremely low rent to value rates that exist. The rent to value estimates are used as a proxy for the discount rate. Any assumed change in the discount rate due to risk reduction would be relatively large given current rent to value estimates.

In Table 4 (see page 9), two different levels of risk reduction are shown; a .1 percent reduction and a .9 percent reduction. These two values were chosen to represent a small discount rate reduction (.1 percent) and a relatively large reduction (.9 percent). Note that as the discount rate is lowered, the value of the insurance increases. Lowering risk decreases worry about the future income and so the subsidy value increases.

The final three columns of Table 4 show the impact of crop insurance premium subsidies on land values with and without considering a risk reduction component. The third column, No Risk Reduction, is repeated from Table 3, column five.

Using this income approach to estimate the impact of subsidies on land values shows variable impacts over time. The average impact of crop insurance subsidies increases as one considers only the recent years. Using all observations from 1989 to 2015, subsidies averaged 4.8 percent of land values without considering risk reduction. But, using just the last 15 years the percentage increases to 7.2 percent and using only the last decade subsidies averaged 8.5 percent of land values. The percentage value of the subsidies increases when considering a risk reduction component to the crop insurance programs. Over the past decade the crop insurance programs have averaged 8.8 percent or 11.2 percent of land values for a relatively small or large reduction in the discount rate, respectively.

Crop insurance programs will also influence rents. This influence is more difficult to estimate relative to the impacts on land values but there will be impacts nonetheless. The correlation coefficient between land values and cash rents in Iowa is .94. This indicates a strong correlation which implies that as land values change so too will rents. Table 2 shows this relative relationship has been changing over time as the rent to value decreases.

TABLE 3: IMPACT OF CROP INSURANCE SUBSIDY ON LAND VALUES

	Land Value	Net Subsidy per Acre	Net Rent to Value	Value of Subsidy at Net Rent to Value	Subsidy as a Percent Land value
1989	$ 1,095	$ 0.90	7.5%	$ 12	1.1%
1990	$ 1,090	$ 0.69	7.9%	$ 9	0.8%
1991	$ 1,139	$ 0.59	7.7%	$ 8	0.7%
1992	$ 1,153	$ 0.59	7.9%	$ 7	0.7%
1993	$ 1,212	$ 0.51	7.6%	$ 7	0.6%
1994	$ 1,280	$ 0.79	7.0%	$ 11	0.9%
1995	$ 1,350	$ 1.70	6.6%	$ 26	1.9%
1996	$ 1,450	$ 2.19	6.5%	$ 34	2.3%
1997	$ 1,700	$ 1.85	5.8%	$ 32	1.9%
1998	$ 1,860	$ 1.97	5.5%	$ 36	1.9%
1999	$ 1,930	$ 1.74	5.2%	$ 33	1.7%
2000	$ 1,890	$ 1.67	5.5%	$ 30	1.6%
2001	$ 1,980	$ 4.61	5.3%	$ 87	4.4%
2002	$ 2,040	$ 4.42	5.3%	$ 83	4.1%
2003	$ 2,120	$ 4.97	5.2%	$ 96	4.5%
2004	$ 2,320	$ 7.03	4.9%	$ 144	6.2%
2005	$ 2,650	$ 6.13	4.4%	$ 138	5.2%
2006	$ 3,100	$ 7.21	3.9%	$ 187	6.0%
2007	$ 3,600	$ 12.20	3.8%	$ 325	9.0%
2008	$ 4,260	$ 18.66	3.6%	$ 520	12.2%
2009	$ 4,050	$ 16.09	3.9%	$ 414	10.2%
2010	$ 4,600	$ 12.97	3.4%	$ 377	8.2%
2011	$ 5,600	$ 22.30	3.2%	$ 708	12.6%
2012	$ 6,810	$ 19.84	3.1%	$ 639	9.4%
2013	$ 8,000	$ 19.34	2.9%	$ 674	8.4%
2014	$ 8,750	$ 14.66	2.7%	$ 548	6.3%
2015	$ 8,200	$ 14.15	2.7%	$ 516	6.3%
Average since **1989**		$ 7.40	5.1%	$ 211	4.8%
2000		$ 11.64	4.0%	$ 343	7.2%
2005		$ 14.87	3.4%	$ 459	8.5%

TABLE 4: IMPACT OF RISK REDUCTION AND SUBSIDIES ON LAND VALUES

	Risk Decrease Level .1% Value of Subsidy and Risk Reduction	Risk Decrease Level .9% Value of Subsidy and Risk Reduction	Percent of land value With No Risk Reduction	Percent of land value Risk Decrease Level .1%	Percent of land value Risk Decrease Level .9%
1989	$ 12.16	$ 13.63	1.1%	1.1%	1.2%
1990	$ 8.81	$ 9.82	0.8%	0.8%	0.9%
1991	$ 7.74	$ 8.66	0.7%	0.7%	0.8%
1992	$ 7.59	$ 8.46	0.7%	0.7%	0.7%
1993	$ 6.83	$ 7.65	0.6%	0.6%	0.6%
1994	$ 11.40	$ 12.89	0.9%	0.9%	1.0%
1995	$ 25.97	$ 29.59	1.9%	1.9%	2.2%
1996	$ 34.16	$ 39.03	2.3%	2.4%	2.7%
1997	$ 32.35	$ 37.61	1.9%	1.9%	2.2%
1998	$ 36.72	$ 43.15	1.9%	2.0%	2.3%
1999	$ 33.97	$ 40.26	1.7%	1.8%	2.1%
2000	$ 30.98	$ 36.40	1.6%	1.6%	1.9%
2001	$ 88.37	$ 104.37	4.4%	4.5%	5.3%
2002	$ 85.04	$ 100.52	4.1%	4.2%	4.9%
2003	$ 97.85	$ 116.15	4.5%	4.6%	5.5%
2004	$ 146.78	$ 176.23	6.2%	6.3%	7.6%
2005	$ 140.95	$ 172.72	5.2%	5.3%	6.5%
2006	$ 191.76	$ 243.56	6.0%	6.2%	7.9%
2007	$ 334.37	$ 428.23	9.0%	9.3%	11.9%
2008	$ 534.40	$ 693.24	12.2%	12.5%	16.3%
2009	$ 424.75	$ 538.44	10.2%	10.5%	13.3%
2010	$ 388.03	$ 510.08	8.2%	8.4%	11.1%
2011	$ 731.14	$ 991.10	12.6%	13.1%	17.7%
2012	$ 659.96	$ 899.32	9.4%	9.7%	13.2%
2013	$ 698.67	$ 982.57	8.4%	8.7%	12.3%
2014	$ 569.43	$ 826.18	6.3%	6.5%	9.4%
2015	$ 535.33	$ 767.59	6.3%	6.5%	9.4%
Average since **1989**	$ 217.61	$ 290.28	4.8%	4.9%	6.3%
2000	$ 353.61	$ 474.17	7.2%	7.4%	9.6%
2005	$ 473.53	$ 641.19	8.5%	8.8%	11.7%

FURTHER CONSIDERATIONS

There have been considerable changes over the time periods shown in Tables 1 to 4. The many changes in the crop insurance program have impacted participation, coverage levels chosen, type of coverage and the level of subsidies. For example, notice the jump in the payment per insured acre between 2000 and 2001. This corresponds to the year revenue insurance became available.

Subsidies are a function of the premiums and the premiums in turn are a function of the value of the crop being insured. Crop prices and yields fluctuate considerably over time. Changes in the value of the crop will change subsidy levels regardless of government programs.

Finally, another factor that has changed considerably from 1989 to 2015 is the level of farm income. Farm income is the primary driver of land value changes.

Table 5 (see page 11) presents Iowa cropland values, gross revenue per corn and soybean acre and the level of crop insurance subsidies. Note that Table 5 starts in 1997. There are two major reasons for this shift from the previous tables. In 1996 crop insurance was no longer mandatory for receiving direct payments and other government benefits. Also, in 1997 the USDA began publishing cropland values as well as total agricultural land values which include real estate values. Land values from 1989 to 1996 in Tables 1 to 4 are the agricultural land values. But, from 1997 onward the values are for cropland. Analyzing from 1997 eliminates the need to mix land definitions.

Corn and soybean prices used in Table 5 are the average for the marketing year. Yields are reported by the USDA. The 2015 prices are the monthly average for September 2014 through July 2015. Yields for 2015 are the August estimates.

Notice in Table 5 the correlation between income and subsidy level. It is not surprising there is a correlation because the subsidy is based on the amount of the premiums and as noted, when the value of the crop increases so too will the premium and value of the subsidy. Even though there is a correlation between gross revenue and subsidy level the order of magnitude of change in subsidy is considerably greater. This indicates the change in crop revenue is not the total reason for the increase in subsidy.

Another factor to consider when analyzing the impact of crop insurance on land values is the impact of changes in income. Table 6 shows the changes in cropland values, subsidies, the value of the sector production and net farm income in Iowa. The time period is 1997 to 2014. Estimates for 2015 Iowa income are not available at this time.

Table 6 (see page 12) shows there is a correlation among the income and subsidy variables. The percentage change in subsidies is the highest for all the variables. But, the correlation is the strongest between gross farm income and land values, followed by subsidy and land values. Some researchers suggest land values should be lagged to reflect the impact of this year's income on next year's land value. The impact of lagging land values by one year is shown in Table 7 (see page 13).

Table 7 shows the correlation coefficients among the variables. The Table also shows the impact of using a one year lag in farmland values. Correlation between land and crop revenue includes 1997 to 2015 whereas correlation between land and income only includes 1997 to 2014.

TABLE 5: IOWA LAND VALUES, GROSS REVENUE AND CROP INSURANCE SUBSIDY

		GROSS REVENUE			
	Cropland			Total	Subsidy per Insured
	Value	Corn	Soybeans	subsidy	Acre
1997	$ 1,700	$ 322	$ 291	$ 49,662,002	$ 2.75
1998	$ 1,860	$ 270	$ 230	$ 52,870,901	$ 2.90
1999	$ 1,900	$ 256	$ 202	$ 46,677,389	$ 2.49
2000	$ 1,940	$ 252	$ 195	$ 44,677,834	$ 2.30
2001	$ 1,980	$ 277	$ 191	$ 123,683,837	$ 6.40
2002	$ 2,040	$ 362	$ 266	$ 119,939,944	$ 6.19
2003	$ 2,120	$ 372	$ 250	$ 134,958,068	$ 6.94
2004	$ 2,310	$ 360	$ 282	$ 190,827,936	$ 9.67
2005	$ 2,760	$ 336	$ 291	$ 166,447,222	$ 8.36
2006	$ 3,100	$ 503	$ 332	$ 195,846,427	$ 9.71
2007	$ 3,600	$ 734	$ 546	$ 321,181,001	$ 15.85
2008	$ 4,260	$ 701	$ 474	$ 491,034,675	$ 23.83
2009	$ 3,980	$ 650	$ 486	$ 423,516,062	$ 20.12
2010	$ 4,450	$ 863	$ 571	$ 341,420,526	$ 16.15
2011	$ 5,600	$ 1,066	$ 649	$ 586,846,825	$ 27.11
2012	$ 6,810	$ 948	$ 648	$ 520,834,550	$ 23.98
2013	$ 8,000	$ 736	$ 596	$ 507,913,129	$ 22.91
2014	$ 8,750	$ 659	$ 520	$ 384,888,087	$ 17.32
2015	$ 8,200	$ 670	$ 529	$ 371,624,156	$ 17.06
Percentage Change	382%	108%	82%	648%	520%

TABLE 6: IOWA LAND VALUES, Value of Sector Production, and Net Farm Income

	Cropland Values	Value of Ag. Sector Production in $1,000	Net farm Income in $1,000	Total subsidy	Subsidy per Insured Acre
1997	$ 1,700	$ 13,752,795	$ 3,807,557	$ 49,662,002	$ 2.75
1998	$ 1,860	$ 12,165,139	$ 2,298,247	$ 52,870,901	$ 2.90
1999	$ 1,900	$ 10,737,838	$ 1,697,113	$ 46,677,389	$ 2.49
2000	$ 1,940	$ 11,733,418	$ 2,434,393	$ 44,677,834	$ 2.30
2001	$ 1,980	$ 11,946,377	$ 2,362,019	$ 123,683,837	$ 6.40
2002	$ 2,040	$ 12,570,829	$ 2,004,954	$ 119,939,944	$ 6.19
2003	$ 2,120	$ 12,905,518	$ 2,100,674	$ 134,958,068	$ 6.94
2004	$ 2,310	$ 17,262,526	$ 5,664,482	$ 190,827,936	$ 9.67
2005	$ 2,760	$ 16,066,059	$ 4,043,063	$ 166,447,222	$ 8.36
2006	$ 3,100	$ 16,260,649	$ 3,001,392	$ 195,846,427	$ 9.71
2007	$ 3,600	$ 21,245,507	$ 4,119,873	$ 321,181,001	$ 15.85
2008	$ 4,260	$ 24,419,384	$ 5,093,461	$ 491,034,675	$ 23.83
2009	$ 3,980	$ 22,379,684	$ 3,229,930	$ 423,516,062	$ 20.12
2010	$ 4,450	$ 23,583,871	$ 4,016,607	$ 341,420,526	$ 16.15
2011	$ 5,600	$ 31,389,202	$ 9,554,961	$ 586,846,825	$ 27.11
2012	$ 6,810	$ 32,457,785	$ 6,531,817	$ 520,834,550	$ 23.98
2013	$ 8,000	$ 35,224,315	$ 8,382,515	$ 507,913,129	$ 22.91
2014	$ 8,750	$ 35,501,774	$ 5,241,072	$ 384,888,087	$ 17.32
Percentage Change	415%	158%	38%	675%	529%

Table 7: Correlation Coeffients Between Land Income, Subsidies, and Gross Revenue

		With land lagged one year
Land/Subsidy	0.80	0.87
Land/ Corn gross revenue	0.73	
Land/ Soybean gross revenue	0.82	
Land/Value of sector production	0.97	0.98
Land/Net farm income	0.74	0.79
Subsidy/Corn gross revenue	0.93	
Subsidy/Soybean gross revenue	0.94	
Subsidy/Value of sector productio	0.91	
Subsidy/Net farm income	0.82	

There is a relatively high degree of correlation among the variables, especially for subsidies per acre and revenue per acre and income. Correlation with a one year lag for land values shows little change, especially with the value of the sector production. The correlation between land and net farm income and subsidies shows an increase of .05 and .07, respectively.

DISCUSSION

When analyzing these results it is important to bear in mind a couple of caveats. The direct income approach assumes that the premium established by the government is actuarially sound. A problem with this assumption is the number of years used to determine probabilities of a loss. As more years become available the premiums could change. This bias could be up, down, or not at all but the issue remains that the estimates for premiums could change as more observations are added.

Another consideration is that no administrative costs are considered. The government covers all administrative costs.

The use of crop insurance has steadily increased since 1989. Starting in 2000 approximately 75 percent of the acres had crop insurance and since 2009 80 percent or more of the acres use crop insurance. The value of the subsidy per acre has also increased. Starting in 2007 the value of the subsidies has risen to double digits with the high of $22.30 per acre coming in 2011.

The value of the subsidy and the risk reduction produce positive impacts on land values. As shown Table 3 the capitalized value of the subsidies can be considerable. Over the past 15 years the subsidies averaged 7.2 percent of land values and over the past decade they have averaged 8.5 percent. If risk reduction is considered the impact on land values over the past 15 years increases to 7.4 percent or 9.6 percent with low or high risk reductions, respectively.

The results in Table 4 point to a definite relation between the level of subsidies and land values. But, Table 7 shows there is a stronger correlation between land values and the value of the sector output. The correlations between the yearly percent changes in the variables are not strong but the overall correlations are strong.

Unfortunately this means that we can say there is a relation between land values and crop insurance subsidies but separating the impact of changes in production will be problematic. Subsidies and value of sector production are good predictors of land values. But, there is considerable overlap in their effects, especially over time. Using strictly an income approach as shown in Table 4 subsidies represented approximately 7.2 percent of the land values without a risk reduction factor for the time period 2000 through 2015.

During the time period considered, 1997 to 2015, sector production and net farm income rose considerably. This has been especially true since 2007. It appears quite likely that the value of the sector production and net farm income will fall as commodity prices fall. How this will impact the level of subsidies and their relation with land values remains to be seen. However, given the close relationship between crop revenue and subsidy levels it seems quite likely that subsidy levels will decline. What is not known is whether or not they will fall faster than land values.

The federal government has chosen to rely more on crop insurance as a means of income support for farmers. Although crop insurance doesn't have the same impact as a direct payment, there are impacts nonetheless, especially with high levels of premium subsidies.

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Established in 1973, the Center for Rural Affairs is a private, nonprofit organization with a mission to establish strong rural communities, social and economic justice, environmental stewardship, and genuine opportunity for all while engaging people in decisions that affect the quality of their lives and the future of their communities.

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