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The Safety Net of Farming: An Introduction and Literature Review of Agricultural Insurance and Other Stabilization Policies and Proposals

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ABSTRACT

With the pending debate on the 1995 Farm Bill, crop insurance and disaster assistance have become major topics for discussion. This paper explores the performance of the current MPCI program and presents alternative programs. The need for a unified approach to ease the problem of agricultural instability is addressed..

THE SAFETY NET OF FARMING: AN INTRODUCTION AND LITERATURE REVIEW OF AGRICULTURAL INSURANCE AND OTHER STABILIZATION POLICIES AND PROPOSALS

As the time approaches for debate and preparation of the 1995 Farm Bill, the issues of agricultural insurance, disaster assistance, and farm revenue stabilization have again surfaced as major areas of policy debate. Tweeten (1993) wrote:

> ... agriculture continues to be troubled by problems of international competitiveness and efficiency, environment, family farm loss, farm succession, cash flow, poverty, instability, and farm community decline. Commodity programs either are not helpful in addressing these problems or need extensive restructuring to address these problems in a cost-effective manner.

Tweeten also stated that economic instability in U.S. agriculture provides the strongest justification for commodity programs; however, he suggested that more effort in insurance, buffer stocks, and forward pricing mechanisms by the private sector would be a more cost effective approach than current government programs. Agricultural economic instability arises from a variety of sources; market price fluctuations, weather conditions, and domestic and foreign agricultural policies all contribute to this instability. Numerous authors have examined the issue of agricultural instability with proposals ranging from major revision of government commodity programs to assorted combined policy approaches containing various levels of government sponsored programs including agricultural insurance, stock-holding, trade policies, and pricing. This paper reviews some of these approaches to stabilization policy with a prime focus on crop insurance and its relationship to disaster policy, commodity programs, and a potential revenue insurance program.

Calls for reform of federal agricultural programs have come from producers, politicians, and scholars. Arguably, the current system of various ad hoc and supplemental programs does a lackluster job of providing agricultural stability. It contains programs that counteract and contradict each other. Implementation of disaster programs, for example, tends to reduce the crop insurance participation rate and exacerbate actuarial problems in the insurance program. Streamlining the system would create a unified, goal-oriented program to adequately address the agricultural instability problem in a clear, unobstructed manner and benefit producers, consumers, and policymakers. Budget constraints also add pressure to reform farm programs, as reduced resources imply that we need to "get more bang for our buck" in agricultural programs to meet all needs and concerns.

A program's success or failure in alleviating agricultural instability depends upon the source of the instability. If price uncertainty creates most of the instability, price stabilization schemes would tend to reduce both price and revenue variability. However, if weather conditions (yield uncertainty) were the major factor, price stabilization would increase revenue variability (Helmberger 1989). Federal crop insurance is one policy approach to ameliorate agricultural instability. When the Federal Crop Insurance Act of 1980 was passed, its primary goal was to replace all federal disaster assistance programs to farmers. As evidenced by the disaster relief efforts of 1983, 1986, 1988, 1989, and 1993, federal crop insurance has not reached the goal of full disaster assistance replacement. This paper examines the current crop insurance program and its problems, reviews the literature on the subject, and looks at proposed alternatives to this system.

U.S. Federal Crop Insurance

The federal government first began its venture into crop insurance in the 1930s. Due to severe losses in the first few years, the program was scaled down to an experimental level, covering only a few crops within a limited geographic area. Federal crop insurance continued in this manner until 1980. During this experimental stage, the federal crop insurance plan was an effective risk management tool. Its historical loss ratio over the period was nearly 1.0, implying that the system ran on an actuarially sound basis. With the push to replace the statutory disaster assistance program of the 1970s, federal crop insurance was brought back out of the experimental closet.

The Federal Crop Insurance Act of 1980 established federal crop insurance as the primary type of government disaster aid. The crop insurance program was extended to all counties that had significant agricultural production and to all crops for which sufficient actuarial data could be obtained. The program was designed to be delivered by private insurance companies reinsured by the Federal Crop Insurance Corporation (FCIC). To induce both farmers and private insurers, the government subsidized 30 percent of the premium cost, allowed the producer to choose from three yield and price coverage levels, paid for both the delivery and servicing costs of private insurers, and assumed any excess indemnities over premiums. Thus, the federal government assumed most of the risk associated with the program.

Since 1980, federal crop insurance has undergone a few changes. Federal crop insurance policies are multiple peril crop insurance (MPCI); they insure against the effects of draught, flood, pests, frost, and other natural occurrences. From 1981 to 1985, the

insurance and premium rates were based upon area yields and, because the MPCI program suffered from the insurance problems of adverse selection and moral hazard, loss ratios exceeded 1.0 over this period. In an attempt to correct this, the insurance and premium rates were adapted to be based on the producer's past proven yield performance and this is how the program still stands.

It is not hard to argue that the goals of the federal crop insurance program have thus far failed to be reached. Ad hoc disaster assistance programs have become commonplace since 1980. Participation in MPCI has been below what was hoped for and expected. The MPCI program has suffered from a severe lack of actuarial soundness resulting in a considerable drain of funds. Problems that MPCI policies face are adverse selection, moral hazard, and rapid expansion (Harwood, Calvin, and Glauber 1991).

Adverse selection can be viewed as a problem of asymmetric information. In the case of MPCI, the difference in information lies between the farmer and the insurer with regard to expected yields. Farmers whose expected yield is below (above) the insurance yield will (will not) purchase MPCI. Thus, MPCI serves only those producers who expect to receive excess indemnities over premiums; that is, the higher risk producers. Moral hazard is a problem of individual action. Once the farmer has obtained MPCI, it might be in his/her best interest to change input usage on the covered crops and increase the likelihood of collecting an indemnity on the crops. These two problems have been addressed in most, if not all, studies on agricultural insurance.

The moral hazard dilemma shows the possible agricultural supply consequences of agricultural insurance. Ramaswami (1993) wrote that the supply response to agricultural

insurance has both a "risk reduction" and a "moral hazard" effect. Horowitz and Lichtenberg (1993) found that corn farmers who purchased MPCI used more nitrogen fertilizer, pesticides, herbicides, and insecticides than uninsured farmers. Moral hazard would suggest that insured farmers would use riskier technology than uninsured farmers. Thus, fertilizer and the damage control inputs seem to be risk-increasing inputs.

Quiggin, Karagiannis, and Stanton (1993) examined moral hazard and adverse selection as a combined problem. Using a Cobb-Douglas production function, they found insured farmers used fewer variable inputs and had smaller yields than uninsured farmers. Their results suggested most of MPCI's problems arise from adverse selection and moral hazard. With regard to the low participation rate, the authors stated "It may be that there is no insurance policy which will be attractive to a significant group of farmers while having prices sufficiently high to yield a positive return on the inevitable bad risks". Other papers that have studied these issues are those by Ahsen, Ali, and Kurian (1982); King and Oamek (1983); Skees and Reed (1986); Nelson and Loehman (1987); and Chambers (1989).

Since participation in the MPCI program is low, the demand for crop insurance has been studied by several authors. Goodwin (1993) examined the demand for MPCI by Iowa corn producers during the period 1985-90. Employing county-level data, Goodwin found the per acre premium, previous yield, percentage of land rented, land value, average size of farm, and an interaction term between the per acre premium and the loss-risk were the significant variables affecting the decision to purchase MPCI. The loss-risk is the county's average ten year loss ratio (indemnities/premiums) normalized by the state average loss ratio.

The author also concluded that adverse selection would be aggravated by raising premiums in an attempt to achieve better actuarial results.

Khojasteh (1992) examined 18 possible variables that could explain demand for MPCI by Iowa farmers using data collected through the Iowa Farm Finance Survey. He used three model specifications: linear, probit, and logit. Relevant variables to MPCI demand were the farmer's age, disaster aid receipts, total acres, total gross sales, the farm's net worth, the farm's after tax asset rate of return, and the farmer's view of future government agricultural policy. Khojasteh also found disaster aid could have both positive and negative effects on the demand for MPCI, instead of just the expected negative effect.

Hojjati and Bockstael (1988) also developed a model to investigate the demand for MPCI. They formed equations describing crop insurance and planting diversification choices as a joint decision. Yield variability was of primary interest while price variability was virtually ignored. The study examined the area-based MPCI of 1981-85 since their study relied on 1982 data.

Other papers have looked at a variety of issues concerning MPCI ranging from measuring willingness-to-pay for the program to how distributional assumptions affect participation rates. Williams, Harper, and Barnaby (1990) examined producer preferences of different combinations of government programs (deficiency payments, crop insurance, and disaster relief) for northeast Kansas corn and soybean farmers. Using stochastic dominance, the authors found that for a farm planting a corn-soybean rotation the dominant combination, based upon per acre net returns, was MPCI for corn and disaster assistance for both corn and

soybeans. They also conducted willingness-to-pay analysis to see how much premiums would need to change in order to make the producers indifferent among program choices.

Nelson (1990) criticized the distributional assumptions underlying crop insurance premiums. He revealed that assuming normally distributed yields creates a larger loss probability than assuming beta distributed yields. He recommended that a more flexible distribution with respect to skewness should be employed since crop insurance losses are not independent. Arguing that the central limit theorem does not hold for crop insurance losses, Nelson concluded that the use of the normal distribution implied higher premiums for MPCI than they should be if yields are negatively skewed. This would help to explain the low participation levels for crop insurance because nonparticipants indicate that premiums are too high. His findings are the opposite of Skees and Reed (1986), who concluded symmetric distributional assumptions lead to lower premiums.

Patrick and Rao (1989) investigated MPCI's risk management role for hog/crop farms in central Indiana. Overall, they found MPCI to have a limited risk management role. Farms were divided into three debt levels and two off-farm income levels. The analysis was conducted for four levels of yield variability. The authors found MPCI had the greatest risk management capability for medium or high debt farms with high yield variability.

Fraser (1992) estimated producers' willingness-to-pay for crop insurance in the Australian wheat industry using numerical methods. He did not differentiate between individual- and area-based crop insurance since he assumed identical producers; that is, yields are identically distributed and perfectly correlated. Using normally distributed yields and a mean-variance framework, Fraser studied the impact of crop insurance on the level and

variability of income. He found his results to be sensitive to the coverage level and to yield variability, but not to price variability or the utility function specification (CRRA, CARA, or quadratic). His results implied moderately risk-averse farmers would prefer crop insurance even if premiums exceed actuarial cost by nearly 10 percent.

Driscoll (1988) and King (1988) examined the setting of insurance and premium rates. Skees and Nutt (1988) investigated crop insurance pricing effects on financially stressed farms and found crop insurance could hurt or help depending on the farm's debt and loss ratio situation. Leatham, Richardson, and McCarl (1988) and Pflueger and Barry (1988) examined lender response to crop insurance.

Crop Insurance Alternatives

Many studies have been conducted on alternatives to the current crop insurance program and comparisons of these alternatives with MPCI. These alternative approaches seek to solve agriculture's problems through quelling price, yield, and/or revenue instability. A variety of insurance and "assurance" programs are outlined. Many, if not all, of these schemes face the same problems of adverse selection and moral hazard; but each tries to diminish their effects. Also, many of the authors aim their programs at a unified approach to agricultural policy.

Mayer (1991) suggested modifying the deficiency payments program to cover low yield years by adjusting target prices to counteract differences between actual and target yields. As the difference in yields becomes more positive (negative), the target price falls (rises). This adjustment to the deficiency payments program would provide income protection in low yield years. Mayer discussed several options to setting the yield, including

a five-year average and a ten-year trend, and showed with set price adjustments how the modified program would payout in comparison to the current deficiency payments program for both wheat and corn. Target price adjustors could use national, state, county, or individual yield data, trading program sensitivity for administrative cost. Possible problems with the system include that those outside a disaster area could receive benefits depending on the scale of the program; that is, whether it is based on national, state, county, or farm data.

Miranda and Glauber (1991) also recommended modifying the deficiency payments program. To cover low yield years, they set a target revenue for farms and payments are based on the difference between the target revenue and the area's average revenue. Their program relied upon individual production being highly correlated with area production. Using a regional corn model, the authors showed that for the same cost the target revenue program provided better income protection, smaller revenue variability, and stabilized government expenditures over the target price-crop insurance program now in place. They examined the target revenue program using national, state, and county data. For each program, the deficiency payment was the same. Miranda and Glauber found the current government program destabilized county level per acre corn revenues for program participants (in comparison to nonparticipants); but that the target revenue programs, at any level, would stabilize them, with the county level program performing the best. If the program support price is low, the revenue stability was decreased and the program is less likely to eliminate the need for disaster assistance. An individual farm-based target revenue program was not brought out in great detail since moral hazard problems could arise. The results were robust to different demand and export function parameters. The authors,

though, warned that this type of analysis should be conducted on other crops before generalizations about the possibilities of this program are made.

Cochrane and Runge (1992) proposed reducing a majority of the current agricultural programs for major field crops and combining all farming and most conservation acreage into an individual "farm base" for the purpose of gearing payments to stabilize farm income. Farmers would be allowed to plant a variety of crops to maintain their base (although the switching of crops would be controlled to avoid major production shifts). Payments would be based upon the relationship between indices for prices received and paid for a regional "basket" of commodities. Three-year moving averages of the indices were used to determine if payments were needed for six regions of the country. When the percentage change in paid price index exceeded the percentage change in received price index, payments were triggered. The payments were developed on a per acre basis and would allow differing payments across regions. Limits would be put on both the total farm program receipts and total government expenditures.

Harrington and Doering (1993) proposed a complete reshaping of federal agricultural programs in an attempt to "provide comprehensive risk management (gross revenue insurance) and forward planning prices for farm commodities". Their program combined actuarially sound crop insurance with commodity price stabilization through deficiency payments. Nonrecourse and marketing loans, set-aside requirements, flex acres, bases, disaster relief, ARP, 0/92, 50/92, Farmer Owned Reserve, PIK certificates, and storage payments would all be eliminated. Target prices and yields would be established by 10- to 15-year moving averages of market prices and yields. This program was modeled after the

Ontario Market Revenue Plan. The authors compared revenues and costs for nonparticipants and participants in the current government programs and their program for wheat, corn, and soybeans. They indicated their program could be self-financing in six to eight years.

Moving to the realm of area-based crop insurance, Miranda (1991) compared an area-based crop insurance to the current MPCI. He recommended the area-based insurance to cut down on the problems of adverse selection and moral hazard. Differentiating the area-based insurance proposed here and the area-based insurance of 1981-85, the program put forth here scales all coverage, premiums, and indemnities on area yields; the 1981-85 program based coverage and premiums on area yields, while indemnities were based on farm yields. Applying the theoretical area-based crop insurance to western Kentucky soybean farms, Miranda compared MPCI, full coverage area insurance, and optimal coverage area insurance. Optimal coverage area insurance is optimal in the sense that the producer could choose various levels of coverage, including coverage over 100 percent of yields. The author concluded yield variance reduction was the highest under optimal coverage area insurance followed by MPCI and full coverage area insurance. Premiums and indemnities were measured in bushels per acre. Miranda also stated area insurance would virtually eliminate moral hazard, and the risk reduction performance of area crop insurance would depend upon the correlation between farm and area yields and the farm's yield variance.

Skees (1993) looked at the Group Risk Plan (GRP), a form of area crop insurance that will be pilot tested for eight major crops in 1994. The GRP was first used in 1993 for soybeans. The GRP allows the producer to choose among six trigger yield levels: 65, 70, 75, 80, 85, and 90 percent of expected county yield. A protection level of up to 150 percent

of expected revenue is allowed to attract high yield farmers. The indemnity is equal to the product of the percentage shortfall and the protection level. (Administrative costs are estimated to be nearly 40 percent of the total net cost of MPCI. This would be significantly lowered under GRP.) Advantages of GRP are that adverse selection and moral hazard problems should diminish, administrative costs to both the government and the producer will fall, and higher possible coverage levels can be obtained at a lower cost. Skees put forth four possible reasons MPCI participation is lower than expected:

1. Premiums are higher than producers will accept, even with the insurance subsidy;
2. Farmers expect disaster relief for large crop losses;
3. Farmers are unable or unwilling to acknowledge low probability events that cause large losses; and
4. Some farmers are willing to accept the risk and self-insure.

One problem with the GRP program is that farms could suffer a loss when the county stays above the trigger yield level. Three suggestions to combat this problem are:

1. Combine a low level (50 percent coverage level) MPCI with GRP;
2. Develop better crop zones with homogeneous conditions, instead of using counties; and
3. Encourage private insurance companies to offer supplemental insurance products (such as hail insurance).

Others who have encouraged the push for area-based crop insurance are Barnaby and Skees (1990) and Glauber, Harwood, and Skees (1993).

Williams et al. (1993) used stochastic dominance of farm-level net return distributions to compare the government commodity programs, MPCI, area crop insurance, a linked deficiency payments-crop insurance program, individual disaster assistance, and area disaster assistance for Kansas wheat and sorghum producers. They found that risk-averse farmers would need a subsidy to prefer area crop insurance over MPCI. The results indicated that

the government commodity program and individual or area disaster relief programs were the least dominated strategies. Farmers with higher yield risk preferred individual crop insurance, while those with lower yield risk would be more willing to accept area crop insurance. Subsidies in the range of 10 to 30 percent of producer costs were needed for farmers to prefer area crop insurance.

Carriker et al. (1991) tested the yield-equivalent variability and the gross income variability under five disaster relief schemes. The effects of MPCI, optimal coverage area crop insurance, full coverage area crop insurance, individual disaster assistance, and area disaster assistance with and without deficiency payments were examined for Kansas wheat and corn farmers. For yield-equivalent variability, the results were the same for all four cases. MPCI brought out the largest reduction followed by optimal and full coverage area insurance. These results also held for the reduction in gross income variability for wheat without deficiency payments and both corn and wheat with deficiency payments. For corn without deficiency payments, MPCI again led the way and individual disaster assistance was preferred over both full and optimal coverage area crop insurance in this case.

Revenue Insurance

Articles on revenue (or portfolio) insurance and "assurance" have appeared recently. Turvey and Amanor-Boadu (1989) looked at premium setting for revenue insurance for a representative Ontario cash crop farm. They pointed out the problem of assuming a normal distribution when the underlying distribution is nonnormal. If, for instance, the underlying distribution is positively skewed, then the normality assumption leads to higher premiums. In 1993, the Iowa Farm Bill Study Team, under the *Iowa Plan*, suggested "revenue

assurance" replace MPCI. Under revenue assurance, the federal government would support farmers a set percent of their gross revenue. The plan would bring farming decisions back into the market and out from under government control (from commodity programs). The program would keep CRP in place and eliminate set-aside requirements and ARP.

Employing a nonlinear, farm-level analysis of agricultural insurance, Kaylen, Loehman, and Preckel (1989) tried to account for moral hazard effects under price, yield, and revenue insurance plans. Under CARA utility, the model predicted input-output decisions for the various insurance plans and yielded willingness-to-pay measures for each. Turvey (1992a) examined price, crop, and revenue insurance. Using normally distributed yields, he estimated premiums for each type of insurance and a combined price and crop insurance for corn, soybeans, and wheat. He found revenue insurance premiums would be lower than the combined insurance premiums. Turvey also mentioned the link of futures contracts to revenue insurance.

In another study, Turvey (1992b) compared price insurance, crop insurance, crop and price insurance, good-specific revenue insurance, and general revenue insurance. The study was specifically aimed at the new GRIP for a representative southern Ontario farm under a direct expected utility maximization problem. Agricultural insurance was seen to stimulate risk-neutral behavior; that is, to produce higher risk crops, and premium subsidies reinforced this behavior. Good-specific revenue insurance sets a target revenue for each good; if the actual revenue is below this, an indemnity is paid. Price and/or yield declines can trigger payments. Price insurance sets a target price; if the price falls below the target, the indemnity is paid on the basis of a fixed yield, not on the actual yield. General revenue or

portfolio insurance establishes a coverage level for the entire crop mix based upon expected returns. The premiums are set ex post. Indemnities are paid if gross revenue drops below the coverage level for any reason. Turvey looked at the corn, soybean, and mixed grains crops and showed that using normal densities to describe the skewed distributions of yields, prices, and revenues resulted in the overstating of the risk reduction effects of insurance. If premiums were subsidized, the author concluded the combined price and crop insurance would be preferred since it yielded a higher utility and expected profit. If premiums were actuarially sound, 80 percent price insurance was preferred. Turvey also compared dollars of public expenditure per dollars of risk reduction and found general revenue insurance was the best at promoting self-insurance through diversification.

Glauber, Harwood, and Miranda (1989) examined the effects of five disaster relief options on market prices, commodity program participation, producer revenue, and budget outlays. These options were MPCI, free crop insurance for commodity program participants, compulsory crop insurance for program participants, a target revenue program, and a disaster assistance program. They found program costs would be roughly the same except for the target revenue program, which would cost more. Free crop insurance would boost commodity program participation. Compulsory crop insurance had different effects on participation, depending on the commodity. Participation rates fell under the disaster assistance and target revenue programs. The target revenue program was the best at stabilizing per acre farmer income and market prices.

Summary and Conclusions

Each of these studies presents a program geared toward alleviating agricultural instability. Successful strategies to resolve price, yield, and/or revenue volatility depend upon many factors, including the sources of instability and their magnitudes. Many have concluded that some form of agricultural insurance or assurance is the most appropriate way to reduce instability. As mentioned at the outset, a unified approach is needed for agricultural policy and programs. The piecemeal programs of the past and present have cost us in agricultural efficiency, stability, and government expense. Reducing these problems should be the primary goal of all those concerned with agriculture.

Ways to reform current government programs as well as alternatives have been examined. Federal crop insurance has failed to reach its goals. Alternative programs, such as revenue insurance, would suffer from the same problems as those encountered by existing programs. Success will be measured by the program's ability to reduce these problems and to provide stability to agriculture in an efficient manner.

During the next few years, these issues will receive much more attention, especially with the debate over the 1995 Farm Bill. The final package will be crafted by the political battles among budget hawks, agricultural backers, and commodity groups. Most of the alternatives discussed here may be considered as the main element of federal disaster assistance for the future. But each program's effects on both the budget and agriculture should be viewed with skepticism.

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