Whole Farm Revenue Insurance for Crop and Livestock Producers

Bruce A. Babcock and Dermot J. Hayes

Briefing Paper 99-BP 22
February 1999

Center for Agricultural and Rural Development
Iowa State University
Ames, Iowa 50011-1070
www.card.iastate.edu

Bruce Babcock and Dermot Hayes are professors in the Department of Economics, Iowa State University.

Questions or comments about the contents of this paper should be directed to Bruce Babcock, 578 Heady Hall, Iowa State University, Ames, IA 50011-1070; Ph: (515) 294-6785; Fax: (515) 294-6336; E-mail: babcock@iastate.edu.

WHOLE-FARM REVENUE INSURANCE FOR CROP AND LIVESTOCK PRODUCERS

The collapse in hog prices in the fall of 1998 has renewed interest in using insurance as a means of providing an affordable safety net to U.S. farmers. One option that has received attention is to expand USDA's crop insurance program to include livestock producers. A coalition of U.S. senators, for example, has introduced legislation to amend the Federal Crop Insurance Act to allow livestock insurance. And, President Clinton has called for livestock insurance as part of his FY 2000 budget submission to Congress.

The ongoing financial crisis in the hog sector was not caused by production or disease problems. Therefore it is apparent that what the senators and the president have in mind is either price insurance or revenue insurance. The creation of a price or revenue insurance program raises a number of practical issues regarding what to insure, how to insure it, and how much the coverage should cost. This briefing paper discusses some of the issues raised by an expansion of revenue insurance, and provides a "worked example" of a whole-farm insurance product that insures against revenue losses from a farm that raises corn, soybeans, and hogs.

Livestock Risk

All farm operations face two sources of risk that affect gross revenue: output price risk and production or yield risk. In addition, livestock producers are exposed to significant risk arising from changes in the price of inputs such as feed. Until 1996 the only form of insurance provided by the USDA was traditional crop insurance that protects farmers against yield losses. The historical focus on yield insurance is understandable for at least three reasons. First, in most areas of the country, yield risk for the major crop commodities, including corn, soybeans, cotton, wheat, grain sorghum, and barley, is much greater than price risk. Thus, yield insurance provides significant financial protection to many farmers. Second, until the 1996 crop year, farmers were able to count on government commodity programs for price insurance. The size of subsidy payments (deficiency payments) were inversely related to crop price, so that low prices brought on higher payments. And third, price insurance is provided by the private sector at commodity exchange markets such as the Chicago Board of Trade, The Kansas City Board of Trade, the Chicago Mercantile Exchange, and the Minneapolis Grain Exchange.

The elimination of government deficiency payments coincided with the introduction of revenue insurance programs in 1996. Crop Revenue Coverage (CRC) and Income Protection (IP) became available in that year. Revenue Assurance (RA) became available in 1997, and Group Risk Income Protection (GRIP) will be available in 1999. None of these new revenue insurance products cover livestock revenue. If livestock revenue were to be included into any of these revenue insurance products, how could it be done? The first

issue to be addressed is whether to cover both production risk and price risk or just price risk.

Livestock production risk for most producers is significantly less than crop production risk. This lower risk is due to livestock being more adaptable to variations in weather than crops, and because modern livestock operations attempt to insulate animals against stress caused by adverse weather conditions. This is not to say, however, that production risk does not exist. Hog and poultry producers can unexpectedly lose significant numbers of animals from disease or mechanical failure in confinement operations. Another source of production risk is variability in weight gain in grass-fed beef cattle operations. Poor range conditions due to inadequate rainfall can lead to less than expected weight gain.

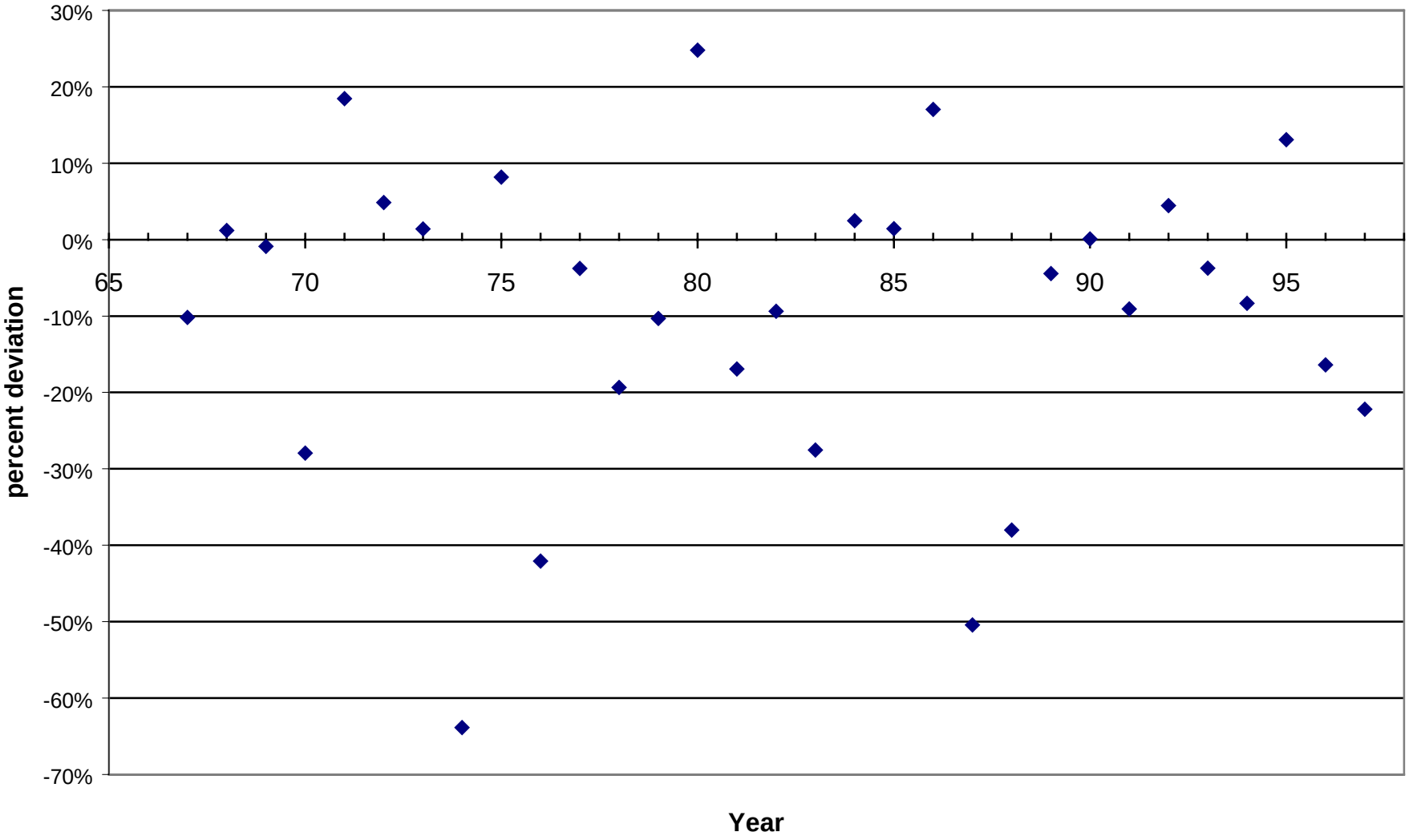
Thus, for some livestock operations, production risk may be a significant source of overall risk. But for most livestock producers production risk is relatively minor compared to price risk. Figure 1 (see p. 3 of this report) illustrates the amount of price variability in the U.S. hog market. Graphed is the percent deviation in the closing August live hog futures from the futures price quoted on March 1 from 1967 to 1997. As can be seen, it is difficult for a hog farmer to count on a certain price being available five or six months ahead.

Also relevant to livestock producers is the variation in input costs. With the run-up in corn and soybean prices that began in the fall of 1995, hog producers faced production costs that were much greater than anticipated. These two types of risk (output prices and input costs) are the source of most of the income risk faced by hog producers. Therefore, in this paper we model both input and output price risk for hog producers in a manner similar to the way yield and output prices are modeled under crop revenue insurance policies. The livestock guarantee protects net revenue, i.e., output revenue less feed costs, while the crop revenue guarantee is for total revenue. This difference between net revenue for livestock and gross revenue for crops is not important because crop producers typically know what their input costs will be. Thus a gross crop revenue guarantee essentially protects net crop revenue.

A Whole-Farm Safety Net

One term that occurs frequently in the debate about adding livestock revenue guarantees is the concept of a whole-farm safety net (or farm income safety net). The implication of this phrase is that farmers care more about their end-of-year finances than about any of the components, (yield, output prices, or input costs) that contribute to this year-end position. From an insurance perspective this concept also makes sense because fair insurance premiums of a whole-farm policy may be far lower than the sum of insurance premiums on all of the components. It is also possible to offer much higher coverage levels on whole-farm policies. Higher coverage levels are possible not only because they are more affordable because of a lower risk, but also because the moral hazard problems that may occur when one component (such as yield) is insured are far less important when the policyholder has insured all enterprises on the farm.

Figure 1. Percent Deviation in August Settlement Price from March Futures Price on Live Hog Contract



The possibility of protecting entire farm revenue at a high but affordable coverage level creates the safety net that is so much in demand. Thus, as a first step, this paper focuses on livestock net revenue insurance *coupled with* crop revenue insurance.

Utilizing Existing Private Sector Financial Instruments

It is currently possible for livestock producers to purchase a form of price insurance on the Chicago Mercantile Exchange. This can take the form of a futures contract used to lock in a price or a put option that is used to create a price floor. Before anyone proposes the introduction of federally-subsidized competition to existing futures markets, they may be asked to show why such coverage would be more attractive to livestock producers, or show how the federal product could complement rather than substitute for existing speculative markets.

Why might livestock price insurance be more attractive than futures and options markets?

An easy answer to this question might be that very few livestock farmers use futures and that a federal subsidy might at least increase the number of those who do. However, there may be more compelling reasons. First, the futures market offers a standardized product that attempts to be useful to a large number of individuals. Participation in these markets requires some specialized knowledge, access to liquid funds, and involves insuring relatively large amounts of product under one contract. Put options are an expensive form of insurance because they pay out even in years in which whole-farm revenues are otherwise at a satisfactory level. Futures contracts are risky because losses on the short futures position can be large when prices rise. Also, there is no guarantee that the futures market position would exactly offset the price risk associated with hog production. For example, a severe price drop might occur after one futures has expired and prices might rise before the next contract expires (as happened in December of 1998). Also, prices in one location may not always be correlated with the cash prices used to settle futures contacts. Finally, the livestock futures markets do not protect against increases in feed costs that can be as detrimental to producers as reductions in live hog prices.

The insurance product we describe here could potentially eliminate some of these disadvantages. First, the insurance contracts could be individualized to reflect the actual sales record of an individual producer. This individualization could include the use of the weighted average sales price received by a particular producer over the course of a marketing year. Also the terms and conditions used to define a contract would be those used in crop and life and casualty insurance and should not require any specialized knowledge or vocabulary. Third, they would be relatively inexpensive because they would insure against revenue losses on an entire farm operation over the course of a marketing year. A loss caused in a hog operation in one month might be erased by profits made several months later, or by better than average crop yields or crop prices. By insuring only against truly bad years, a whole-farm revenue contract will logically cost substantially less than separate insurance against declines in each of the components that contribute to whole-farm revenue.

Would insurance complement or compete with existing futures and options markets?

An important advantage of the types of insurance described here is that they could potentially *increase* liquidity on the futures and options markets. If USDA rules allowed, insurance companies could lay off the systemic portion of the risk on the relevant futures or options market. The insurer would retain only that portion of total risk that is poolable or non-systemic. For example, low prices in one area of the state might be offset by high prices in another area. The insurer could use the premiums from the high price areas to pay indemnities in the low price areas. If prices were low everywhere, then the insurance companies would receive a payout from the futures or option market and be in a position to pay all indemnities.

The procedures by which insurance companies could sort out the poolable from the systemic risk are technically difficult. However, they have been successfully implemented and submitted to the USDA to gain approval for this concept. To date such approval has not been granted although recent media stories suggest that the USDA may be considering a partial relaxation of reinsurance rules to allow the price risk associated with livestock insurance to be laid off on the Chicago Mercantile Exchange.

Whole-Farm Revenue Insurance Incorporating Livestock

As mentioned, the most straightforward way to incorporate livestock into a farm safety net would be to add the output price and input cost risk associated with livestock enterprises to an existing whole-farm crop or revenue insurance policy. To date the only commercially available whole-farm, crop revenue policy is an option under Revenue Assurance. This crop revenue insurance product is owned by the American Farm Bureau Insurance Services, Inc., and is now being sold in six states in the upper Midwest. The procedures used to obtain the actuarially fair premium rates for the product described below are very similar to those used to rate Revenue Assurance. The procedures are discussed in Hennessy, Babcock, and Hayes.[1]

Before an example can be worked out, some differences between crops and livestock must be accounted for. Crop farmers generally harvest their crops once per year at a predictable time. Thus the price used to value harvest is the price that occurs at harvest time. For example, for Crop Revenue Coverage and Revenue Assurance, the price used to value harvested corn is the average November quote of the December futures contract on the Chicago Board of Trade. With livestock, however, "harvest" can occur many times during the year. A livestock revenue insurance policy should be flexible enough to match the harvest price with livestock delivery.

For hog producers, the Chicago Mercantile Exchange has seven futures contracts in a given year: February, April, June, July, August, October, and December. Typically, farmers have a good idea about both the timing of deliveries and the quantity that will be delivered each year. A sensible way of determining an expected hog price to use is to construct a weighted-average settlement price, with weights given by the number of hogs to be marketed in each contract month. For example, suppose a farmer plans on delivering 100 hogs in April, June, and August and 200 hogs in

October and December, and the current prices (adjusted to a per 100 pounds live-weight basis) on these contracts are $50, $50, $40, $45, and $45 respectively. Then the expected live hog price per hundred pounds used to value the average hog produced that year would equal $45.71.

We would then need to adjust this expected live hog price for an expected feed cost. In the example reported below we use the corn and soybean futures markets to calculate an expected total ration cost for each hog. For example if the December corn contract was trading at $2.50 and the November soybean futures was at $5.50, then our expected ration cost would equal $0.176 per pound of live animal. The producer would then have expected net revenue of $28.11 per 100 pounds. Actual futures market settlement prices would later be used to calculate the actual net revenue using the same methods[2]. A component of the whole-farm revenue guarantee would then be the difference between actual and actual net livestock revenues.

One issue arises from the timing of the revenue guarantee. For spring-planted crops in the Midwest, March 15 is the sales closing date for crop insurance policies. Correspondingly, CRC and RA use the average February quote of the December futures contract for corn as the price used to set revenue guarantees for corn. In this example, we will maintain a March 15 sales closing date, and use the average of the first five trading days in March as the projected price for each of the live hog futures contract.

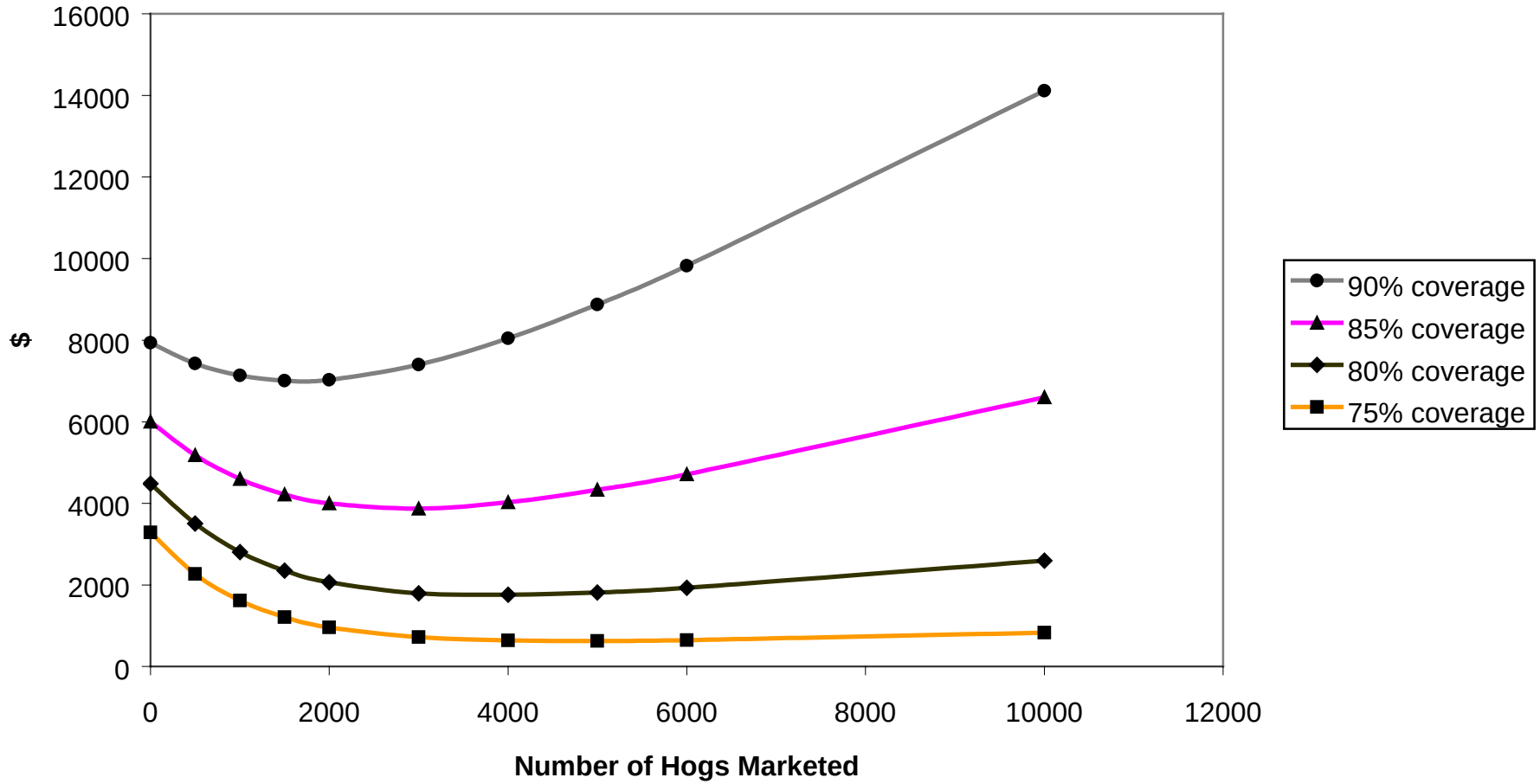
The way that this example contract is set up, the farmer has until March 15 to determine the number of hogs that will be guaranteed under each futures market contract. This will subsequently determine the whole-farm revenue guarantee. Thus the amount of market revenue from hogs that will be added to harvest revenue from crops to determine whole-farm revenue can only be determined upon settlement of the last futures market. Waiting for the last futures contract to close may delay calculation of whole-farm revenue because crop revenue from corn is known on December 1. Thus, payment of indemnities will have to wait if the farmer plans on delivering hogs under the December or February contract.

Fair Premiums for a Representative Corn-Soybean-Hog Farm

To show the effects of adding hogs to a corn-soybean whole-farm insurance contract, we look at a 500-acre farm in Webster County, Iowa. This farm has 250 acres each of corn and soybeans. Projected local prices of corn and soybeans in the fall are $2.10 and $5.00 respectively. The approved yields for corn and soybeans are 135 bu/ac and 40 bu/ac respectively. The way we determine how much coverage should cost is to calculate how much an insurance company would lose on average if it sold this producer this policy for 5,000 years. The procedures we use to rate this whole-farm policy are very similar to those used to rate Revenue Assurance.

Figure 2 (see p. 7 of this report) shows how introduction of hogs affects the actuarially fair whole-farm premium for this farm.[3] When no hogs are marketed, the fair premium depends only on the percent of expected crop revenue insured. Expected revenue from crops is springtime price times expected yield times acres for each crop, or $123,500 for the 500 acres. At 90 percent coverage, the whole-farm revenue guarantee

Figure 2. Effect of Increasing Hog Marketings on Whole-Farm Revenue Insurance Premium (500 acres of corn/soybean land)



is $111,150 and the fair premium is $7,936. At 85 percent coverage, the fair premium is $6,004. At 80 percent and 75 percent coverage levels the fair premiums are $4,479 and $3,020 respectively.[4] For a 500-acre crop farmer, a 90 percent premium of almost $8,000 is probably not affordable. Also, such a high coverage level may cause concerns among insurance companies and the federal re-insurers because of the potential for moral hazard.

When we add 2,000 hogs to the mix, however, the whole-farm fair premium actually *declines* (see Figure 2). This decline occurs even though hogs greatly *increase* the level of the revenue guarantee. In this example, the amount of revenue insured increases by $62.25 for each hog with 90 percent coverage, $59.73 per hog for 85 percent coverage, and $56.22 per hog for 80 percent coverage.

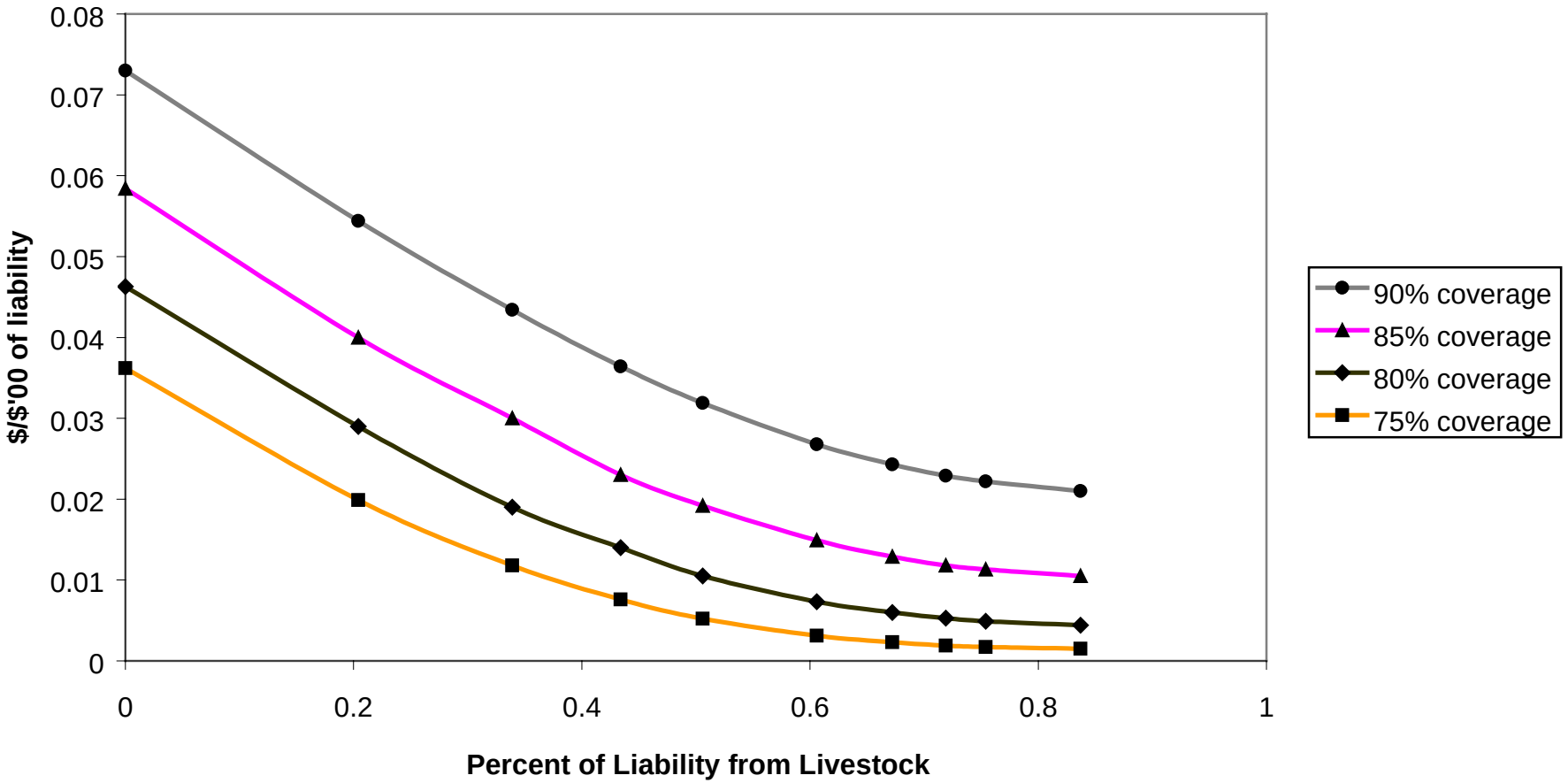
The reason why the fair insurance premium decreases as the amount of insurance increases is that a corn-soybean-hog farmer is much more diversified than a corn-soybean farmer. Greater diversification means lower risk. That the total premium initially decreases as the amount of insurance increases means that the premium rate (dollars of premium per dollar of liability) must decrease dramatically as hogs are added to a whole-farm insurance contract.

Figure 3 (see p. 9 of this report) shows how the introduction of hogs influences the insurance rate. This is the cost (in cents) to this producer for each dollar of coverage. This figure shows that the decline is initially quite dramatic at all coverage levels. The decline slows down as the percent of liability from livestock increases, flattening out as percent liability becomes greater than 50 percent. The effect of adding hogs to the policy is dramatic. In most cases the rate falls by more than 60 percent as the farmer diversifies into hogs. This low rate makes the higher coverage levels very affordable. Also the presence of hogs in the policy makes it much more difficult for the producer to cheat, thereby making these higher coverage levels more acceptable to the insurance industry.

There are two reasons why the premium rate declines. The first is that hog prices are largely uncorrelated with corn and soybean prices. Adding hogs to corn and soybeans means that when corn and soybean revenue is low, there is a 50 percent chance that hog revenue will be greater than expected. Thus, adding hogs significantly lowers the probability that an indemnity will be paid on corn and soybeans. The second reason why the premium rate continues to decline even after full (50 percent) diversification is achieved is that net revenue from hogs is less variable than corn and soybean revenue. Thus the hog revenue added to corn and soybeans is not as risky as crop revenue alone, so the premium rate continues to decline as the farmer specializes in the less risky enterprise (hogs).

Referring back to Figure 2, notice that the slowdown in the decline in premium rates means that total premium must eventually rise as more hogs are marketed. As shown, the turning point depends on the coverage level. When 3,850 hogs are marketed at the 90 percent coverage level, the whole-farm premium with hogs equals the whole-farm premium without hogs. This means that a farmer that markets 3,850 hogs pays the same insurance premium as a farmer who markets no hogs. The

Figure 3. Effect of Crop/Livestock Diversification on Whole-Farm Revenue Insurance Premium Rate (500 acres of corn/soybean land)



difference is that the farmer who markets 3,850 hogs has $239,663 more insurance coverage than the farmer who markets no hogs.

The break-even number of hogs at 85 percent coverage is 8,800 hogs. At 80 percent coverage, the break-even number of hogs is approximately 19,000. As shown, the power of diversification means that a farmer can have a lower insurance premium even though the amount of insurance increases. As mentioned, a common response to this type of diversification is to increase coverage level. For example, if this farmer were to include 5,500 hogs in a whole-farm revenue insurance policy, the total fair premium at 85 percent coverage is approximately equal to the total premium at 80 percent coverage for a crop-only whole-farm policy. The fair premium is the same, but the whole-farm revenue guarantee increases by $328,500, from $96,700 to $431,279.

Concluding Remarks

The U.S. agricultural insurance program has evolved from insuring only individual crop yields to insuring the combined revenues from several crops. The next phase in this evolution may involve the addition of livestock. Here, we argue that the most effective way to insure livestock is to insure expected annual production against output price risk and input cost risk. We also argue that it would be technically feasible to add this livestock net revenue guarantee to existing whole-farm crop revenue guarantees. These policies could complement existing financial instruments offered on the Chicago mercantile exchange and the Chicago Board of Trade.

In some preliminary sample rates presented here we show that the addition of livestock to whole-farm revenue guarantees can dramatically *reduce* both insurance rates and insurance premiums. These lower rates make 90 percent coverage affordable and economically justified. The availability of a 90 percent revenue guarantee would create a farm income safety net for large numbers of diversified family farms.

Endnotes

1. Hennessy, D., B.A. Babcock, and D. Hayes. "The Budgetary and Producer Welfare Effects of Revenue Asssurance." *American Journal of Agricultural Economics* 79(August 1997):1024-34.

2. Note that this expected net revenue does not include other variable input costs such as labor and veterinary costs, nor does it include overhead costs such as depreciation and loan financing. We have ignored these costs because they are somewhat predictable and because they would greatly complicate any written insurance contract. In addition, because feed costs also vary throughout the year, it may be better to construct season-average feed price indices to correspond to season-average hog prices.

3. An actuarially fair premium is set so that over the long haul premiums collected equal indemnities paid. It does not include expense or underwriting loads typically applied by insurance companies and it does not include premium subsidies available under USDA crop insurance programs.

4. The representative premiums calculated here do not correspond to actual whole-farm premiums available through Revenue Assurance because of different rating assumptions. For comparison purposes, at the maximum available coverage level of 80 percent, the whole-farm Revenue Assurance fair premium for this farm is $4,440 at Chicago Board of Trade prices of $2.35 and $5.25 for corn and soybeans. The fair premium at 75 percent coverage is $3,020 at these prices.