
Cash renting affords the renter flexibility, although the renter absorbs all of the yield and price risk.

ed way with receipts from the operation, thus stabilizing the after-rent income position relative to a fixed-payment cash lease.

Share-rental arrangements can be difficult to manage, however, and the trend has been away from share leasing to cash leasing. Some of the impetus for this trend is on the part of landowners, particularly if the owner is absentee and questions arise regarding the renter's practices and skills. The owner may decide that his or her income risk is too great and that monitoring the management skills of the renter is too time consuming, and may instead opt for a cash rental arrangement. Some of the impetus for this trend is also from operators. It is easier to bid for additional tracts of land using cash bids than share bids, and cash leasing avoids the sharing of management responsibilities with several landlords.

With cash renting, the tenant rents the land for a pre-specified, fixed amount per acre. Cash renting affords the renter flexibility, as in a share-rent agreement. All of the yield and price risk are absorbed by the renter in a cash renting arrangement, and none remains with the owner, who receives only the agreed-upon cash rent payment (Perry, 1997). In addition, the renter typically provides inputs other than the land (including the machinery), reducing the fixed costs committed by the landowner. To better match rental arrangements with the needs of landlords and tenants, "hybrid" contracts are now being used. These "flexible" cash rents incorporate the risk-sharing advantages of share leases, without the sharing of responsibilities (Barry).

Research suggests that accounting rates of return may vary systematically with a farm's tenure position, but that these differences do not necessarily have implications

for performance in terms of economic rates of return. Accounting rates of return for owned farmland have been low historically, with empirical research indicating that, as tenancy increases, accounting rates of return to assets and leverage positions tend to increase (Ellinger and Barry). Differences across tenure classes largely reflect the nondepreciability of farmland and its inherently low rate of return and low debt-carrying capacity because part of the returns to land ownership occur as capital gains rather than as current income (Barry and Robison). Low accounting rates of return may mask underlying economic rates of return, and provide producers with liquidity problems that worsen with the degree of financial leverage.

Owners who hire custom help (who provide skilled labor and their own equipment) can lower the costs associated with committing capital to fixed inputs. Producers may, at times, find that hiring workers full-time for the entire year may be costly when those workers are only essential during harvest or other peak months. With the use of custom workers (or hired or contract labor), the owner has a great deal of flexibility, potentially lowers his or her costs, and obtains specialized labor (Perry, 1997). The use of such arrangements, however, may increase the owner's risk because he or she would have less control over resources than if equipment were owned outright or workers hired full-time.

Insuring Crop Yields and Crop Revenues

Insurance is often used by crop producers to mitigate yield (and hence, revenue) risk, and is obviously prevalent outside of agriculture. Property, health, automobile, and liability insurance are all

forms of insurance regularly purchased by individuals to mitigate risk. For an individual, the use of insurance involves the exchange of a fixed, relatively small payment (the premium) for protection from uncertain, but potentially large, losses. When losses occur, virtually all types of insurance policies require a deductible, meaning that the individual must assume a portion of the value of the loss.

Indemnities compensate individuals for losses up to the level of the insurance guarantee, which is based on the deductible chosen by the insured (within ranges set by policy terms).

A key characteristic of an insurance market involves the concept of risk pooling. Risk pooling involves combining the risks faced by a large number of individuals who contribute through premiums to a common fund, which is used to pay the losses due any individual in the pool (Ray). More specifically, when an insurance company sells policies to many different individuals who have less than perfectly correlated risks, the total portfolio will be less risky than the average of the individual policies. This is because, at any point in time, the odds of all insureds in the pool having a claim are extremely low. Thus, the insurer diversifies non-systemic (uncorrelated) risks across the insurance pool (Goodwin and Smith; Miranda).

In part because of several “market failure” arguments, the Government operates the multi-peril crop insurance (MPCI) program. One market failure argument is based on the idea that many of the natural disaster risks associated with crop production (such as drought, flooding, and disease) are correlated across widespread geographical areas. As a result, it has been argued that pooling risks on a scale that is feasible for most private insurers is difficult (Miranda and Glauber;

Ray).¹⁷ Others argue that private multi-peril insurance fails because other types of producer responses to risk—such as diversification and smoothing of consumption over time through savings and borrowing—greatly reduce the additional effect of insurance in smoothing consumption, and make insurance unattractive to farmers when offered at competitive market prices (Wright and Hewitt).

In addition, research has shown that moral hazard and adverse selection are problems that significantly affect the viability of multiple peril crop insurance (Ahsan, Ali, and Kurian; Chambers; Goodwin and Smith). Moral hazard is present when an insured individual can increase his or her expected indemnity by actions taken after buying insurance. Adverse selection occurs when a farmer has more information about the risk of loss than the insurer does, and is better able to determine the fairness of premium rates. Both moral hazard and adverse selection affect the actuarial soundness of insurance, and pose a particularly difficult dilemma in multi-peril crop insurance. A lack of extensive producer-specific yield-risk information, which is needed to control adverse selection, has been a problem historically, and monitoring farmers’ protection against losses, which is the basis for controlling moral hazard, is also difficult. Empirical research has used various data sets and approaches, and provides evidence of moral hazard in multi-peril crop insurance (Just and Calvin, 1993a; Coble, Knight, Pope, and Williams), as well as

In part because of several “market failure” arguments, the Government operates the multi-peril crop insurance program.

¹⁷This argument has been countered by those who argue that a wide array of reinsurance options are available in international markets that allow systematic risks to be diversified. Goodwin and Smith, for example, state that, “Such markets are more than able to permit a sufficient degree of diversification to permit risks that appear to be systematic to individual markets to be spread across a wider range of activities and markets.”

The Federal Crop Insurance Reform Act of 1994 increased the level of the premium subsidy provided to producers, as well as grower participation.

adverse selection (Just and Calvin, 1993b; Goodwin; Luo, Skees, and Marchant; Quiggin, Karagiannis, and Stanton).

In contrast to multi-peril crop insurance, certain other agricultural risks—such as the risks associated with hail damage or the death of livestock—are insured by private companies with no government subsidization or reinsurance (see box for information on livestock insurance, p. 53). Unlike multiple peril crop insurance, these markets are generally characterized by risks that are nonsystemic across producers, similar to the risks underlying liability, automobile, life, and other types of private-market insurance.

The Federal multi-peril crop insurance program has been the focus of interest in recent years, and the Federal Crop Insurance Reform Act of 1994 increased the level of the premium subsidy provided to producers, as well as grower participation. With passage of the 1994 Act, Congress introduced catastrophic (CAT) coverage, for which growers do not pay a premium. Rather, producers who choose to obtain CAT must pay an administrative fee.¹⁸ CAT policies pay for losses below 50 percent of a producer's average yield (based on a 4- to 10-year "actual production history," or "APH," yield series for the grower). When losses qualify, indemnity payments are made at a rate of 55 percent of the maximum price set by USDA's Risk Management Agency (RMA).¹⁹

Growers can select among a wide variety of coverage levels under the program. More specifically, a grower can obtain multi-peril crop

¹⁸Before 1999, producers paid an administrative fee of \$50 for CAT coverage. Beginning in 1999, the fee is \$60.

¹⁹Starting in 1999, CAT coverage declined from 50-percent yield and 60-percent price coverage to 50-percent yield and 55-percent price coverage.

insurance at levels between 50 and 75 percent of his or her APH yield, using 5-percent increments.²⁰ Growers can also select a price coverage level of up to 100 percent of the established price set by RMA. Coverage above the CAT level, up to a maximum of 75/100 (the first number refers to the yield coverage and the second number to the price coverage level), is termed "buy-up" coverage. Producers receive indemnities under the program according to the following equation:

$$\text{Indemnity} = \text{Max} [(\text{Guaranteed Yield} - \text{Actual Yield}), 0] * \text{Price Guarantee.}$$

Within this equation, the guaranteed yield is calculated by multiplying the producer's APH yield by the coverage level that he or she selects. To illustrate, assume that a soybean producer has an APH yield of 40 bushels per acre, and selects a coverage of 75 percent. The guaranteed yield is then 30 bushels per acre (0.75 * 40). If the actual yield is 20 bushels in a given year, an indemnity would be paid on the 10 bushels (30 - 20) of shortfall from the yield guarantee. If the actual yield is above the guarantee, the farmer receives no indemnity. The price guarantee places a dollar value on the loss. If the farmer chooses a \$5.50 price election, for example, his or her indemnity would total \$5.50 * 10 bushels, or \$55 per acre.

Except at the CAT level, producers must pay a premium for coverage under the multi-peril crop insurance program. The key to insurance rate setting is the accurate estimation of expected indemnities.

²⁰Starting in 1999, APH coverage is available at the 85-percent yield coverage level in selected areas and for selected crops. Various revenue insurance products (see upcoming discussion, p. 52) will also allow 85-percent coverage in selected locations and for selected crops. Higher level coverage is also available under the Group Risk Plan (see upcoming discussion, p. 52).

In effect, insurers must set actuarially sound premium rates so that the premiums collected are in balance with total expected indemnities. Under an actuarially sound program with no subsidization, the average insured individual would, in the long run, expect to receive the same amount in indemnities as is paid in premiums.

While actuarially fair rates provide a starting point, insurance premiums generally must cover additional costs. Private insurance companies must price their products in order to recover overhead, operating costs, and a desired return on equity. When these costs are added into the premium, the cost of insurance over time exceeds indemnities that will be paid out. Individuals are willing to accept such contracts for automobile, medical, and other private insurance products (as well as hail and livestock insurance) due to risk aversion (see appendix 2). In short, private insurance is priced according to the following formula:

$$\text{Premium} = (\text{Actuarially Fair Premium} + \text{Administrative Costs}) > \text{Expected Indemnity.}$$

In contrast, Federal multi-peril crop insurance attempts to encourage participation by providing four primary types of subsidies. These categories include the following:²¹

- *Premium subsidy*—The premium paid by producers has been subsidized since 1980, with the subsidy depending on the level of coverage. Currently, the maximum subsidy for multi-peril crop

²¹In addition, the administrative costs associated with funding USDA's Risk Management Agency are appropriated annually by Congress. This funding supports RMA's development of rates and policy terms for the multi-peril crop insurance program, the research and development costs associated with new RMA product introductions, compliance functions associated with private companies delivering policies, and other activities.

insurance (other than for CAT, which is subsidized at 100 percent), is 41.7 percent of the total premium, and is offered at the 65/100 coverage level. The subsidy varies with other levels of coverage and by type of product.

- *Delivery expense reimbursement*—The private companies delivering policies to farmers are, as of 1998, reimbursed for their sales and service expenses at 11 percent of (implicit) total premium for CAT coverage and 24.5 percent of total premium at buy-up levels. In the absence of government involvement, private companies would include this expense in the premium paid by the producer.
- *Reinsurance*—The Government reinsures private companies that sell policies (that is, the Government shares in the risk of loss) to help reduce financial losses in years of widespread disasters. Companies can also earn underwriting gains when certain conditions are met, as determined in the Standard Reinsurance Agreement signed between USDA and the companies.
- *Excess losses*—Indemnities are paid to qualifying farmers regardless of the level of premium income. Such "excess losses" are paid by the Government in years when indemnity payments exceed total premiums. The Federal Crop Insurance Reform Act of 1994 legislates that operation of the program (including the setting of premiums) is to be conducted in a manner so that the loss ratio (total indemnities divided by total premium) is not to exceed an expected maximum of 1.075 over the long run.

Thus, premiums charged the farmer under multi-peril crop insurance are priced according to the following equation:

Federal multi-peril crop insurance attempts to encourage participation by providing four primary types of subsidies.

$$\text{Premium} = (\text{Actuarially Fair Premium} - \text{Premium Subsidy}) < \text{Expected Indemnity.}$$

As a result, farmers have two incentives for obtaining multi-peril crop insurance. Because the program is subsidized, participants are expected to receive indemnities in excess of their premium cost, resulting in a positive net return. In addition, research has confirmed the risk-reducing effectiveness of crop insurance, particularly in situations of high yield variability.

Risk protection is greatest when crop-yield insurance (which provides yield risk protection) is combined with forward pricing or hedging (which provide price risk protection). Using an example, research indicates that a corn producer in North Carolina—a fairly high-risk corn-producing area—would expect that his or her revenue would fall below 70 percent of expected revenue about 23 percent of the time. With the purchase of 75/100 crop insurance, the percentage falls to 17 percent, and with the use of both crop insurance and an optimal hedge, the percentage falls to 7 percent. Generally, revenue insurance provides protection similar to the combination of crop insurance and an optimal hedge (Harwood, Heifner, Coble, and Perry).

Since 1990, Congress and the Administration have become increasingly interested in encouraging the development of new types of policies. Group Risk Plan (GRP) insurance, which is based on county (rather than individual) yields, was first introduced on a pilot basis in 1993, and has since been expanded to nearly all major field crops in the late 1990's (Skees, Black, and Barnett). Because it is based on area (not individual) yields, producers with significant yield losses may find themselves unprotected because the county yield does not warrant

an indemnity payment. Various studies have shown that GRP is most effective at protecting individual yield risk when a strong correlation exists between individual and county-level yields (Miranda; Skees; Glauber, Harwood, and Skees).

In addition, both producers and policymakers have expressed considerable interest since the early 1980's in the concept of revenue (and cost of production) insurance. In the 1981 Farm Act, for example, Congress mandated a study on the feasibility of revenue insurance. In the 1994 Federal Crop Insurance Reform Act, Congress mandated a cost of production insurance plan that was to compensate producers for reductions in yield and/or price resulting from an insured cause. And, in the 1996 Federal Agriculture Improvement and Reform (FAIR) Act, Congress clearly signaled the need for introducing pilot revenue insurance programs.

As of 1998, three revenue insurance products were available to producers of major field crops in selected areas: Crop Revenue Coverage, Income Protection, and Revenue Assurance (see appendix 3). These products complement many strategies, such as the use of diversification, and provide a more comprehensive alternative to the use of multi-peril crop insurance. In designing these alternatives, policymakers, program analysts, and insurance companies have benefited from witnessing Canada's experience with the Gross Revenue Insurance Program (GRIP) in the early 1990's. Canada's GRIP was expensive (in terms of both government and farmer costs) and interfered with market signals and planting decisions, largely because it used long-term average prices in establishing the guarantee (Sands; Turvey and Chen). Based on this experience, U.S. revenue insurance products use an intrayear futures

Generally, revenue insurance provides protection similar to the combination of crop insurance and an optimal hedge.

Several Types of Livestock Insurance Are Available Through the Private Sector

Several types of insurance covering livestock are widely available in the United States through the private sector. Like private hail insurance, these products are not subsidized by the Federal Government. Livestock and hail insurance are quite different from multi-peril crop-yield and crop-revenue insurance in that coverage is typically limited to those losses that are independent geographically, such as hail (in the case of hail insurance) or fire, lightning, hail, collision, and other such perils (in the case of livestock).

One of the most popular private products used by livestock producers is a blanket farm personal property policy. Under this type of policy, livestock coverage is included as part of the farm's business property, and is subject to the same terms, conditions, and limitations faced by other property associated with the farm business. The insured selects an amount of protection and pays premium on that amount, with each policy limiting the actual cash value or market value per animal. Typical per animal values are \$2,000 per head of cattle and \$500 per head of swine (Anderson). At least one insurer offers an endorsement to their blanket policy, for an added premium, that includes coverage for freezing or smothering in blizzards or snowstorms (Skees and Pyles).

An alternative to a blanket policy is a "stated value" policy. Under this type of policy, the insured provides the insuring company with a list of the value of individual animals to be insured. Coverage is for animal death caused by named perils for animals on the farm or in transport to another location. Perils typically covered by such policies include fire, lightning, aircraft or falling objects, collision with a vehicle, smoke, vandalism, and theft (Anderson).

A third type of insurance is livestock mortality coverage, which is all-risk term life insurance. This coverage is typically used to insure high-value show or performance animals and covers loss due to death or theft. Livestock insured under such policies must pass a veterinarian's inspection and their values must be substantiated at the time of policy issuance (Anderson).

Hail insurance and several types of livestock insurance are available through the private sector.

price guarantee, rather than a guarantee based on long-term average prices.

Revenue insurance was first introduced in the United States in 1996. The Income Protection product was developed by USDA's Risk Management Agency in 1996. Crop Revenue Coverage, which was designed by American Agrisure, Inc., a private company, was also introduced in 1996. These programs were expanded from limited coverage in 1996 to new geographic areas in 1997 and 1998. A more recent product, Revenue Assurance, was offered in 1997 for corn and soybeans in Iowa, and was developed by the Iowa Farm

Bureau. Research has indicated that the effectiveness of revenue insurance in reducing farm-level income risk can be substantial, and is similar to the effectiveness of combining the purchase of crop insurance with hedging (Harwood, Heifner, Coble, and Perry).

As implemented for 1998 crops, these three plans have many similar features, but also differ in many ways. Each of the products combines price and yield risk protection in one program. Indemnities under each plan equal the amount, if any, by which guaranteed revenue exceeds the revenue realized at harvest. All calculate guaranteed and realized revenues from

Among the revenue insurance products available, Crop Revenue Coverage has the highest enrollment.

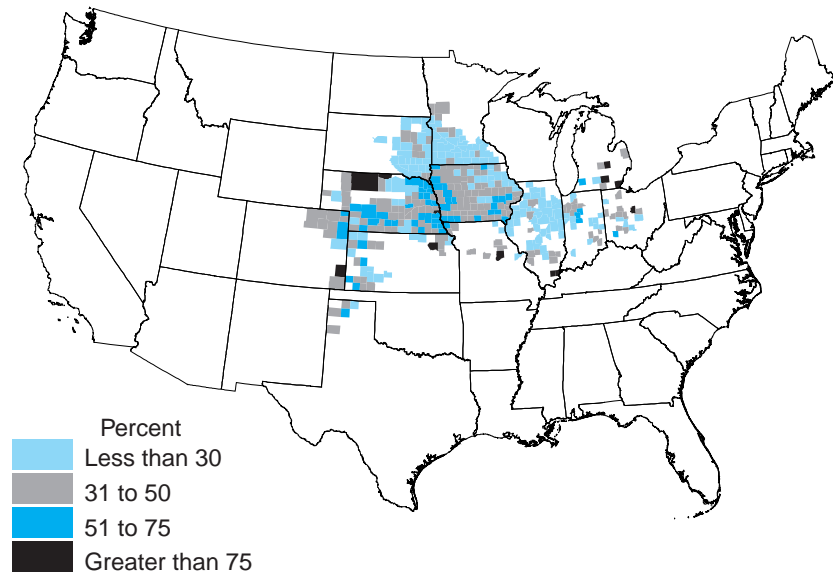
farm yields and from futures prices at signup and at harvest time. They all use policy terms associated with basic coverage under the multi-peril crop insurance program. In addition, each product requires that producers pay a premium for coverage, which is subsidized by the Federal Government in a manner similar to multi-peril crop insurance. The Federal Government also reinsures private companies against a portion of the losses associated with each of the products, and provides reimbursement for delivery expenses. The uniqueness of each product, in terms of the specification of the guarantee and other variables establishing the producer's coverage, is explained in the appendix. In addition, each product is unique in its rating methodology and the producer's ability to subdivide acreage into individual parcels for loss adjustment purposes.

Among the revenue insurance products currently available, Crop Revenue Coverage (CRC), which is available over the widest geo-

graphic areas and has been the most widely publicized, has the highest enrollment. Despite CRC's higher premium rates, sales were strong relative to multi-peril (APH) crop insurance in 1996 and 1997 in many areas (see figs. 9 and 10 for 1997 data). Indeed, little correlation appears to exist between premium rates (relative to APH) and the proportion of acreage covered by CRC.

CRC sales were particularly strong for corn and soybeans in Iowa and Nebraska in 1997. Two factors likely explain this result. First, Iowa and Nebraska were the only States having prior experience with CRC in 1996, and producers were likely more familiar with the program than in locations in which 1997 was the first year of CRC coverage availability. Second, Nebraska has a large American Agrisure, Inc. (the CRC-developing company) sales force, and agent enthusiasm—a key to the successful marketing of insurance policies—was likely strong. Third, American Agrisure, Inc., invested consid-

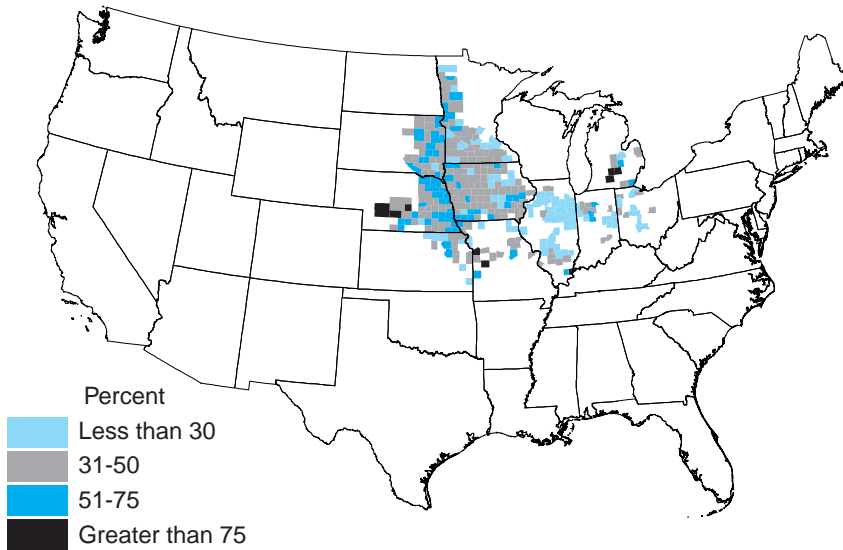
Figure 9
Proportion of corn Crop Revenue Coverage (CRC) acres to all buy-up insured corn acres, 1997



Note: Shaded areas include counties with at least 500 acres planted to corn.
 Source: Estimated by ERS from USDA, Risk Management Agency, electronic experience and yield record database, 1996 and 1997.

Figure 10

Proportion of soybean Crop Revenue Coverage (CRC) acres to all buy-up insured soybean acres, 1997



Note: Shaded areas include counties with at least 500 acres planted to soybeans.
Source: Estimated by ERS from USDA, Risk Management Agency, electronic experience and yield record database, 1996 and 1997.

erable time and effort in promotional activities (such as agent and commodity group meetings) in Iowa and Nebraska (Cleaveland).

Off-Farm Employment and Other Types of Off-Farm Income

Earning off-farm income is another strategy that farmers may use to mitigate the effects of agricultural risk on farm family household income. Not only can off-farm income supplement household income, it may also provide a more reliable stream of income than farm returns. In essence, off-farm income can offer a form of diversification. The incentives for diversifying income sources depend on the level and variability of returns when considering a risk-averse producer. If farm households are risk averse, then they will be willing to supply relatively more labor to stable off-farm occupations than they would otherwise (Mishra and Goodwin, 1997). Or, they may seek out other types of off-farm income (such as interest and dividends) to counter negative fluctuations in farm income.

According to USDA's ARMS data, a large percentage of farm families earn off-farm income, and the levels of off-farm income relative to farm income can be significant. ARMS data for 1996, for example, indicate that 82 percent of all farm households had off-farm income that exceeded their farm income (Hoppe). For each farm type category (including very large farms), at least 28 percent of the households within the category had off-farm income exceeding farm income.

Farm household income can be categorized as earned off-farm income (wages and salaries), unearned off-farm income (social security, pensions, and investments), and farm net cash income (fig. 11). As illustrated in the figure, reliance on off-farm income is related to farm size. About 10 percent of farm households were classified as primarily engaged in farming and having sales between \$100,000 and \$249,999 in 1996. These farms relied on off-farm sources for about 57 percent of their total household income. In contrast, households operating very large farms (those

Off-farm income can offer a form of diversification.
