



Improving the effectiveness and acceptability of the Federal crop insurance program  
by Dana H Myrick

A Thesis Submitted to the Graduate Faculty in Partial Fulfillment of the Requirements for the Degree  
of DOCTOR OF PHILOSOPHY in Agricultural Economics  
Montana State University  
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**Abstract:**

The Federal Crop Insurance Corporation is a government-operated business-like firm, born in 1938 after 16 years of Congressional debate and research. The FCIC offers an insurance service under contracts purchased, voluntarily by farmers. It is obligated to charge premiums that will cover loss indemnities paid under the contracts over some period of years.

The Corporation is akin to private insurance firms in several ways: The FCIC must develop a sound actuarial system. It must define insurance groups, build high participation, avoid adverse selectivity, and employ the tools of underwriting and merit rating to achieve the purpose for which the Federal Crop Insurance Act was initially designed. It is entrusted with the management of accumulated reserves.

Drouth is the most important peril covered. Precipitation records indicate that an actuarial period of at least 20 years is required for a sound rating program covering the major crops. Since the Federal crop insurance program was placed on an experimental basis in 1947, it has not yet completed one actuarial period, even on wheat, the first crop insured. Whereas the drouth peril does not occur randomly from year to year, even over large geographic areas, annual and even ten-year loss ratios of individuals, counties and states are not representative of their longterm loss expectancies based on a "complete" weather cycle.

The Federal crop insurance program must cope with the problems of insurance imperfections, such as lack of homogeneity among insured, and non-random effects on losses (such as differences in management, farm size, and soils). The FCIC has developed size and experience-credit formulas to take account of these non-random differences between insureds. Consideration should be given to the reformulation of experience and size credits to accomplish merit-rating purposes. An improved merit-rating system could make possible the use of larger rate areas, defined by pronounced topographic and geological differences. Methods will need to be devised for rating large units as the program is adjusted to the major trend toward larger and fewer farms.

A new federal farm program, beginning in 1964, provides participating farmers with part of the function of crop insurance, by guaranteeing an income regardless of crop yields through its certificate plan. This program will have an effect on the participation in the Federal crop insurance program and upon its actuarial data.

Attention is called to the relatively short history of the crop insurance program, to the social investment (including a public financial investment of \$200,000,000), and to the progress the FCIC has made toward achieving its goal. Further attention is called to the disturbance to insureds and farmers caused by conflicts between agencies, and by annual changes in program policy.

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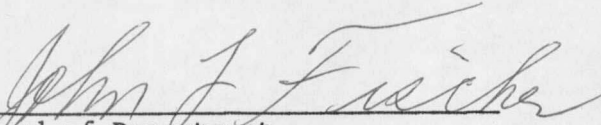
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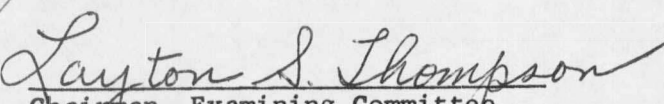
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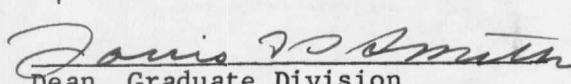
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## ABSTRACT

The Federal Crop Insurance Corporation is a government-operated business-like firm, born in 1938 after 16 years of Congressional debate and research. The FCIC offers an insurance service under contracts purchased voluntarily by farmers. It is obligated to charge premiums that will cover loss indemnities paid under the contracts over some period of years.

The Corporation is akin to private insurance firms in several ways: The FCIC must develop a sound actuarial system. It must define insurance groups, build high participation, avoid adverse selectivity, and employ the tools of underwriting and merit rating to achieve the purpose for which the Federal Crop Insurance Act was initially designed. It is entrusted with the management of accumulated reserves.

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Attention is called to the relatively short history of the crop insurance program, to the social investment (including a public financial investment of \$200,000,000), and to the progress the FCIC has made toward achieving its goal. Further attention is called to the disturbance to insureds and farmers caused by conflicts between agencies, and by annual changes in program policy.

## CHAPTER I

### INTRODUCTION

#### The Problem

The Federal Crop Insurance Corporation celebrated its Twenty-Fifth Anniversary in 1964. The program was conceived in the agricultural stress of the 1920's and born amidst the agricultural crisis of the 1930's. There are differing opinions as to who or what was the father, from whence came the urge, and why the nurses have so desperately worked to keep the baby alive. There have been those who sincerely believed that crop insurance was a response to the demand of the farmers. Others would argue, just as sincerely, that it was a part of the plans of the Administration to meet the emergency needs of agriculture--a supplement to or substitute for relief measures. There are undoubtedly those who now feel that it is just another government bureau which desperately strives to perpetuate itself.

Twenty-five years of experience should provide a base from which the program may be viewed with a better chance of gaining some perspective of its accomplishments, its problems, and future plans for meeting its problems and attaining its objectives. Three stages in the Federal crop insurance program are now discernable:

Stage One is characterized by the trials and errors of an experimental model. It incorporated from previous models whatever appeared to have been acceptable features. The rest of the model was conceived on the drawing board, based on theory combined with results of experiments on various parts. More specifically, the crop insurance program made use of research studies and the experience of private insurance companies. One reason the private experiments failed was because they included price protection, a feature which was avoided in the government program. They also failed because of lack of capital, and because it was not feasible to base premiums on a sufficiently long actuarial period. This, more than anything else, was responsible for the private support of the governmental experiment, which could incorporate sufficient capital and provide the

opportunity to carry out experiments over a long period. The specifications for the new experimental model called for features relating to goals other than insurance. Emergency relief, and price and income instability were major concerns of the administration. Thus, commodity storage and political pressures influenced the design of the first program. Stage One included the shake-down tests of the new model, characterized by some narrow escapes, and finally an almost disastrous crash, when Congress failed to appropriate funds for continuation of the program in 1943. An overall view of Stage One reminds one of wartime production, where the emergency situation precludes the setting up of a well-planned experimental program, and forces production before the model is properly tested. It is pointed out in Chapter 3 that one of the early mistakes in developing the Federal crop insurance program was that, whereas the intention was to go slowly and experiment with one crop at a time, political pressures dictated otherwise.

Stage Two began with the revival of the crop insurance program on a planned experimental basis in 1947, when the program was set up on a planned-growth projection, and experienced insurance personnel were enlisted in the development and administration of the program. Sales development was finally given a prominent place in the plans.

Stage Three of the Federal crop insurance program begins with what some individuals hope is the launching of the second twenty-five years of all-risk crop insurance. This stage will be affected by the impact of the rapidly changing agricultural situation in the United States. The average size of farms is rapidly increasing, resulting in a rapidly decreasing political power of agriculture. Just as important is the rapid shift from labor to capital in all of agriculture. There is also the effect of some pertinent changes in other Federal agricultural programs, which directly affect Federal crop insurance. The growing emphasis of the Administration on budget economy will have its impact on the future of the program, forcing it to justify more forcefully than ever its existence and continuation.

This latter situation is the problem for the FCIC. Up to this point in the Federal crop insurance history, Congress has judged that the marginal returns from public money invested in crop insurance are comparable to the returns from the funds if invested elsewhere. As the whole structure of governmental expenditures is reviewed, all programs will be reexamined in the light of their accomplishments, and the possibilities of upgrading their operations--to increase their marginal returns per dollar invested. Some measures that will likely be used in the evaluation of the crop insurance program include the degree of participation in the program, administrative costs (now borne by the government) relative to total premiums, and need. Evaluation of the need would include an estimate of costs directly to the government and to society, of any effect which the absence of the program would have on production efficiency. The possibility of shifting administrative costs from the government to the FCIC would likely be explored. It is a matter of record that supporters of the original crop insurance act hoped that some day the program could be transferred to private insurance companies. This, too, may be explored. In October of 1964, at the annual convention of the National Association of Mutual Insurance Companies at Denver, the Crop Insurance Research Bureau was formed, "to tell the truth" about the FCIC. Max D. Rutledge, president of Farmers Mutual Hail of DesMoines, and head of the Bureau said that

It is our intent to publicly challenge statements made by FCIC regarding its original purposes, its future intentions, its financial reports, its administration, its sales methods, its list of supporters, and its effect on the insurance business. 1/

Don W. Montgomery, outgoing president of the NAMIC, while he deplored the FCIC as a prime example of "government escalation," indicated that cooperation between government and private companies might be acceptable.

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1/ Damman, George H., reporter, "NAMIC Concerned About Government Insurance Growth," The National Underwriter, October 23, 1964, page 1.

But we also have other examples of what I believe constitutes a proper and effective relationship, such as the emerging pattern of business and government cooperation for special perils in such as atomic power coverage and foreign credit insurance. 2/

If these individuals are sincerely interested in public service, it follows that they would consider an alternative to Federal crop insurance, such as some cooperative arrangement with the government to provide all-risk crop insurance.

#### The Research Problem

The research problem is to attempt to find answers to the question: "What variations in the all-risk insurance program would increase its effectiveness and acceptability as a program and make it more nearly meet the needs of farmers?" The research will be concentrated on the program in Montana, with the assumption that solutions to the Montana problem will have some application to the total program for the United States.

Contemporary studies in other states are analyzing farmers' attitudes about insurance and other risk-bearing devices. A survey by the Economic Research Service, USDA, has analyzed the impact of the Federal crop insurance program in two areas, one in Virginia and one in Montana, where large indemnities were paid on the 1963 crop.

This study will reappraise the Federal crop insurance program in relation to the intended objectives and principles underlying insurance in general and crop insurance specifically. The objectives of the crop insurance program are stated in the implementing statutes. The question is, are the objectives still consistent with the needs of the farmers for protection and does the program meet the objectives?

The FCIC feels a need to expand its operations into new areas, to new crops, and especially among more farmers. Expansion requires a study of coverage adequacy and rates, special area problems, and farmers needs.

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2/ Ibid., p. 1.

There is the large general question of fitting the program into the changing agricultural situation. What new needs for crop insurance are being created, and what old needs are disappearing? How will changes in agricultural programs affect the needs for crop insurance? How can all-risk crop insurance be better integrated with other agricultural programs? It will be pointed out in subsequent chapters that crop insurance is no different from other insurance programs in that sound actuarial work must be based upon past experience, yet must project substantially into the future, depending upon the nature of the risks insured. Furthermore, in a dynamic society, all insurance must be adaptable to change.

#### Hypothesis

The hypothesis is that there are improvements that can be made in the crop insurance program which will make it more acceptable to farmers, and allow it to better accomplish the objectives for which the program was originally designed. It is expected that methods can be found which will better recognize the differences between insureds which are due to non-random characteristics such as management, size of farm, and soil differences. It is expected that methods can be found whereby crop insurances can be extended into crops and situations where it is not now available by making more use of known insuring devices. The present crop insurance administration can be expected to continue to expand its services and justify its existence only if it can continue to improve its administrative efficiency and its status as an insurance institution.

#### Procedure

The chapter on background theory and concepts provide a review of risk theory and the theory of insurance. Insurance is compared with other means of shifting the burden of uncertainty. Crop insurance in particular is compared with other insurance, bringing out the unique characteristics of the former with an analysis of perils and insurance requirements.

A search of the Congressional Record provides some answers to the question of what the Federal crop insurance program was intended to do,



as revealed by the debates, testimony, and research results presented during the 16-year Congressional gestation period that gave birth to the final act.

Major concerns of insurance institutions are the proportion of participation relative to the insurable population and the continuity of participation. Generally, an insurance institution finds itself in a decreasing-cost situation, such that added participation (ignoring sales cost) tends to decrease cost per unit of premium volume. Further, an increasing proportion of participation tends to improve the actuarial accuracy. Based on these assumptions, an analysis of participation in the Federal crop insurance program provides an indication of the program's success.

Frequent reference has been made during the history of crop insurance to over-insurance and restriction of coverage to "investment in the crop." Also a concern was frequently expressed regarding the adequacy of coverage provided under all-risk insurance programs. Comparisons of available coverage with costs of production provide answers to the question of adequacy and over-insurance.

The problem of establishing appropriate premium levels can be solved only by continuous research covering loss-causing perils and the characteristics of insured units. This study is concerned mainly with an analysis of the perils, particularly drouth, and the variability among insureds, as these factors affect the probability of indemnity payment, or actuarial work of the FCIC.

Merit rating, or recognition of individual differences between insureds, is a rating tool that can be used to take account of non-random factors affecting crop-loss probability. A study of its use in the crop insurance program reveals how merit rating might be used to better advantage in the development of the program.

The changes that have occurred in agriculture since the birth of the crop insurance act, and especially since the program was put on an experimental basis in 1947, have a critical impact on its mission and

justification for continuance. Of particular importance is the impact of other Federal programs which tend to assume some of the insurance function. An analysis of the impact of the changing American agricultural industry and programs should aid in adjusting the crop insurance program to the changes that have occurred and those to be expected.

The future of all-risk insurance may depend upon changes in the insurance institution itself. Alternative organization structures should be contemplated as possible means of better accomplishing the objectives of crop insurance as it fits into the future political and economic framework of the country.

Whether or not to buy insurance is only one of many economic choices with which farmers are faced. The decision-making processes of managers provide the basis for a lengthy dissertation in itself. But this study would not be complete without at least a brief look at decision theory as it might apply to all-risk crop insurance.

The summary reviews the most plausible ways in which variations in the all-risk insurance program would increase its effectiveness and acceptability as a program and make it more nearly meet the needs of farmers.

## CHAPTER II

### BACKGROUND THEORY AND CONCEPTS

This portion of the study reviews the relevant theories of risk, uncertainty and insurance. The purpose is to clarify the terms "risk" and "uncertainty" as they will be used in this study; to present the theory of insurance as a frame of reference for analyzing crop insurance problems; to compare insurance with other means of meeting risk; to compare crop insurance with other types of insurance as a clue to solutions for crop insurance problems; and finally to summarize the theoretical guides for the study.

#### Risk and Uncertainty

##### Definition

A general text on insurance, especially if it contains a section on theory, will have a chapter on risk and uncertainty. Uncertainty arises out of the failure of future events to occur according to expectations--out of errors in predictions. The results can be favorable or unfavorable. Risk on the other hand is most often thought of as the chance of future events occurring with results unfavorable to those expected. Schickele says that risk and uncertainty are very different things:

Uncertainty is lack of knowledge about some specific future event; risk is my evaluation of how badly the actual event may affect me in my well-being when it occurs, and this evaluation influences my present action and planning.

Risk always has an unfavorable connotation. It implies the possibility of a risk loss, but does not necessarily imply a corresponding possibility of a risk gain. <sup>1/</sup>

Schickele does not mean to imply that there are no risk gains, but rather that it is the risk losses which create economic problems, and which give the risk its unfavorable connotation. Losses are abhorred, but gains are delightful!

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<sup>1/</sup> Schickele, Rainer, "Socioeconomic Aspects of Risk and Uncertainty in Agriculture," Proceedings of Research Conference on Risk and Uncertainty in Agriculture, Great Plains Council Pub. No. 11, North Dakota State University, 1953, p. 15.

Insurance texts tend to consider risk as an adverse deviation of the actual occurrence from the expected. Probably this is because insurance is not concerned with risk gains. Magee presents the following definition:

The uncertainty of the happening of an unfavorable contingency has been termed "risk." More simply, from the standpoint of insurance, risk is present when there is a chance of loss. 2/

Athearn also stresses the loss aspect of risk:

As was mentioned in the preceding chapter, risk is the chance of loss. It is the chance that something unpleasant or undesirable will occur. The chance or possibility that your car may be stolen or your house destroyed by fire is a risk. Because there is merely a possibility of such losses and an individual cannot be sure whether they will or will not occur, the presence of risk is a source of uncertainty. Uncertainty is a state of mind which most people find unpleasant. 3/

Some authors do not make a point of distinguishing between risk and uncertainty; for instance, Lucas and Wherry combine the two terms, but again imply a risk loss rather than risk gain:

Briefly, the term "risk" is used to denote uncertainty. In insurance, it may be termed the "event insured against" or "the chance of loss." 4/

In the last three definitions risk is described as a chance of loss, which implies a probability of loss. Schickele speaks of an evaluation of how badly a deviation from the expected event may affect a person's well-being. There is agreement that risk implies a probability of loss arising out of deviation from the expected occurrence--that the loss expectation is amenable to calculation. Thus, the most appropriate definition of risk and

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2/ Magee, John H., General Insurance, Richard D. Irwin, Inc., Homewood, Illinois, 1953, page 54.

3/ Athearn, James L., Risk and Insurance, Appleton-Century-Crofts, New York, 1962, page 45.

4/ Lucas, George G., and Wherry, Ralph H., Insurance Principles and Coverages, Rinehart & Co., Inc., New York, 1954, page 16.

uncertainty for the purposes of this dissertation is that by Knight, the "Dean" of Risk and Uncertainty:

To preserve the distinction which has been drawn in the last chapter between the measurable uncertainty and an unmeasurable one we may use the term "risk" to designate the former and the term "uncertainty" for the latter. . . .

The practical difference between the two categories, risk and uncertainty, is that in the former the distribution of the outcome in a group of instances is known (either through calculation a priori or from statistics of past experience), while in the case of uncertainty this is not true, the reason being in general that it is impossible to form a group of instances, because the situation dealt with is in a high degree unique. 5/

The important point in these definitions is that risk is measurable, a distinction which will be adhered to when the term is used in this study, except that sometimes the term "risk" will be used to denote the object to which the chance of loss is applied. Magee brings this use of the term into his definition of risk:

The term is likewise used with reference to the object to which the uncertainty attaches. We speak of the building insured as a good risk, a poor risk, a protected risk, or a fireproof risk. 6/

The use of the term in this way is a matter of convenience, particularly since it is used universally in insurance literature to designate the insured object.

#### Measurement of Uncertainty

Using the definition that risk is a measurable uncertainty, a future event that is an uncertainty to an individual can be a risk to a group of similar individuals. A man knows that his house could burn down. He may know that according to statistical probability he would not expect it to burn within his lifetime. But it could burn down tomorrow. He is

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5/ Knight, Frank H., Risk, Uncertainty and Profit, Kelley & Millman, Inc., New York, 1957, page 233.

6/ Magee, op. cit., page 54.

faced with uncertainty. He cannot measure the uncertainty, because, for instance, he can in no way estimate how much reserve to lay aside each year to protect himself against the contingency. On the other hand, there is some size group of similar homeowners, with similar houses under similar conditions, such that it is possible to find some annual rate of deposit which would be sure within a given range of probability to accumulate sufficient funds to pay for any fire losses within the group during the year. This is the essence of insurance, which Knight refers to as the consolidation method of dealing with uncertainty:

Following the order of the classification already given of methods of dealing with uncertainty, the first subject for discussion is the institutions or special phenomena arising from the tendency to deal with uncertainty by consolidation. The most obvious and best known of these devices is, of course, insurance, which has already been repeatedly used as an illustration of the principle of eliminating uncertainty by dealing with groups of cases instead of individual cases. 7/

Before proceeding to the discussion of the theory of insurance it is necessary to define what is meant by the measurability of uncertainty. It has been implied that a sufficient number of similar individuals in a group, or of similar objects subjected to uncertainty, provides a basis for measurability. But uncertainty involves the future, and there is no reason to expect that even extremely large groups will provide a basis for an expectation exactly the same as the actual event. In lieu of exact predictions, which are impossible in the real world, statistical measures based on probability provide the tools for measurement of risk, or chance of loss. According to Athearn, there are two methods of making estimates of probability: (1) Deductive reasoning whereby the characteristics of the object and perils are examined and through a process of logical reasoning, the chance of occurrence of all the possible events are estimated. An example is the process of deducing the occurrence of heads or tails in the toss of a coin by analyzing its physical characteristics. However,

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7/ Knight, op. cit., page 245.

most economic uncertainties are not amenable to a priori cataloging of characteristics, but must be handled by (2), the inductive method, whereby events of the past are observed and the assumption is made that the same will happen in the future if the same conditions prevail. The simplest example is figuring the probability of getting heads by the flip of a coin by flipping it several times and observing what proportion of the flips turn heads. 8/

A problem is injected at this point, the solution to which is vital to insurance understanding. In the case of the coin example of the inductive method, how can one be certain that enough observations have been made that he can be reasonably certain of the estimated probability of obtaining heads? "Enough observations" involves the Law of Large Numbers, and "reasonably certain" involves the tests of significance or reliability, each of which will be discussed in turn.

The Laws of Large Numbers are defined in various degrees of precision, depending upon the purpose for which the concept is used. For purposes of this discussion of insurance the simple definition of Athearn's is sufficient:

The law, or principle, of large numbers may be stated as follows: The larger the number of trials, the more nearly actual experience will approximate the underlying probability. 9/

Thus, the Law says that, using the inductive method of estimating probability, the more observations made upon which to base the estimate, the more accurately can the estimate be made. However, the definition says nothing about how many observations are necessary so that the estimator can be reasonably certain of the accuracy of his estimate. Tintner's more sophisticated definition provides a clue to reliability:

It is almost certain that the difference between the theoretical mean value (mathematical expectation) and the

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8/ Athearn, op. cit., pp. 52-53.

9/ Athearn, op. cit., page 53.

empirical arithmetic mean of a number of random variables becomes as small as desired, if the number of random variables is sufficiently large. 10/

His definition implies that an allowable deviation be selected, and enough observations be taken so that the probable error of the estimate falls within the desirable deviation. The method is familiar to students of statistics: A reliability test is applied to the data such that the estimator can be, for instance, "95 percent confident" that the true outcome will be within a given range of the estimate. If he wants to be, say, 99 percent confident, the number of observations must be increased accordingly. The problem for the estimator then becomes that of selecting the confidence level he wishes to obtain.

Tintner's definition of the Law of Large Numbers refers to "random variables," a common term in sampling theory, which in turn is part of the inductive process of estimating probability. An adherence to sampling theory is basic to accurate probability estimating. Later in this chapter it will be brought out that perfection in probability estimating is impossible of achievement with respect to risk and insurance. However, it should be stressed at this point that the closer the approach to achievement of perfection, the more reliable the results.

#### Requirements of Good Sampling Procedure

Pfeffer says that the most difficult question for the actuary (the insurance-industry name for the estimator referred to above) to answer is whether or not ". . . inferences derived from the mathematical model (are) valid for the universe under study." 11/ In other words, if the actuary observes the effects of grouping of past events upon a sample of individuals how can he determine the validity of applying or inferring the results to a similar group in the future?

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10/ Tintner, Gerhard, Mathematics and Statistics for Economists, Holt, Rinehart and Winston, Inc., New York, 1953, page 210.

11/ Pfeffer, Irving, Insurance and Economic Theory, Richard D. Irwin, Inc., Homewood, Illinois, 1956, page 60.



The solution of this problem hinges upon meeting the requirements implicit in the formulae of sampling theory. Statistically, randomness and the existence of fixed limits to relative frequencies--there must be an underlying probability for the occurrence of the variate in the universe of data--are the only essentials for the applicability of the Laws of Large Numbers. In practice, however, these requirements must be stated more explicitly in order to determine the extent to which they are met. 12/

The first requirement is a clearly defined collective--the statistical universe whose characteristics are to be inferred from the sample. 13/ For the actuary this means that there must be a high degree of homogeneity between the observed sample and the universe to which the derived inference is to be applied. If known changes have occurred between the sample and the future population, and if they are not amenable to a correction factor, then this first requirement is not met. The crop insurance actuary's problem with this requirement is that he must be careful that his sample of potential insureds is representative of the actual insureds. He must allow for changes that have occurred in technology, for instance, between his sample or observed potential insureds and the actual insureds. He must be alert to changes that have occurred in control over perils between the sample and the population to which inferences will be applied.

The second requirement of the sampling method is randomness, referred to in Tintner's definition above. Pfeffer lists two requirements for randomness which most clearly defines the term: (1) Homogeneity of units within the group or population:

Exposure units are said to be homogeneous when their probabilities of loss from the occurrence of a specific peril are equal. . . .

Homogeneity can only be maintained in the absence of factors which tend to disturb the underlying probability of the variate in a random sample. The existence of a "moral hazard," which causes the insured to alter the expected loss

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12/ Ibid., page 60.

13/ Ibid., page 60.

experience either by the commission of arson, suicide, or some other crime against an insured life or property; and the presence of a "moral hazard" whereby insureds grow careless because of the possession of insurance, both destroy the homogeneity of the sample. Homogeneity thus requires that the event insured against be "accidental" in the sense that the occurrence is beyond the control of the insured. 14/

Here the concept of adverse selection of risks is described. It will be discussed more extensively later in this dissertation. It is apparent that the risk units must not only be homogeneous, but also the perils must not change between the sample and the future group. For instance, the estimate of risk of crop loss may include a substantial grasshopper peril, based on past loss history. However, it is well known that grasshopper infestation can now be effectively controlled by chemicals.

(2) The events must be statistically independent, meaning that "the occurrence of any one of them does not affect the occurrence of the others." 15/ Here again is a requirement that is rarely achieved in reality, but which should be carefully noted and properly accounted for to the greatest possible degree. Statistical independence forms the basis of a considerable portion of this dissertation in the sections on perils and merit rating.

The third requirement of the sampling method is mass--a sufficiency of exposure units in the sample. This requirement, too, is often unattainable, yet is the goal of the actuary who follows the rule that the larger the sample, the better will be his estimate. Later this requirement will be discussed in connection with the problem of participation in crop insurance, spread of risk, and merit rating.

#### Summary--Risk and Uncertainty

Uncertainty arises out of the failure of future events to occur according to expectation. Specialists in the field of risk and uncertainty usually reserve the risk term for the measurable chance of gain or loss

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14/ Ibid., page 62.

15/ Ibid., page 63.

arising out of uncertainty. Risk usually is identified with loss rather than with gain, particularly in the field of insurance because insurance is concerned only with the problem of risk loss. Also in the field of insurance the term risk is used to denote the object to which the chance of loss is applied--the object insured, such as house, person, or crop.

Chance of loss implies an estimate of probability. In insurance the inductive method of estimating probability is used, which involves the observation of samples of past events or risks, including the accompanying perils, and from the sampling process infers loss probability for a population similar to the sample.

The inductive method requires correct sampling theory for accuracy in estimating probabilities. The requirements are: (1) A clearly defined collective--a homogeneity between the sample and the population about which an inference is made from the sample; (2) Randomness--a homogeneity of units within the population, and a statistical independence between events; (3) Mass--a sufficiency of exposure units in the sample, which is also a requirement of the Law of Large Numbers and a basic consideration in tests of reliability.

The point is often stressed that the ideal requirements of sampling theory are not attainable "in the field," but that the closer they are approached, the more accurate will be the results achieved. Thus meeting the requirements becomes the goal of the insurance actuary, although it (the goal) is seldom perfectly achieved.

### Theory of Insurance

#### Definition

There are many definitions of insurance, depending upon whether the problem is related to the insured, to the insurer, to legal matters, to an actuary striving for perfection, to a private corporation, or to a public official committed to the job of executing a program legislated by Congress.

The simplest and most appropriate definition from the standpoint of the insured is that insurance is a device whereby an individual can

substitute a certainty for an uncertainty. In the case of crop insurance, a farmer can use the device of Federal crop insurance to exchange part of his uncertainty of crop yield for a certain crop insurance premium. Magee begins his book with this definition:

The function of insurance is to provide certainty. To effect this end, insurance seeks to reduce the uncertain consequences of a known peril, so that the cost of losses as they affect individuals will be certain, or at least relatively certain. 16/

This suffices as the functional definition of insurance. A great deal of time and space could be used to expound the many other definitions of insurance which would contribute very little to the idea of its function as simply stated above. However, for purposes of this dissertation and in order to be more precise when speaking of "insurance," the "necessary and sufficient criteria of insurance" must be established. Pfeffer combines these criteria or conditions into what he calls his generic definition:

Insurance is a device for the reduction of the uncertainty of one party, called the insured, through the transfer of particular risks to another party, called the insurer, who offers a restoration, at least in part, of economic losses suffered by the insured. 17/

Thus the necessary and sufficient criteria for insurance as the term will henceforward be used are: (1) It is a device, something contrived to accomplish a specific purpose. A deficiency in his definition is that he does not stress the grouping aspect of insurance, which is implied in the term risk, and is necessary to future discussion of insurance. That is, insurance is an institution--a device whereby there is a grouping of individuals, or risks, for the purpose of accomplishing certain ends, namely decreasing uncertainty to the individual members. (2) By means of this institution or device, risks are transferred to another party. This party may be a person or a legal entity such as partnership, corporation, or

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16/ Magee, op. cit., page 3.

17/ Pfeffer, op. cit., page 53.

association, which binds itself by agreement to a given degree of restoration of given economic losses suffered by the participating individuals.

(3) The purpose of insurance is implied in the above two criteria--to reduce the uncertainty of the participating individuals, the insureds.

Pfeffer tends to avoid the use of the term "institution" in his final connotation of insurance; other authors consider it as a necessary part of an insurance definition. This author prefers to stress the inclusion of "institution" in the definition because the collective aspect is important in distinguishing insurance from many other devices for reducing uncertainty. Examples are so-called self-insurance schemes such as one individual assuming the risk of another, without grouping several risks-- a father pledging some of his resources to back his son's venture. Another example is an individual storing grain in lieu of taking crop insurance. Athearn incorporates the institutional concept in his definition:

The essence of the insurance scheme is that it is a social device, that it involves the accumulation of funds, that it involves a group of risks, and that each person or firm who becomes a member of the group transfers his risk to the whole group. 18/

A "social device" is an institution. This author is now taking the liberty of contriving his own generic definition for purposes of framing the term for all future reference in this dissertation: Insurance is an institution devised for the purpose of reducing the uncertainty of each party (called the insured) participating in the institution through the transfer of particular risks to another party (called the insurer). The transfer is accomplished through an accumulation of funds paid by the insureds to the insurer, from which funds the insurer agrees to restore a given part of economic losses suffered by an insured resulting from given uncertainties (called perils).

Insurance provides the insured with the means of substituting certainty for uncertainty. The insurance institution faces the problem of

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18/ Athearn, op. cit., page 51.

combining risks in such a way, and charging the insureds such an amount that premiums collected equal the probable losses paid plus any additional costs involved, such as administrative, adjusting and sales costs. The probable loss is a function of the perils covered, the probabilities of their occurrence and extent of losses caused thereby.

### The Nature of Insurance

The ideal insurance situation is one in which the risks covered meet the accepted requirements of insurability. Greene prefaced his list with the reservation:

These requirements, as presented below, are not necessarily complete. . . . The requisites listed are intended to be suggestive of the type of underwriting standards usually looked upon as basic to the acceptance or rejection of risks as submitted to the insurer. These requirements should not be considered absolute, as iron rules, but rather as guides. In practice, for example, it is not at all uncommon for an insurer to accept a risk even though some of the following requirements are not met, providing the premium to be earned is great enough to compensate the insurer for his risk. 19/

Likewise, the following list of requisites for ideal insurability, compiled from Athearn and Greene, are to be used as guides in evaluating and analyzing the subject insurance problem: 20/

1. The risk should be measurable within some predetermined level of reliability; that is, there must be homogeneity among the insured units, the loss-causing perils covered must occur randomly and independently, and there must be a large number of exposure units (These are the requirements of sampling theory). This requisite is vital to the insurer, who must be able to predict his probable loss cost to which he has obligated himself by the insurance agreement, and to calculate a charge or premium for the insured that will

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19/ Greene, Mark R., Risk and Insurance, South-Western Pub. Co., Dallas, 1962, page 47.

20/ Athearn, op. cit., pp. 54-56 and Greene, op. cit., pp. 46-50.

not only cover the expected loss cost, but must include the insurer's expenses of operation and normal profit over the actuarial period. (The actuarial period is the time span over which the insurer predicts his loss cost. In most insurance, the period is one year, geared to the normal annual premium. However, it is very important to note that the actuarial period must be much longer in an insurance program, such as crop insurance, where perils do not occur randomly within a year, but rather over several years.)

2. Losses must be accidental. This requirement is implied in the requirement for randomness, since perils under the control of the insured could not be expected to be random, nor completely independent of other perils. Further, a peril that can be influenced by the insured, or otherwise not accidental, is no longer uncertain. This requirement is important in avoiding the "moral hazard"<sup>1</sup>-the chance of an insured using insurance for gains over and above his expected losses from uncertainty. The failure to meet this requirement can have a very adverse effect on fulfilling the requirement for large numbers of insured units:

Because of the requirement that the loss be accidental, insurers normally exclude in all policies any loss caused intentionally by the insured. If the insured knew that the insurer would pay such losses, a moral hazard would be introduced, and there would be a tendency for losses and premiums to rise. If premiums become exceedingly high, so few would purchase insurance that the insurer would no longer have sufficiently large numbers of exposure units to be able to obtain a reliable estimate of future loss. Thus, the first requirement of an insurable risk would not be met. <sup>21/</sup>

3. Loss must be determinable and measurable. In addition to a risk being capable of statistical measurability, the loss involved must

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<sup>21/</sup> Ibid., page 48.

- be identifiable and capable of being evaluated. One example of the problem involved when this requirement is not met is in accident and health insurance: If the policy provides for payments in the event of "complete disability" the question arises as to exactly what constitutes complete disability, and just exactly when does it begin? Another example is in the case of bodily injury liability: What is the exact loss caused by the injury of a person, to himself and to his family? Greene points out that the evaluation procedures and determination procedures must be set up by the insurer before he assumes the burden of risk. <sup>22/</sup>
4. The loss must not be subject to catastrophic peril. A catastrophe can be defined in different ways, but in general it means an extreme deviation from the expected average that was not contemplated. An example is a peril that affects simultaneously the whole group of insureds, such as a storm that devastates an entire geographic area. Most types of insurance cannot avoid the catastrophe peril, but make allowances for it by wide geographic dispersion of risk, by wider dispersion of the actuarial period over time, by weighting the premium to accumulate a special reserve over a longer period, or by reinsurance, which in effect sets up a new insurance institution. Hail insurance is an example which uses several of these methods of meeting the incidence of catastrophe risk. Most insurers do specifically exclude certain catastrophes where the potential loss is essentially limitless or for which adequate reserves would not be feasible. The best example is the clause excluding war and insurrection in every domestic property-damage policy.
  5. The potential loss must warrant protection. This means that the potential loss from perils covered must be significant to the individual insured:

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<sup>22/</sup> Ibid., page 49.



Regardless of how economically the scheme may be operated, insurance for risks that are not significant for prospective insureds will not function. No one wants it. The possible loss must be significant to the person who faces the risk or he will not bother insuring it. If, for example, all the people who own automobiles were millionaires, it is doubtful that much automobile physical damage insurance would be written. Such losses would not be significant to the automobile owners. 23/

Much can be said about types of insurance that include coverage for insignificant perils--risks which most insureds can absorb out of current income or savings. However, most of these risks are included with more vital coverages. Greene points out that from the standpoint of the insured:

A basic principle of insurance buying, however, is that the most economical use of insurance premiums is first against the serious loss and then against the less serious losses, and not vice versa. 24/

6. The probability of loss must not be too high, or, as Athearn puts it, the insured risk must be economically feasible. The higher the probability of loss, the more certain it becomes, and the higher will be the ratio between the premium and the possible loss and the less attractive the insurance appears to the insured:

The contract becomes one of "trading dollars" with the insurer, but on an unfavorable basis to the insureds, since the insurer must collect more money than he pays out to the policyholders in order to cover the cost of doing business. 25/

This last requirement is the one with which crop insurance comes into conflict. Writing it is not economically feasible in certain especially high-risk areas. Flood insurance is not economically feasible because the

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23/ Athearn, op. cit., page 56.

24/ Greene, op. cit., page 50.

25/ Ibid., page 50.

high probability of loss requires a premium too high for those who are interested in it--those located where floods can occur.

#### The Nature of Insurance--Imperfections

In practice, the different types of insurance rarely if ever meet all the accepted requirements of insurability listed in the preceding section. Rarely are two situations, people, objects, or perils exactly alike. Definitions of classifications or groupings can seldom be perfectly inclusive and exclusive. This is why, as Greene said, the requisites for insurability are looked upon as guides, not as absolute requirements. 26/ The problems in insurance programs are found in the deviations from these insurability requisites. The place to look for solutions to the problems is in the deviations and how they are handled by the insurance institutions.

Most insurance fails to meet the measurability-of-risk requirement, or the requirements necessary for accurate predictability, especially within the premium time period. For instance, the normal time period covered by a premium is one year, except in life insurance. However, the time period required for an accurate prediction of a certain type loss may be five or more years. Where this is the case, the insurance institution must in some way predict the probable annual deviation from their long-term prediction and make allowances accordingly:

Experience has demonstrated that in a particular group of risks for a given period the losses will not of necessity correspond exactly to the average loss as indicated by statistical evidence. Losses vary from year to year, one way or the other, from the average figure. The insurer who is interested in eliminating uncertainty must recognize this element of variation and make provision for meeting it. Accordingly, he is interested in knowing not only the probable losses for a given year but also the probability of a deviation from the predictable average. 27/

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26/ Greene, vid., page 19.

27/ Magee, op. cit., page 74.

An insurance institution must therefore build reserves in premium-surplus years to balance deficits in premium-deficiency years. Some companies, rather than risk their own financial position to meet this situation, use the reinsurance method to protect themselves against the uncertainty of deviations from the long-term predictions. By reinsurance, they combine their risks with those of other companies, converting their own individual uncertainty to a risk for the larger group, paying the reinsurance institution a premium for the risk assumption. Institutions which do not recognize or choose to ignore the annual deviations from the long-term predictions are risking financial difficulties or having to adjust premiums every year, either of which leads to inefficiency in operation.

It is important to note that all-risk crop insurance covers perils that can strike an area as large as the entire United States in a given year. An example is the drouth of the 1930's. This situation precludes the use of a reinsurance plan to convert uncertainties for a smaller company to a risk for a group. The only recourse in this case is to huge resources which are available only to the Federal government.

All insurance companies prefer to limit themselves to coverage of only the accidental and unintentional losses--to eliminate the moral hazard. However, it is impossible to "ride herd" on insureds, and also to accurately discern the moral hazard. For this reason, sound insurance institutions are obliged to do two things: (1) Incur expense to "underwrite"--that is, expend effort to eliminate as much of the moral hazard as possible; and (2) make a charge for an estimate of moral hazards that cannot be eliminated. In the section on merit rating it will be shown how a premium can be weighted to allow for the moral hazard, and how experience credits can be used to discourage voluntary loss-causing acts, and encourage risk-improvement efforts, instead.

The most difficult problem in disability, workmen's compensation, and liability insurance is the failure to fully meet the requirement of determinability:

It is a real problem to insurers, however, to be able even to recognize certain losses, let alone to measure them. For example, in health insurance, the insurer may agree to pay the insured a monthly income if "he should become so totally disabled as to be unable to perform the duties of his occupation." The question arises, however, as to who will determine whether or not the insured meets this condition. . .

Even if it is clear that a loss has occurred, it may not be so easy to measure it. For example, what is the loss from "pain and suffering," or of an auto accident victim? Often only the jury can decide. 28/

Here again is a deviation from the ideal insurance requirements which is a source of insurance-management problems. Not only must annual deviations from the long-term average be recognized, but also the premium must allow for the non-random effects of changing laws, variations between jury attitudes, effects of new court interpretations, and other influences not amenable to statistical prediction.

One can scarcely conceive of a risk that is not subject to some catastrophe peril. Here it must be remembered that the definition of a catastrophe depends upon the situation of the insurance institution. To a small insurance company, concentrating most of its hail insurance in one state, a severe hailstorm would be a catastrophe against which it could probably not build sufficient reserves. However, if it traded risks with other companies over several states in different agricultural regions, this same storm would not be a catastrophe. This is the typical method used by insurance companies to convert what might be a catastrophe to the individual company into a measurable risk for a group of companies. Sometimes there are catastrophes of a type that cannot be accepted by insurance institutions within a feasible premium framework. An example is the war peril. It is usually excluded from coverage altogether. Another example is damage from nuclear activity, which is assumed to a certain extent by the Federal government. Some catastrophe perils are accepted by special risk bearers, such as the Lloyds Group, who are in the business of

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28/ Greene, op. cit., page 49.

combining so-called catastrophe perils, and in some cases assuming the uncertainty of others with the hope of gaining a profit over a period of years.

From the standpoint of the insurance institutions it is not important whether a risk is worth insuring, as long as buyers are willing to pay the required premium. Insurance sales efforts, and lack of understanding, often cause consumers to overestimate the actuarial value of small coverages. However, there are other values that the consumer attributes to insurance and for which he is willing to pay. In health and accident insurance the cost of paying small doctor bills through insurance is much higher than if paid directly. Yet many insureds apparently prefer the expensive "forced saving" feature of insurance to voluntary saving for health contingencies. In auto insurance apparently many people prefer the convenience of an insurance company taking care of their losses, rather than taking care of small losses themselves at a lower cost. Thus, many potential losses are covered under insurance policies, whether or not they theoretically "warrant protection."

The economic feasibility of a risk is difficult to determine, and varies considerably from one type of insurance to another. It would appear that the greater the probability of loss, the more likely would the individual want to insure. However, there appears to be a point (and it varies with different types of insurance) where the ratio between premium and the insured's potential loss is higher than he is willing to go. Insurance companies in most cases are forced to "feel their way" in attempting to determine whether potential insureds will accept the premium necessary to safely insure a certain peril in a particular situation. The author noted during his experience in selling insurance that many insureds would, for instance, pay as much as \$50 per year for collision insurance on a car worth \$500, and turn down the opportunity to protect themselves more adequately by raising their liability coverage from \$10,000 to \$25,000 for a premium increase of only \$5 per year. It is not now feasible to write flood insurance on dwellings, but if those who are interested would be

willing to pay the necessary premium, it could probably be written. On the other hand, businesses in some risky categories are willing to pay rates as high as 10 percent of the value insured. Naturally when the probability of loss is high more effort will be expended, and more cost will be incurred in decreasing the probability of loss. This is why investments are made in sprinkler systems in large business establishments, and why time and money is expended on safety programs.

Some insurance programs deviate so far from the requirements of insurability that it is questionable whether they are in fact insurance. Reede, expressing the actuarial view in 1936 when writing on unemployment insurance, argued that there were reasons why unemployment should not be considered an insurable risk. In fact he indicated opposition to using the term in connection with any form of social insurance:

The increasing use of the term "reserves," (or "compensation," or "benefits") rather than "insurance," when referring to unemployment insurance, reflects a prevalent view that it is unwise actuarially to treat the problem of unemployment. It has long been held that the term "insurance" should not be used in connection with any form of social insurance. . . . The objections to the use of the term seem strongest in regard to unemployment insurance. The opposition seems to come from two sources. On the one hand, many business leaders, economists and actuaries doubt that unemployment is an insurable risk. On the other hand, many students of labor and other social problems fear that many features of an unemployment insurance program will not be included unless there is escape from the term "insurance." 29/

Reede gives the following reasons why unemployment insurance should not be considered "insurance:"

1. Inadequacy of data covering a long period of time.
2. Lack of predictability: The past is inaccurate indication of future; imperfect knowledge of causal factors; occurrences are

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29/ Reede, Arthur Hallam, The Actuarial Aspect of Unemployment Insurance: British Experience, Penn. State College Studies, Vol. 1, No. 1, 1936 page 2.

not independent over time, and also not even independent of the insurance.

3. Difficulty involved in classifying of risks because of problems in defining homogeneous groups.
4. The insurance itself provides an incentive for stability, so that the exposure to risk is not random. 30/

A social risk-assumption program can qualify as insurance under this definition as long as it involves the grouping of risks, the individual risks contribute to the accumulation of funds, and restoration of losses are made from this fund. In Chapter VII under the Judgment Rating section it will be pointed out that some phases of fire insurance, one of the oldest accepted types of insurance, are completely devoid of statistical prediction, but still qualify as insurance.

#### Summary--Theory of Insurance

Insurance is an institution devised for the purposes of reducing the uncertainty of each party (called the insured) participating in the institution, through the transfer of particular risks to another party or group (called the insurer). The transfer is accomplished through an accumulation of funds paid by the insureds to the insurer, from which funds the insurer agrees to restore a given part of economic losses suffered by an insured resulting from given uncertainties (called perils). From the standpoint of the individual confronted with economic loss due to uncertainty, insurance provides him with the means by which he can substitute certainty for uncertainty.

The soundness of an insurance program depends upon the degree to which the insured situation meets the accepted requirements for insurability: (1) Statistical predictability, which requires randomness and independence of occurrence of events; (2) losses accidental--no moral hazard; (3) determinability and measurability of losses; (4) losses not

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30/ Ibid., page 2.

subject to catastrophe perils; (5) losses are significant to the potential insureds; and (6) relatively low probability of loss.

Practically all types of insurance written fails to meet some or all of these insurability requisites to some degree, in one way or another. Most of the insurance problems arise out of the deviations from the ideal situation. The requirements are a guide, and solutions to the problems are found in methods used to allow for the deviations. Newer insurance programs will find many parallels in the older, more mature institutions.

#### Insurance Compared with Other Methods for Meeting Uncertainty

Insurance involves costs of administration, including normal profits to the business firm. In addition, since few if any risks meet all the requirements of insurability, the insurance premiums must also include a payment for the assumption of some uncertainties along with the risks. Where this portion of the premium (which arises from factors other than the pure risk itself) is relatively large, there is a strong incentive for individuals and firms to use other methods to meet uncertainty. (It should again be emphasized at this point that the uncertainties under question are those that can be converted to insurable risks--they do not include such uncertainties as those due to management ability, market changes, technology, government policy, or changing tastes and customs.) Any classification of other-than-insurance methods is beset by the problem of overlapping, the following being no exception:

#### Examples of Other Methods

Loss Prevention.--The commonest method, and socially most desirable, is removing or reducing the uncertainty by reducing or removing the loss peril. Examples of such methods are the installation of sprinkler systems (this adds the sprinkler-leakage peril, which is not as severe as the fire peril which is reduced by the installation), building of fire-resistant structures, safety installations, physical checkups, better farming methods, information and education. All of these methods of loss prevention involve added costs to the firm, which must weigh the added costs against the cost



of insurance. Loss prevention is combined with insurance as a method of reducing the insurance premiums. In some cases insurance companies employ loss-prevention methods to reduce a risk to a level which makes insurance economically feasible. Loss prevention will be discussed further in Chapter VII, under merit rating.

Expansion of the Firm--Diffusion, Diversification, and Dispersion.--

Individual firms can, by expansion, accomplish the conversion of uncertainties into measurable risks, which is no different from insurance except that perils are grouped within the firm, rather than combined with those of other firms under an institutional arrangement outside the firm. This method is often called "self-insurance," but does not meet the usually accepted definition of insurance (nor the definition accepted for this study), particularly that insurance is an institution apart from the firm, set up for a special purpose.

By expansion a firm is able to increase its volume of business activities such that any one peril may not be relatively important. Suppose, for example, that a firm has one plant, and that its fire risk is the loss of this plant in 100 years. If it lost the plant within the first five years of operation, the uninsured loss would presumably put the firm out of business. On the other hand, suppose the firm had 100 such plants, dispersed geographically. It could expect one plant to be destroyed each year, and building a reserve for such contingency is not out of the question. Further, the firm would not necessarily be out of production while the plant was being restored, but could possibly add the output to the other 99 plants. This is the "diffusion" process of meeting uncertainty by expansion of the firm--as a firm becomes larger, a given loss peril becomes relatively less critical.

Diversification of enterprises is possible through expansion of the firm. By expansion into enterprises which are not subject to the same perils, a firm is reducing the relative risk from any one peril. Farming presents one of the best examples of this method of meeting uncertainty. It is often argued that a diversified farm does not need crop insurance

as badly as a straight crop farm, the idea being that the same perils that cause crop losses are not the same ones that cause livestock losses. Some crops are not susceptible to the same perils as others.

However, the big disadvantage of diversification, especially if not accomplished along with expansion, is that it requires a sacrifice of some of the advantages of specialization. Here again, the firm must weigh the sacrifices against the gains. If a firm can be expanded to the point where each enterprise is a completely specialized unit in itself, then it avoids the sacrificing of specialization advantages.

Especially where weather perils are critical, as in farming, dispersion of the firm is an important method for meeting uncertainty. For example hail is known to occur over a relatively small area in each storm. One wheat farm in Montana with which the author is acquainted has had a maximum annual total hail loss in over 50 years of less than 50 percent, but has had nearly 100 percent loss on part of the farm at least ten times. The farm has a maximum dispersion of two miles in one direction and one and one-half miles in the other.

Reserves.--An individual or firm can accumulate reserves against the risk of loss. Three problems are involved here: (1) Having sufficient time to accumulate reserves to meet the first critical loss; (2) protecting against the contingency of being the concern that has more than the expected losses from uncertainties; and (3) the management of the reserves--how much, maintaining liquidity, and profitable investment. This method, of course, overlaps in many ways the expansion method. The larger the firm, the more accurately can the required size of the reserves be determined, the less (relatively) reserves are needed, and the more the firm can specialize in the management of the reserves. Farmers have often maintained stores of crops for meeting uncertainty of crop loss. However, storage of commodities has the disadvantage of possible loss through deterioration, accidental loss by fire and other perils, and unfavorable changes in price. Storage also involves costs. Reserves in small firms are subject to dissipation--being used for other contingencies--or not

being sufficiently liquid when needed, principally because of management deficiency.

#### Basic Advantages of Methods Other Than Insurance for Meeting Uncertainty

The concern here will be with the economic advantages of using methods other than insurance for meeting uncertainty. If there is a monetary gain in using other methods, what are the basic sources of the gain? The sources must be found outside of pure risk, or in differences between the magnitude of the risk as faced by the insurance institution as compared with the risk as faced by the firm itself. In most cases, and in farming especially, risks are not perfectly random, and the producer does have some opportunity to affect the amount of risk. If he chooses some method other than insurance for meeting uncertainty, the incentive to prevent losses is greater than if he is paying a premium to an outside institution. This is particularly true if his risk of loss is lower than the average upon which the premium is based, and such difference is not compensated by a premium reduction. If a firm is assuming its own risks, all the net gains from loss prevention and avoiding claim-settlement costs accrue to itself. Also, there is nothing gained by creating a moral hazard within a firm. These factors are all elements of cost that can seldom be completely avoided in insurance.

Some firms, which are of sufficient size that they can afford specialized management and sufficient resources to ride out a financial storm, can meet their own uncertainty situation at less cost than an insurance company because of better knowledge of their business. Some firms are faced with risks which are so far below the average that the cost of their own loss-protection methods is appreciably below that of insurance. This is a situation that should be carefully considered with respect to large farming units.

It is sometimes argued that the insurance-sales costs are an appreciable portion of an insurance premium and can be saved when a firm uses other methods of meeting uncertainty. On the other hand, insurance companies would argue that sales efforts are responsible for efficiency in

the operation of insurance companies, and consequently are not an added cost. To the extent that this is not so, sales costs can be a saving to a large concern that uses other methods to treat its own risks.

If we accept Knight's thesis that "pure profits" arise out of uncertainty, then the firm which can well-manage its own risk assumption is in a position to keep these profits to itself--an addition to its total volume of business and profits. 31/

#### Basic Economic Advantages of Insurance--To the Firm

The circumstantial evidence (high volume of sales) points to the fact that there are economic advantages of insurance to individuals and firms. These advantages, if there be such, are especially important to this study if it is to contribute to the improvement of the Federal crop insurance program. The economic advantages must be isolated, analyzed, and exploited. The magnitude of the total volume of insurance sales in the United States indicates acceptance of insurance and the apparent awareness of advantages. Table I shows that the total of insurance purchases in 1959 was equivalent to about one-eighth of the total national income of \$400 billion. Private insurance alone equalled about one-twelfth of the national income. But particularly important is the fact that insurance buyers were willing to pay private insurers twice as much premium as they received in benefit payments! Even allowing for the fact that this was a period of growth, particularly in life insurance, and that benefits would accordingly tend to lag behind premiums, it is notable that insureds would be willing to pay such a high margin above actual risk. According to Best's, in 1961 the 100 largest stock and mutual fire and casualty companies earned almost \$12 billion in premiums; indemnities and

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31/ Knight, op. cit., page 48. It should be noted here that "profit" was previously defined by Knight: "It will be perceived that the word 'profit' is here used in the sense of 'pure profit', a distributive share different from the returns to the productive services of land, labor, and capital." (page 18)

TABLE I. INSURANCE ACTIVITY IN THE UNITED STATES, 1959, MEASURED BY ASSETS, PREMIUMS, AND BENEFIT PAYMENTS.\*

Sector of Activity	Assets	Premiums	Benefit Payments
<b>Private insurance activities</b>			
Private insurance companies	\$142,251,876,057	\$30,706,360,406	\$15,192,950,061
Private noninsured pension funds <sup>a/</sup>	23,800,000,000	3,100,000,000	1,000,000,000
Total private	\$166,051,876,057	\$33,806,360,406	\$16,192,950,061
<b>State government insurance activities</b>			
Compulsory temporary disability funds	255,053,700	200,478,000	164,375,000
Hail insurance funds	2,888,200	2,072,719	1,554,756
Life insurance funds	2,177,311	193,410	89,301
Retirement funds (state and local) <sup>a/</sup>	9,249,000,000	1,755,000,000	603,000,000
Unemployment insurance funds	6,892,173,000	1,955,666,000	2,279,017,000
Workmen's compensation funds	1,229,673,615	339,194,666	263,730,779
Total state	\$ 17,630,965,826	\$ 4,252,604,795	\$ 3,311,766,836
<b>Federal government insurance activities</b>			
Civil Service retirement & disability	9,212,841,693	1,515,852,193	791,615,469
Federal crop insurance	48,700,448	18,473,807	14,130,937
Federal Deposit Insurance Corporation	2,089,800,000	78,400,000	500,000
Federal Housing Administration	1,087,188,587	165,639,263	84,063,086
Federal Savings & Loan Insurance Corp.	301,541,000	32,948,845	None <sup>b/</sup>
Life Insurance (Veterans Administration)	7,389,510,020	541,445,722	457,644,116
Old-Age, Survivors, and Disability Ins.	23,207,620,512	8,460,000,000	9,388,230,682
Railroad Retirement Board	3,862,210,915	629,216,717	1,028,900,000
Total federal	\$ 47,199,413,175	\$11,441,976,547	\$11,765,084,290
Total government	\$ 64,830,379,001	\$15,694,581,342	\$15,076,851,126
Total private and government	\$230,882,255,058	\$49,500,941,748	\$31,269,801,187

\* Source: Athearn, James L., *Risk and Insurance*, Appleton-Century-Crofts, New York, 1962, Table I, p. 10.

<sup>a/</sup> 1958 figures. "Noninsured" means not insured by a private insurance company.

<sup>b/</sup> Losses have averaged 1.5% of premium for 24 years.

adjustment costs amounted to 60 percent to 70 percent of the premiums earned. 32/

The most obvious reason why individuals and firms are willing to pay a relatively large margin for the transfer of risk is that they are in no position to take advantage of the other methods of meeting uncertainty. Usually size is the limiting factor; they cannot group risks, diversify, or disperse their risks. Though there is a wide margin of cost above the pure risk of loss, these firms and individuals find they can save no money by using other methods.

Insurance is a specialized business, as are most other modern businesses. As such, it attracts the skills and experience that is necessary to calculate risks efficiently, allow for inherent uncertainties, and manage reserves. Even large companies would hesitate to build the organization that is necessary to handle risk as efficiently as a well-organized and competitive insurance company. They prefer to use their skills in furthering their own business, rather than divert or expand into an unrelated field, such as insurance.

Even though a firm is large enough that it can take advantage of insurance techniques, this does not necessarily mean that it can provide for its own risks as efficiently as an insurance institution. For example, suppose that a firm is composed of 100 plants. It is conceivable that it could calculate its fire and liability risks within some degree of reliability, and set up an allowance for reserves to meet the risk. However, it must also make an allowance for uncertainties within its framework of risk calculation. Logically, an insurer covering 100 such companies is in a position to calculate risk more accurately (the Law of Large Numbers), and require less allowance for uncertainties as to its risk calculations, changes outside the firm, and unknown perils.

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32/ Best, Alfred M. Company, Inc., Best's Insurance Guide, Alfred M. Best Co. Inc., New York, 1962; pp. 76B-79B.

Services to insureds have been developed over the years, probably as a result of: (1) Sales competition and (2) an attempt to make risks insurable. It is hardly conceivable that many of these services would be as available and as effective under methods for meeting uncertainty other than through the competitive insurance industry. For example, risk program planning is one of the common services which is an important tool of insurance sales competition. In smaller companies this is a responsibility that is awarded to one of the managers who is probably much better trained for the principal business of the firm. A trained insurance company planner can be given the responsibility, and release the manager's time for work for which he is specially trained.

Another example of service is that provided in boiler insurance. Engineering and inspection was a necessary part of making boiler risks insurable, principally because boiler accidents were largely a function of management. It was necessary that this non-random peril be eliminated as completely as possible. Actually this service eventually resulted in relatively low rates. In addition, the trained boiler inspectors often were able to provide firms with cost-saving and efficiency-gaining advice with respect to installations and changes in boilers and machinery.

Insurance is an important tool in the availability of credit. The insurance policy is recognized evidence of loss protection. Few, if any, other methods for meeting uncertainty provide as strong evidence as the insurance contract. Many smaller firms are required by lending institutions to file evidence of insurance when they obtain credit. Particularly is this true in farming.

Summary: Insurance Compared with Other Methods for Meeting Uncertainty

The purpose of this section is to provide a background for the principal objective in this dissertation--to find ways in which the crop insurance program can be improved. The FCIC is in competition with methods for meeting uncertainty other than insurance. Three major categories of methods are: (1) Loss prevention; (2) expansion of the individual or firm's operations to the point where loss perils may be converted

from uncertainties to measurable risks for the firm; also expansion tends to reduce the maximum potential loss to the firm from any one peril; (3) the accumulation of reserves.

The evidence indicates that the cost of risk assumption through insurance amounts to as much as 30 to 70 percent of the premium earned by fire and casualty companies. This cost includes costs of administration and services, including sale costs, engineering, inspection, loss prevention and planning. In spite of striving for accuracy in prediction of losses, there remains the element of uncertainty, the cost of which is also included in premiums. The choice between buying insurance or meeting uncertainty by some other method is essentially no different from other economic choices: The choice will favor the method which will give the highest ratio between the marginal net gain and marginal net cost of the alternative methods. The difficult process is to determine correctly all costs and all gains, many of which are subjective and not amenable to measurement.

#### All-Risk Crop Insurance Compared With Other Types of Insurance

If all-risk crop insurance, in particular the Federal crop insurance program, is compared with more mature types of insurance, solutions to crop insurance problems might be found where there are similarities in organization, characteristics of insurability, perils covered, characteristics of the insureds, or wherever else the problems appear to be centered.

#### Federal Crop Insurance--A Public Institution

As a government institution Federal crop insurance enjoys a potentially unlimited source of resources against the uncertainty of a catastrophic loss, which is not available to private companies unless underwritten by the government. This situation is similar to other government insurance corporations, such as the Federal Deposit Insurance Corporation (FDIC), Federal Savings and Loan Insurance Corporation, Veterans Administration, the Investment Guaranties Division of the International



Cooperation Administration (foreign-investment insurance), and the Federal Housing Administration (loan insurance). "Unlimited" resources makes it possible for the Federal Crop Insurance Corporation to carry on experiments that are not economically feasible for private concerns. This is the basic reason why, after several failures of private companies to write all-risk crop insurance successfully (see Chapter III), it appeared that such insurance could be written only by the Federal government, at least during development stages.

Also related to the "unlimited" resources is the advantage a Federal institution has in the time over which it can extend and evaluate its loss experience. This does not mean the Federal government will always sanction consecutive years of net underwriting losses, but annual loss experience is not as pressing upon the government as it is upon a board of directors of a private company.

On the other hand there are at least two problems inherent in a public institution: Its operations are subject to public obligation and to political influence. These factors are sometimes in conflict with sound management, as will be discussed in the next chapters.

Most of the other insurance institutions of the Federal government are completely compulsory (Social Security) or are in effect compulsory. The national banks are required to carry FDIC coverage, which, in effect, compels all banks to protect their depositors. One cannot obtain a FHA loan without obligating himself to pay for the loan insurance. However, Federal crop insurance is completely voluntary, not even required for compliance with farm programs, nor required by quasi-public corporations, such as Federal Land Banks or Production Credit Associations. Neither is it required by the Farmers Home Administration. As a public institution, the non-compulsory characteristic of the Federal crop insurance program is an important indication of how Congress (the public) views the FCIC's problems.

Competition

Insurance management seeks high sales volume. A basic reason is that requirements for insurability include a large number of insured units. High participation in the program is an inverse function of the premium. In other words, Federal crop insurance shares with other insurance the "circular" problem of seeking low premiums to attract high participation to make it possible to offer low premiums to attract high participation, and so on.

Not only is high participation an inverse function of premium, but it is also a function of net gains to be obtained from the insurance purchase. Premiums are high or low only relative to benefits received. It therefore becomes a function of the potential buyer's knowledge of available benefits, which in turn is a sales function. Most non-compulsory insurance must be sold, and Federal crop insurance is no exception. True, it is not in direct competition with other insurance companies, but, like other insurance, it is in competition with other choices available to a buyer as he spends his income. Applying the conditions necessary for maximizing satisfaction, the individual will purchase insurance if his evaluation of the gains from buying insurance relative to its cost is at least equal to the same ratio in other choices available to him. 33/ The function of selling is to inform the buyer of gains to be obtained by the purchase of the product--in this case, crop insurance. Early in the history of crop insurance it was thought by some that, since Federal crop

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33/ Leftwich, Richard H., The Price System and Resource Allocation, Holt, Rinehart and Winston, New York, Rev. Edn., 1961, page 57: "The conditions necessary for maximizing satisfaction will be:

$$\frac{MV_x}{P_x} = \frac{MV_y}{P_y} = \frac{MV_z}{P_z} = \dots "$$

See Chapter IV for further discussion of crop insurance relative to farmers' decisions.

insurance was to be sold at cost, it would not be necessary to actively sell it--that it would merely need be made available to the farmers. However, American people, including farmers, are acclimated to receiving information on goods and services via aggressive advertising and sales efforts. Therefore, there is little reason to expect that Federal crop insurance information can be competitively transmitted any other way than by using some of the same techniques that are used in causing farmers to choose other products.

#### Non-Randomness--Independence--Moral Risk

Federal crop insurance shares with other insurance the problem of lack of randomness of events or perils, and lack of independence between events and between insureds and events. In the first section of this chapter, randomness and independence between events were listed among the ideal requirements for insurability. One can scarcely conceive of a risk or the effects of a risk that cannot be influenced to some extent by the insured. Even life insurance involves the problem of how an individual can affect the length of his life by the way he takes care of his health, or by his occupation. Crop insurance risks can be influenced by the insured by his cropping methods, the dispersion of his farm, and his attitude about small losses. Particularly serious is the problem of adverse selectivity. No group of individuals is perfectly homogeneous, there being both above and below average risks within any insurance group. The problem is to avoid insuring a greater-than-proportionate share of the below-average risks.

If a moral risk is defined as a deliberate attempt to cause an insured loss, it is probably not as prevalent in crop insurance as in such types as fire insurance. The problem is more in the nature of buying insurance when the probability of loss is high and dropping it when it is low. Under present laws, this is more difficult than in the early days of crop insurance, because of earlier closing dates, continuous policies, and chance of losing experience credits.

### Characteristics of the Insured Units

One characteristic that sets all-risk crop insurance apart from most other types of insurance is the extreme variability among the heterogeneous insured units, especially when compared with the total number of units. A comparable situation is that of large commercial fire risks. This characteristic often precludes accurate statistical predictability. In the experimental stage the problem of small numbers and high variability is particularly acute. Imagine opening the insurance program in a new crop area which is characterized by farms that vary in size from 100 acres to 5,000 acres of wheat, with soils that vary from the best of silt loams to shallow gravelly loams, with average rainfall varying from a critical 10 inches, up to 15 inches, with potential insureds who would have had an insurable loss once in thirty years to ones who would have had a loss once every three years, and with hail rates that varied from 7 to 12 percent. This is the situation that exists in almost any cash-grain county in Montana. Fire insurance rate-makers were confronted with a similar situation when they began to establish rates for commercial buildings.

### Characteristics of Perils

Drouth is the principal loss-causing peril covered under crop insurance. It has the peculiarity of occurring in relatively small areas in some years, and in others, such as 1934 and 1952, occurred generally over the entire United States. In other words, geographic spread of risk does not guarantee randomness in the occurrence of drouth, as it tends to do in the case of fire. As shown in Chapter VI, where perils are considered in more detail, there is a significant correlation in the annual precipitation between various stations in Montana over the past 43 years. Therefore the randomness of the drouth peril must be achieved over time, rather than by geographic dispersion of risks. (This is not to say that the latter does not help. There is much less correlation between stations over the Great Plains, than within Montana.)

With respect to the problem of spreading of risk over time, crop insurance is comparable to types of insurance such as supplied by the

Lloyds Group, and the Federal Deposit Insurance Corporation. Hail insurance is faced with somewhat the same situation--generally over the United States the incidence of hail is worse in some years than in others.

Reinsurance and trading insurance risks are means used by hail insurance companies to solve the time problem.

Other perils covered under crop insurance are either closely related to drouth, or are more random in character, within each year. Some insects tend to increase in severity with drouth. Some species break out in small areas, and may persist for two or three years until they either disappear naturally, or defenses are developed against them. Among the diseases, some rusts tend to occur in wet years, others appear in random outbreaks.

Achieving randomness of perils over time poses a special problem. Crop insurance, like most other insurance, is based on annual premiums. Also, there appears to be a tendency to evaluate its achievements on an annual basis, or at least over a very short period of years, not more than two or three years. However, even if the actuarial work resulted in perfectly accurate premiums, the loss experience would show consecutive years of depletion of reserves, and building up net losses.

#### Summary: All-Risk Crop Insurance Compared With Other Insurance

Federal all-risk crop insurance is a public institution, but different from most other public insurance in that it has no compulsory aspects. As a Federal institution, it enjoys potentially unlimited resources, enabling it to continue through catastrophic losses and to carry on extensive experiments over time. On the other hand, it is subject to public obligation and to political influence which causes conflict between policy and sound business management.

Though FCIC does not compete directly with other insurance companies, it does compete with alternative choices for income expenditure available to farmers. Because a large number of insured units is a requirement of insurability, high participation in crop insurance is a goal of management. Therefore, like all insurance, Federal crop insurance must employ selling

methods similar to those used in selling other products and services to farmers.

Crop insurance shares with other types of insurance the problem of imperfections of randomness and independence between events and between insureds and events. There are few risks which cannot be influenced by voluntary actions of the insureds. A particularly serious problem in crop insurance is avoiding adverse selectivity--insuring a greater-than-proportionate share of the below-average risks.

Like large commercial fire risks, crop insurance risks are characterized by extreme variability and lack of homogeneity, compared with the total number of units. This is a problem that is particularly acute in the experimental stages, when the insurance is being offered in a new county or on a new crop, until a large number of the potential insureds are participating in the program.

The nature of drouth occurrence (the most important loss-causing peril in crop insurance--see Chapter VI) is such that randomness can be achieved only through time. Although geographic spread is an aid to randomness, it is not sufficient. This is one reason why the achievements of the Federal crop insurance program cannot be evaluated on an annual basis.

## CHAPTER III

### HISTORY OF CROP INSURANCE

The research problem is to seek ways by which the Federal crop insurance program in Montana can be improved. If history is to be of value to the solution of the problem, it should provide some answers to the questions, "What was the program intended to do in the first place?" and "What were the principal problems encountered?" Therefore, the purpose of this history is to abstract some answers to these questions, rather than to rewrite the general details of all-risk crop insurance history, which have been ably treated in previous studies. 1/

#### The Congressional Record of Crop Insurance

Congress was the focal point of efforts to develop a Federal all-risk crop insurance plan, so it seems that the Congressional Record is the best place to find the answers to these questions. The following is a chronologically arranged review of the more pertinent remarks and events during the progress of the crop insurance program through Congress. This is intended to supplement, rather than to repeat, the previous, more comprehensive histories.

Crop insurance entered the Congressional Record in 1922 with the introduction of HR 10294, to establish a bureau of farm risk insurance in the Treasury Department. 2/ In support of the bill, Representative Edward King of Illinois presented probably the most comprehensive report and analysis of the crop insurance problem that is found in the entire Congressional record of crop insurance. (See complete remarks in Appendix B).

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1/ See Buckler, James L., All Risk Crop Insurance, (A thesis submitted to George Washington University) FCIC, USDA, Dec., 1950. Since this thesis is not generally available, Chapter I, Endeavors of Private Companies, is reproduced in the Appendix of this study.

Also see Halcrow, op. cit., pp. 22-25, where he briefly reviews the private and foreign experiments with all-risk crop insurance. Of particular value is his list of references relative to crop insurance history.

2/ Congressional Record, Vol. 62, Part 13, 67th Congress, 2nd Session, February 6, 1922, page 2205.

HR 10294 proposed an

Advisory board of three insurance experts, to be paid not to exceed \$25 per day while actually working. . . to aid the director and the Secretary of the Treasury in publishing a standard form of farm risk policy and to fix reasonable rates of premiums. 3/

The required use of qualified insurance personnel was apparently considered essential to the program in 1922, but was not included in the final bill that was passed in 1937. When the program was put on an experimental basis in 1947, the requirement was added to the bill by amendment.

Prompt payment of losses and provisions for adequate capital were recognized in the 1922 bill as important to successful operation of an insurance program. Prompt loss settlement is favorable to participation because indemnity and service are tangible evidence to the insured of what he purchased. That is why private companies in other lines of insurance stress prompt settlement and service in their promotional programs. Adequate capital is not only necessary for prompt service, but is also a requisite for bridging the uncertainties of the experimental years.

King stressed the ways by which the need for crop insurance was tied in with other sectors of the economy. He felt that a stable food supply was as important to the consumer as it was to the producer, and that a stable food supply was a function of the availability of capital. In 1922 the critical credit problem resulting from severe crop losses involved loans for seed. We now know that readily available credit has been responsible not only for a stable food supply, but also for the abundance of food, and the remarkable efficiency in food production. King argued that if uncertainty resulting from frequent crop failures could be eliminated, banks would be more willing to make loans. Today, banks are using the crop-insurance assignment privilege to bolster their loans.

The intention of the bill was to make the crop insurance bureau entirely self-supporting. This feature is not included in the present law,

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3/ Ibid., Part 13, March 3, 1922, page 13522.



which only requires premium sufficient to pay the indemnities. However, adverse political pressure from mounting public debt combined with declining farm vote may force crop insurance to become a completely self-supported program.

King included a statement of features necessary to a successful program by V. N. Valgren, at that time associate agricultural economist of the Department of Agriculture, and author of several brochures and articles on crop insurance. Valgren stressed the importance of defining the insurance unit to be the entire farm or at least the total acreage of a given crop, and "adjustment be made on the basis of average yield of such acreage." 4/ The insurance unit so defined, has since become a critical feature of the present program, and an important factor influencing the level of premiums and farmer participation in the program.

He also warned against excess coverage, citing cost as an appropriate limit:

The insurance must cover only such crop damage as will result in serious financial loss to the farmer. This means that only a reasonable amount of insurance an acre must be written. For establishing such reasonable amount the average yield and price for a series of past years is perhaps the best basis. . . . The part of the income or yield guaranteed by the contract . . . should not exceed the value of labor and other costs, including rental, that are actually lost to the insured in connection with the crop. 5/

This is an incomplete definition of "investment in the crop," but is as precise as any found in all the crop-insurance debates and acts. "Other costs" may or may not include normal profits. Furthermore, the term "rental" itself must be defined before it can be operational in this context.

Valgren argued that all perils must be covered. This is a modern concept of insurance that has been developed in many lines. His argument

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4/ Valgren, V. N., see King, Appendix B.

5/ Valgren, see King, Appendix B.

was similar to that used today in selling "blanket" type policies, that

Insurance which protects against certain perils and leaves the insured exposed to total loss from other perils beyond his control is not real crop insurance. 6/

He urged that the moral hazard should be avoided by the limited coverage feature. There should be no encouragement to profit from mismanagement. This problem is critical to successful insurance management. Other methods of coping with it will be discussed later in this study.

An important observation was that

The method of adjusting loss must be such that the insured will receive indemnity for crop damage in the amount or on the basis that he is led to expect from the figures indicating the amount of insurance per acre. 7/

It is considered important in public relations in the field of insurance that not only should an insured be well informed on coverage he purchased, but that adjusting of losses must also be in conformance with coverage he had reason to assume he purchased. Changes were made toward this end as the program was developed.

Valgren urged that the insureds should understand that the most important benefit from insurance is protection, not the receipt of loss indemnities. Lack of this understanding is probably the most serious barrier to a sound insurance program. In all kinds of insurance there prevails a desire on the part of insureds to get their premiums back in indemnities. This desire remains a primary factor causing lack of continuity of participation in crop insurance. He concluded his statements with a recommendation urging economy of administration. He referred to the fact that farm organizations in other countries have been known to promote economy in administration of insurance through group action, and suggested that farmers' organizations in the United States might make a contribution along this line.

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6/ Ibid.

7/ Ibid.

Additional ideas were contributed to this early proposal by letters and speeches which were entered in the Record:

R. M. Bissell, president of the Hartford Fire Insurance Company, had developed little faith in actuarial methods in all-risk crop insurance:

As regards crop insurance, we do write crop insurance; but having had our fingers severely burned in experimenting with this form of insurance, we are now proceeding in a far more careful fashion. . . . After nearly three years of experimentation, during which time we have lost a very large sum of money, we have finally come to the conclusion that insurance on the large crops can only be undertaken on what might be called a banking basis; that is to say, the amount of insurance must be limited to what a bank would under ordinary circumstances advance to the farmer to enable him to finance the making of a crop including harvesting. 8/

Whether such non-actuarial methods can be called insurance has been debated, but the problem is nevertheless well understood in the insurance industry.

N. C. Langford, cashier of the First State Bank of Celina, Texas, spoke favorably for the proposed crop insurance program. He referred to the need for crop insurance as a measure which would prevent financial disaster from drouth. In offering his cooperation in investigating the feasibility of the plan, this banker recognized the importance of Federal crop insurance as a measure enabling farmers to bridge the financial gap caused by disasters over which the farmer had no control. One should not overlook the fact that these were desperate times. There was a general demand at this time for economic relief for the farmers, whether it be through crop insurance or other means. Federal crop insurance, however, was looked upon as more permanent and palatable than relief measures.

T. C. Power, president of a Bismarck (North Dakota) bank, said

Agriculture is the only industry that cannot obtain insurance. It cannot buy insurance. If it could, bankers would furnish money for the cost of feed and labor. 9/

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8/ Bissell, R. M., see King, Appendix B.

9/ Power, T. C., see King, Appendix B.

Here was a banker stressing the improvement of credit availability through crop insurance.

The Wallace's Farmer of Des Moines in-1922 said,

The businessman who has perhaps ten times as much control over his production conditions and his market as the farmer nevertheless removes uncertainty even more from his business by insurance. . . . Now it occurs to a businessman that it might be well for farmers to use insurance far more extensively than they do. Theodore Price, editor of Commerce and Finance, in an open letter to Secretary Wallace, suggests that the Department of Agriculture establish a crop insurance bureau. Mr. Price, like all businessmen, is rather against putting more government into business, but thinks it might be well for the Government to start a project of this sort, insuring typical farmers in representative crop-growing areas, with ideas of securing data after a number of years upon which rates might be worked out for a vast new insurance system. 10/

This was a proposal for a government experiment to furnish a basis for private insurance, an idea that was expressed several times in future debates on all-risk crop insurance bills.

Dr. Andrew Soule, President of the State College of Agriculture, Athens, Georgia, attributed economic development in part to the ability to insure:

Undoubtedly insurance has proven of benign value to many classes of society and has made possible the development and expansion of many phases of our industry that would have languished but for the fact that those engaged in the business were in position to insure themselves against loss. 11/

Several points important to this study were brought out by D. G. O'Shea, president of the Federal Land Bank of Spokane, when he wrote in the Red Cross Echo:

It does not seem reasonable to expect the farmer to continue to take all the chances. It is not suggested that he should receive something for nothing, but that something should properly be devised for affording him a reasonable protection for

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10/ Wallace's Farmer, see King, Appendix B.

11/ Soule, Andrew, see King, Appendix B.

the chances he necessarily has to take when contending with the elements, over which no control can be exercised. 12/

He referred to the Montana State hail-insurance law, and added:

Some method should be devised to protect the farmer against other failure. It is not to give him a charity or a gift, but to furnish him with insurance, to the end that he will be sure to receive at least what it has cost him to plant the crop, plus a small remuneration for his labor in the event that there be an absolute failure caused by weather conditions over which he could exercise no control. 13/

Here again is an attempt to define the appropriate level of coverage, but the "cost to plant the crop" is not explicit as to whether it includes any among a variety of items, such as rent, normal profit, depreciation, seed and fuel. He recognized that costs should include some "profit" or living expenses:

Reasonable provision can easily be devised for determining losses, which may be limited to a stated maximum figure sufficient only to cover the cost incurred and a small margin for labor and living expenses. 14/

O'Shea was aware of the possibility of moral risk:

A scheme of insurance can readily be worked out under the operations of which no unworthy person could receive a benefit; the cost may be borne by the farmers themselves or the National Government may contribute to the fund; the fund should be administered by the Government. 15/

Finally, he suggested the favorable effect of crop insurance on credit:

There seems to be a specific need at this time for this form of legislation; the operations of the Federal land banks can be better assured and extended if such insurance be provided. 16/

Theodore Price (editor of Commerce and Finance) contributed to the development of the crop insurance program with his paper submitted to the Agricultural Conference convened by the President January 23, 1922, and

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12/ O'Shea, D. G., see King, Appendix B.

13/ Ibid.

14/ Ibid.

15/ Ibid.

16/ Ibid.

included in the Congressional Record. 17/ He strongly favored a Federal study of the feasibility of crop insurance. (See Appendix for complete text.) Price stressed the need to determine if agricultural perils are insurable; that is, whether over a period of years the frequency of occurrence of distinctive phenomena would be such as to establish a predictable pattern, and were independent of the management of the producer.

The utility of protection was pointed out by Price, quoting Charlton Thomas Lewis:

The value of insurance as an institution cannot be measured by figures. No direct balance sheet of profit and loss can exhibit its utility, the insurance contract produces no wealth. It represents only expenditure. . . . But the results in the social economy, the substitution of reasonable foresight and confidence for apprehension, and the sense of peril, the large elimination of chance from business and conduct have a supreme value. 18/

For society, the direct economic contribution of insurance is the utility of protection, since premiums must cover losses plus operational costs. A part of the utility of protection is the favorable net economic effects on production efficiency through better capital utilization and economic stability.

Coverage level and determinability of loss were problems of crop insurance pointed out by Price:

Then there is the question of determining or measuring the farmer's loss. Manifestly it would be unwise to allow him to insure his crop for any valuation he chose to put upon it. An overvaluation would be an incentive to neglect and extravagance and would lead to the presentation of many unfair or fictitious claims. On the other hand, an undervaluation would not give the protection required. Insofar as any rule has been applied by those companies who have written crop insurance the practice seems to have been to insure the actual cost of production up to a certain maximum per acre and to require that the farmer

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17/ Congressional Record, Vol. 62, Part 13, 67th Congress, 2nd Session, March 3, 1922, page 13524.

18/ Price, Theodore, op. cit., see Appendix C., (Quotation from Charlton Thomas Lewis, Ph.D., in Encyclopedia Britannica.)

insured must furnish satisfactory proof that the amount claimed has been actually expended. In some cases crop policies have also contained a provision making the farmer a co-insurer for 20 percent of the risk, so that he would have an additional incentive to avoid loss. 19/

Co-insurance, whereby the insured shares in the loss, is a tool that should be considered when attacking the problem of providing more adequate coverage without prohibitive increases in premium.

Like others who were averse to a strictly-government program, Price suggested that the proposed program should provide experience and methods by which private companies could eventually write crop insurance:

Would it not therefore be well for the President or Congress to immediately appoint a committee to make a careful study of the subject with a view of ascertaining whether it would be practical and expedient for the government to establish a crop insurance bureau from which the farmer could buy policies . . . and from which, after a few years, the larger insurance companies who were willing to do the business could obtain data upon which to base rates. 20/

The Presidential Agricultural Conference of January 1922 resulted in a recommendation that the United States Congress investigate the subject of crop insurance. In August of 1922 the first Congressional action was taken on crop insurance with the passage of Senate Resolution No. 341, authorizing an investigation by a committee, providing only expense of a stenographer, later amended to include an additional amount for travel expenses and witnesses. The committee members were Senators Smith (South Carolina), Keyes (New Hampshire) and McNary (Oregon) who at this time was the agricultural leader in the Senate, and during subsequent years established himself as the "dean" of agricultural legislation. No committee results are recorded in the Record, although reference was later made to information compiled by the committee.

By resolution to investigate, crop insurance was brought up in the 68th and 69th Congresses, but legislative action apparently died in

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19/ Ibid.

20/ Ibid.

committee, or was crowded out by emergency farm relief legislation.

In December, 1927, Senator Bruce of Maryland submitted Senate Resolution No. 51:

Resolved, That the Secretary of Agriculture is hereby requested to report to the Senate at the beginning of the second regular session for the Seventieth Congress his views as to whether the insurance of the farmer by the Federal Government against droughts, floods and storms would be consistent with sound governmental and economic policy; and, if so, under what conditions such insurance should be issued. 21/

The resolution was passed, but no results were reported, again apparently because legislators were preoccupied with emergency farm legislation.

In May, 1930, a bill (SB1164) was passed by the Senate authorizing the Secretary of Agriculture to investigate all phases of crop insurance. However, it was lost in the House agricultural committee.

In February, 1932, Senator Sheppard (Texas) introduced SB3793, authorizing the Federal Farm Board (created in 1929) to enter into re-insurance contracts with private insurance companies which insure growing crops against perils to which they are normally subject equal "at least to a substantial part of the cost of producing any crop" as determined by the Board. 22/ This measure was specifically intended to subsidize development of crop insurance through private companies. This proposal died in committee.

Until 1936, little was accomplished in crop insurance legislation. On September 19, 1936, President Roosevelt, in a letter to the Secretary of Agriculture, appointed a crop insurance committee for the purpose of working out a plan of crop insurance. He recommended the use of extensive crop insurance studies then being made in the Department of Agriculture. In his mind, supply stability (and resulting price stability) were to be expected as one of the fringe benefits of crop insurance:

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21/ Congressional Record, 70th Congress, 1st Session, Vol. 69, Part 1, Dec. 13, 1927, page 546.

22/ Congressional Record, Vol. 75, Part 4, 72nd Congress, 1st Session, February 24, 1932, page 4591.



In the past three and one-half years, the Government has helped farmers to meet emergencies of two kinds, the first was collapse of prices resulting from huge surpluses for which the foreign markets disappeared. The second was a failure of crops in wide areas resulting from drought. Each of these emergencies, except for Government action to assist farmers, would have had devastating consequences to consumers and business as well as to farmers. The time has come to work out permanent measures guarding farmers and consumers against disasters of both kinds. Crop insurance and a system of storage reserves should operate so that the surpluses of fat years could be carried over for use in the lean years.

Measures of this kind should make three important contributions to the general welfare of the country as a whole; first, protection of the individual farmer's income against the perils of crop failure or price collapse; second, protection of consumers against shortages of food supplies and against extremes of prices, and third, assistance to both business and employment through providing an even flow of farm supplies and the establishing of stability in farm buying power. . . . I am especially interested in its (Department of Agriculture) studies of a plan providing for the payment of premiums and insurance in commodities. 23/

The President was thinking of crop insurance being tied in with other programs:

By making this insurance available only to farmers cooperating in farm and soil conservation programs, the plan would be safeguarded from the price dangers which the Federal Farm Board operations invited in the years from 1929 to 1932. 24/

The President was undoubtedly aware of the need for political support when he mentioned the benefits accruing to business and consumers as well as to farmers; but others stressed the economic soundness of these benefits (such as lessening the general farm relief load in times of recurring drouth) in subsequent debate, as the basis for government subsidy of the crop insurance program.

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23/ House Document No. 150, "President's Committee on Crop Insurance," 75th Congress, 1st Session, February 18, 1937, page 16.

24/ Ibid., page 16.

In his letter to the Secretary, the President recommended a program of crop insurance on wheat for the crop year 1938 in concurrence with the committee report, with the addition of other crops as producers requested them and as the wheat program provided experience in applying the principles of crop insurance. 25/

The committee made the following recommendations, some of which have not been carried through to the present program, as noted:

1. The administration of the program should be assigned to the Department of Agriculture. (However, local committees in charge of the other farm programs have not proven to be best for local crop insurance administration. Insurance selling and adjusting is too specialized to integrate with the administration of other programs.)
2. The amount of insurance should be determined by the average yield per the individual farm insured. (However, it has been found administratively more practical to establish areas for both rates and amounts of coverage.) It was suggested that county averages should be combined with individual farm yield, which is the equivalent of the present system of area rates combined with experience credits.
3. Premiums and indemnities should be paid in terms of bushels of wheat, with the result that there would be accumulation of stocks in years of abundance, to be placed on the market in years of shortages. (However, the storage principle has been dropped.)
4. Because of the relatively short history upon which to base premiums, the local committees should be given discretion to make adjustments of rates under special circumstances, such as a "super-abnormal" loss occurrence in the base period.

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25/ Ibid., President's Letter of Transmittal, page III.

5. A scheme to pay premiums in good-crop years. (Although this idea is currently discussed, it has not been implemented.)
6. Timely payment of losses was stressed as an essential part of any plan.
7. Compulsory compliance with other programs for participation in crop insurance was recommended. (However, compulsory insurance has not been considered acceptable by farmers in the United States.)
8. Finally, the committee stressed the value of crop insurance in improving the availability of credit.

Nothing with respect to "investment-level" of coverage was mentioned in this committee report. 26/

Following the report of the President's Committee on February, 1937, Senate Bill 1397 was introduced, providing for establishment of a crop insurance corporation in the Department of Agriculture with provisions essentially as recommended by the President's Committee. 27/ This was the beginning of the lengthy Congressional debates on the first crop insurance act. Leading proponents of the bill were Senators Pope (Idaho) and McNary (Oregon). The latter was reluctant to propose a crop insurance plan as a permanent program, but rather as an experiment that would demonstrate the feasibility and practicability of crop insurance. He felt that it would soon be operated and controlled independent of the government.

The influence of the over-all problem of stabilizing farmers' income was prevalent in all the Congressional debate, and was the reason why storage of wheat accumulated as insurance reserves was considered an important part of the bill.

There was general agreement that the coverage level should necessarily be limited, but no attempt was made to relate it to investment in the

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26/ Ibid., Report of Committee, pp. 4ff...

27/ Congressional Record, Vol. 81, Part 1, 75th Congress, 1st Session, page 956, February 8, 1937.

crop. McNary asked, "Do the losses against which the farmer insures include prospective profits, or are they based on cost of production?" Pope replied, "On neither; they are based upon the average yield over a period of years; . . . ." <sup>28/</sup> Then he discussed the 50-percent and 75-percent (of average yield) levels, but made no more mention of profit, or costs of production.

Using the name "insurance" was challenged by Senator Malony (Connecticut) on the argument that "this was not truly an insurance proposal as we understand the word 'insurance.'" <sup>29/</sup> He said that it was an equalization bill, involving subsidy and commodity reserves, and an experiment. He proposed an amendment to substitute "equalization" for "insurance," which was rejected.

The bill provided that administration costs be borne by the Government, but that costs of local committees could be loaded on the premiums.

The importance of Senate Bill No. 1397 was that it contained essentially the main provisions contained in the act which was passed by both houses and signed by the President as Title V of the Agricultural Adjustment Act of 1938. By this time the basic organization, coverage, and general principles had been agreed upon. The main problems remaining to be solved were developing actuarial data and methods, determining the crops to be insured, degree of tie-in with other agricultural programs, local sales and administration methods, level of coverage available, underwriting, and extent of government subsidy. The debate from here on was concentrated on these problems.

An attempt was made in late 1938 to require mandatory participation in other agricultural programs, but this attempt was again stopped. Representative Edward Rees (Kansas) expressed a feeling shared by the majority of the Congressmen that crop insurance, though attached to the Adjustment Act, should be considered an independent program:

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<sup>28/</sup> Ibid., Part 3, pp. 2753ff, March 25, 1937.

<sup>29/</sup> Ibid., page 2865.

I . . . do think it is unfair for the Department of Agriculture to provide and promulgate regulations and interpretations that will require wheat farmers to comply with other features of the 1938 Agricultural Act, in order to have Federal crop insurance. . . . Crop insurance does not affect the Nation's supply or demand, or surplus or shortage of crops. No farmer should be denied a right to take such Federal crop insurance if he is otherwise qualified--just because he does not choose to join a compulsory or reduction program. 30/

The Crop Insurance Act was passed with the agreement that coverage would be extended only to wheat, because more experience data was available on wheat than on other crops. But it was also passed with the assurance to Southern senators that cotton and tobacco would be added as soon as sufficient experience was accumulated on wheat insurance. The Northern congressmen obviously had in mind that at least five year's experience would be necessary before the soundness of wheat crop insurance could be judged. On the other hand, some of the Southern congressmen just as obviously had no intention of waiting that long to add cotton. In 1939, after one year of wheat crop insurance, a bill was passed to extend the program to cotton. The debate on the bill reveals that there were other than economic considerations involved in adding cotton:

Senator Bankhead (Alabama): "The Department of Agriculture is satisfied with the administration of the wheat program, and the Department prepared the bill now before the Senate and brought it to me, with the statement that they wanted cotton put on the same basis with wheat."

Senator Vandenburg (Michigan) questioned the adequacy of one year of experience with the wheat program.

Senator Bankhead on being questioned could give no final loss experience but said the Department made a profit on wheat.

"We have not unduly hurried the Administration. . ."

Senator Austin (Vermont) asked for expected loss and premium figures for cotton, but did not get them. He asked for loss experience with cotton over the past ten years.

Senator Bankhead said he had none. "We have as to wheat. We have no way that I know of to estimate what the situation may be with respect to cotton. The liability in the case of wheat . . . is, on the average greater than it is with cotton." But the Senator presented no evidence on the record.

Senator Austin: "And there is absolutely nothing to go on?"

Senator Bankhead: "Nothing but the judgment of the Department that this program ought to be put into operation. . . . I am sure the Senator (Austin) recognizes that in any program covering basic agricultural commodities cotton should be included. There is a greater population on the farms on which cotton is raised than on farms involving any other agricultural commodity. Cotton farms contain about one-half the total farm population."

Senator Russel (Georgia): "The Senator from Alabama has just stated. . . . that the original venture in wheat insurance had proved very successful, and would result in a profit to the Government. There is no reason to believe there would be a greater loss in cotton than there would be in wheat. . . ." He made other statements indicating that on the basis of the one year experience on wheat and ". . . if we have the same experience over a period of years. . . ." the Government will make a profit.

Senator Taft (Ohio): "Is it fair to say that the program is no longer experimental in the field of wheat, as it was supposed to be in the beginning?"

Senator Bankhead: "I think we have had a very representative experience with it. The Senator knows the probabilities as well as I do, and about how long it would take to make a certain test. . . . I do not think there is as much risk in insuring cotton as there is in insuring wheat. The usual cause for loss in crops is abnormal weather. Except in one or two years, during the past eight or nine years we have had normal weather and normal crop conditions in cotton." 31/

The economic significance of the above exchange was the disregard for amount of time required for sufficient experience to establish a sound base for insurance. Senator Russell apparently realized the danger of political conflict with sound economics when, in spite of pressure that must have

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31/ Congressional Record, Vol. 84, Part 8, 76th Congress, 1st Session, July 6, 1939, pp. 8682 ff.

been put upon him, he spoke in favor of going slowly in adding tobacco to the program because it might jeopardize the whole program. 32/ .....

Senator McNary continued to express an urgency for soundness:

I think that crop insurance, to be effective, must be based upon scientific data gathered through a period of years by the Department of Agriculture, and the application must be along the line of philosophy and theory of the old insurance companies in issuing policies. 33/

He was in favor of the program becoming completely self supporting.

But McNary's was a voice crying in the wilderness. Southern Senators took every opportunity to mention the political strength of the cotton producers. Senator Bilbo (Mississippi) said:

I desire to direct attention to the fact that if the cotton growers in the Cotton Belt, which extends from California to North Carolina, representing 2,000,000 farmers, are anxious to have the legislation enacted, I cannot understand how any Senator could get their consent to vote against it. 34/

To attribute political pressure only to the South would be unfair, because, this being a time of chaos in the agricultural economy, pressures from all sides for economic relief were extremely strong. However, to ignore the political interference with the economic soundness of the program would be unfair to those called upon to administer it.

Representative August Anderson (Minnesota) questioned the length of the wheat experiment, saying that it should be five or six years.

We have had one full year of crop insurance for wheat . . . . we would find the organization lost money; in other words it lost more than 2,300,000 bushels of wheat in addition to the administrative cost which ran about \$4,800,000. If we are to set up a sound insurance corporation--one that will eventually and finally cover all farm commodities--we must act on sound actuarial experience rather than be

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32/ Congressional Record, Vol. 84, Part 9, 76th Congress, 1st Session, July 19, 1939, pp. 9468 ff.

33/ Ibid.

34/ Ibid.

motivated by our political aspirations in order to satisfy some section of the country. 35/

But the bill making crop insurance available for cotton was made law after only one year experience on wheat.

Justification for subsidy of the crop insurance program was related to the emergency relief problem, and also to benefits accruing to segments of the economy other than farming. Representative Sabath (Illinois) quoted a letter from a South Carolina producer:

If this bill is passed. . . .it would absolutely keep farmers off WPA and relief rolls, and would give them three-fourths of the normal value of their destroyed crops, to be used in paying their taxes and other obligations, whereas WPA work and money spent for farmers' relief simply goes to maintain them and their families, and leaves them with their various obligations carried over to the next year unpaid. 36/

Repeatedly, Congressmen referred to the preventive effect of crop insurance on the demand for emergency farm relief.

Representative Larrabee (Indiana) pointed out the importance of severe losses to other businesses:

Such losses, occasioned by adverse weather conditions, not only rob the farmer and his family of their buying power, but that loss of buying power in the channels of trade is immediately felt by those people in towns and cities who are maintained directly by income from other pursuits and occupations. 37/

By 1943, the major problems encountered in crop insurance were becoming obvious. A continuity of high participation was accepted as a requisite of a successful program. The three-year contract has been made available and the 1943 crop was insured on this contract. Consequently, when a move was made to cancel the program, cancelling of these three-year

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35/ Congressional Record, Vol. 86, Part 5, 76th Congress, 3rd Session, April 19, 1940, pp. 4774 ff.

36/ Congressional Record, Vol. 86, Part 5, 76th Congress, 3rd Session, April 19, 1940, page 4748.

37/ Congressional Record, Appendix, Vol. 86, Part 14, 76th Congress, 3rd Session, March 14, 1940, page 1442.



contracts causes considerable opposition. This is just one of many cases which illustrate the importance of having several years time to work out a successful insurance program.

The problem of stratification was raised when, after three years of experience, some states had a loss experience in the red and others in the black. The question is: To what extent can favorable loss experience in some states be used to pay unfavorable experience in other states, and over what period of time must the indemnities balance the premiums? In the debate on the continuance of the program in 1943, Representative Case (South Dakota) argued:

The astonishing fact is that the bank has been broken on this insurance proposition by the grand old states of Indiana, Illinois, Iowa, Kansas and Missouri. The total indemnities paid out last year exceeded the premiums collected by about \$3,000,000 or \$4,000,000. Four of five Central States accounted for more than that much and the truth is the states of North Dakota, Montana, and South Dakota helped to provide the surplus to reduce the amount of loss. . . . The net result is that for the four years, in which Federal Crop Insurance has been in operation, North Dakota has paid in \$1,150,000 more in premiums than she has received in indemnities. 38/

The main arguments that resulted in the suspension of (lack of appropriations for) the program in 1943 were: Losses to capital (over \$17 million in wheat in four years), administrative costs (\$20 million in wheat in four years), relatively low participation (one-third of wheat farmers and only 10 percent of cotton farmers.) 39/

World War II influenced the demand for crop insurance, and some of the program's proponents argued that farmers deserved protection of their production costs comparable to other wartime industries, even to the extent of completely subsidizing the premium on scarce strategic crops.

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38/ Congressional Record, Vol. 89, Part 3, 78th Congress, 1st Session, April 19, 1943, page 3575.

39/ From debates on liquidation of FCIC, Ibid., pp. 3569-3580.

I am only asking that the farmer producing war crops. . . be guaranteed on his actual investment. . . . Insurance of investment in the crop has been suggested in these amendments. . . . Under the proposed amendment he would be paid 75 percent of any loss on his investment as reflected by the cost of producing the crop. 40/

In November, 1944, HR 4911 was introduced to amend the Federal Crop Insurance Act, reinstating the program. There were several provisions aimed specifically at elimination of the above mentioned problems. Excessive coverage had been considered as a reason for excessive losses, and as a result an attempt was made to define "investment in the crop" more accurately. Though this provision was later eliminated from the bill, the definition is of value here to show what the congressmen and the corporation had in mind:

Such insurance shall cover a percentage to be determined by the Board not in excess of 75 percent of the recorded or appraised average yield of such commodities on the insured farm for a representative period subject to such adjustments as the Board may prescribe. . . . Provided, however, that such insurance coverage shall not exceed the investment in the crop based on the cost, as determined by the Board, of preparing the land, or labor, seed, planting, cultivation, disease or insect control, harvesting, ginning, hauling to market, fertilizer, irrigation, use of the land, and other applicable costs as determined by the Board. . . . 41/

Here again is an incomplete definition of "investment in the crop," omitting any mention of normal profits or management costs, and depreciation, and giving the Board open authority to add and determine "other applicable costs." Obviously, as long as cost is not more specifically defined, there is no point in including such a coverage limitation in the

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40/ Congressional Record, Vol. 89 Part II, 78th Congress, 1st Session, October 11, 1943, page A4217.

41/ Congressional Record, Vol. 90, Part 6, 78th Congress, 2nd Session, Nov. 21, 1944: Amendment to subsection (a) of Sec. 508 of Federal Crop Insurance Act.

act. Yet Congressmen continued to emphasize "investment in the crop" as a vital coverage limit. Representative Pace (Georgia) said,

It seems to me that the committee has requested the House to do today what any group of businessmen would do. We have had a crop insurance program that was unbalanced. . . . It offered in many cases an inducement to a man to abandon his crop on account of the fact he could gain more through insurance than he could by completing the crop. . . . The committee comes to you today and it strikes out that program and goes back to rock bottom. That is, it seeks to insure only the farmer's losses. That is his investment in the crop and no more. That is exactly what a fire insurance company does. 42/

HR4911 would have provided for entering new crops on an experimental basis and for research. A minimum number of farms per county was established, as an attempt to lessen administrative costs. The actuarial procedures were to be tightened up to prevent dissipation of capital.

For the first time, sales effort was recognized as a necessary feature of a successful insurance program; HR4911 would have provided for local publicity of losses paid on individual farms. In opposition to sales effort, Representative Ben Jensen (Iowa) said,

I wonder if the gentleman will not agree, however, that it is not necessary to send out a big sales force to sell something the farmer knows about already. . . . It seems to me the farmers who want it will take it anyway.

To which Representative Sam Hobbs (Alabama) replied,

. . . No insurance sells itself. I may say to the gentleman from Iowa. . . . that not a single insurance institution has been built without an adequate selling force of agents, that frequently seems too large. 43/

The question of tying crop insurance with other farm programs was again brought up. Representative August Andersen (Minnesota) said:

There is nothing compulsory in this bill, and if there was anything compulsory in the program, I would not be for it.

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42/ Ibid., page 8300.

43/ Congressional Record, Vol. 90, Part 6, 78th Congress, 2nd Session, November 21, 1944.

. . . They tried that out in the State of North Dakota a number of years ago on crop insurance and hail insurance, where every farmer had a premium put on his tax roll, but the farmers of North Dakota got disgusted with that and then the law was repealed. A thing like that will not work in the United States. 44/

A reference was made to longer-term contracts as a means to eliminating adverse risk selection, by Representative Flannigan (Virginia):

I want to be in a position to give him a four- or five-year policy so that losses and benefits will distribute over a period of years. . . . It is to eliminate the selection. 45/

HR4911 did not pass. The loss experience and administration problems continued to arouse opposition to the crop insurance program during the next three years. In 1947 a bill was introduced (and passed) placing crop insurance on an experimental basis. Senator Aiken (Vermont) was asked to explain the bill:

During the last few years there has been a pretty heavy loss in the insurance of crops. The committee felt that Federal crop insurance is rather in the experimental stage, and for that reason approved the bill, which reduces the scope of the crop-insurance program. We felt that if that were not done perhaps there would be no justification for continuing it at all. We thought at the same time that it should be continued on an experimental basis for some time longer. 46/

This act provided specifically for the first time, that insurance men should be included on the Board.

The present stage of Federal Crop Insurance in the United States was reached when the program was thus placed on an experimental basis in 1947.

#### Attempts by Private Companies

Attempts by private companies to write all-risk crop insurance reveal the principal problems encountered in the evolution of this kind of risk

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44/ Ibid.

45/ Ibid.

46/ Congressional Record, Vol. 93, Part 7, 80th Congress, 1st Session, July 3, 1947.

protection. The experiences of these companies are catalogued according to the problems encountered, which often provide the key to failure. 47/

### Price Protection

The Realty Revenue and Guarantee Company in 1899 issued a policy including price protection with natural perils, guaranteeing an income of five dollars per acre for a premium of twenty-five cents per acre. The company failed, but it is not known whether because of trying to insure income or just because of mismanagement.

In a similar way, price was covered by two companies in 1917, but failure appeared to be due more to other factors.

In 1919 the Hartford Insurance Company introduced a type of policy designed to cover the cost of production. This involved price protection to the extent that, even though the yields remained constant, a price drop could cause the returns to fall below the cost of production. A combination of crop losses and a price recession resulted in severe losses to the company. In 1921, the company eliminated the price-protection feature, resulting in a drastic fall in participation. The company ceased operations after 1923.

Price declines were directly blamed for the failure of the Agricultural Protective Mutual Insurance Company in 1931 and 1932, though it wrote a policy that limited the maximum coverage to \$2,000.

The Sowers Plan of Insurance in 1937 attempted to avoid the risk of price fluctuation by providing a minimum price to be used in computing production income. In spite of this limit, the company failed.

### Availability of Capital

In all cases of private attempts to write all-risk crop insurance, it is apparent that the program covered a period of not more than three years. None of the companies were in a position to nor desired to make changes and experiment over a very long period of time, even the Hartford

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47/ Taken from Buckler, op. cit., pp. 3-7. (Also see Appendix A).

and the Home Insurance Companies. The uncertainties in risk estimating were presumably too great for the capital available for experiment.

#### Miscellaneous Problems

Inadequate analysis of the problems involved was evidently basic to failure of private attempts. There was failure to spread the risk out either geographically or over time. Two of the companies in 1917 failed to cut off policy-writing each year before the farmers were able to predict their crop prospects. The same two companies failed to separate bank-security interests from underwriting responsibilities--the local agents for insurance were also officers of local banks. Where companies attempted to insure the cost of production, they failed to properly define the coverage.

Notable in the efforts of the private companies was their attempt in almost every case, especially in the beginning to insure either a certain income or cost of production. When the Hartford attempted to change to a policy insuring only yield the participation fell off critically. There remains the unanswered question: Would it have been possible for any of these companies to have succeeded if (1) none of them had attempted to insure income and therefore price, and (2) they had been able to obtain sufficient capital to finance research and experimentation during the beginning years?

It is to be noted also that the private attempts were all made during economically desperate times in agriculture, particularly in areas where the insurance was written. The Bankers of Montana and the National Union of Pittsburgh started writing in 1917, encountering a period of severe drouth. The Hartford started writing in 1919, a severe drouth year in the Plains, and continued during the agricultural depression of 1921. The Agricultural Protective started writing in 1931, during the Great Depression. Agriculture was still in depression, especially price-wise, when the Sowers Plan was tried in 1937. The unanswerable but pertinent question that can be raised here is to what extent can even private companies be pressured into a conflict between good business methods and the demands of

potential insureds. A logical assumption is that crop insurance is beset with another unique characteristic: There is little demand for it in relatively good times but demand pressure becomes heavy in bad times. Evidence of this is that the first congressional demand for Federal crop insurance was in the depression of the early 1920's, and the pressure for its final passage was during the Great Depression.

#### Foreign Crop-Insurance Attempts

Little of value for this study is to be found in the foreign attempts to provide all-risk crop insurance. The early attempts are summed up by Halcrow:

Crop insurance has been attempted in every major country of the world. Two general results have occurred. Either (1) the program was discontinued because of large underwriting losses, or (2) the program was continued only because the government (a) subsidized it and/or (b) made it compulsory. In no case has crop insurance become self-supporting on a voluntary basis.

In foreign countries, crop insurance generally has taken some form of state insurance. One explanation of this is that the technical difficulties encountered have been too great to be handled by private companies with limited resources, since crop losses can approach the magnitude of a calamity or a national catastrophe. . . .

Crop insurance was written for brief periods beginning in France in 1858, in Finland in 1860, in Germany in 1870, and in Denmark in 1910. In Sweden plans were made to insure crops but these plans were abandoned because of expected potential losses. In 1888, the Japanese government hired a German economist to study the feasibility of crop insurance. He recommended a plan for crop insurance but the Japanese did not institute crop insurance until 1938, at which time it was made compulsory. The Soviet government also has adopted compulsory crop insurance. . . . Compulsory crop insurance was instituted in Switzerland in 1920. Unsuccessful attempts were made to establish systems of non-compulsory crop insurance in Greece in 1927 and in France during 1929 to 1937. 48/

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48/ Halcrow, Harold G., The Theory of Crop Insurance, Ph.D. Thesis, University of Chicago, 1948, pp. 22-23.

Canada met the crop-failure problem with the Prairie Farm Assistance Act in 1939. Although this act performed some of the functions of crop insurance, it did not operate as an insurance program:

In a nutshell, the Prairie Farm Assistance Act was passed to provide direct financial assistance to farmers in an area suffering a crop failure.

It is simply a type of financial aid--as the name implies--to permit farmers in a crop failure area to carry on their farming operations.

At first glance payments made under the Prairie Farm Assistance Act appear to be a form of crop insurance. This is not so because the payments cannot be made on the individual farm basis. They can only be made on an area basis, and no area of less than a section can be taken into account in the computations and the making of payments. 49/

The Crop Insurance Act was passed by the Canadian Parliament in July, 1959. A principal difference between the Canadian Act and the U.S. Federal Crop Insurance Act is that the former is an enabling act under which:

The federal government may enter into agreements with any province which establishes a crop insurance scheme to provide that province with assistance in the form of contributions and loans. The act does not set up any specific insurance plan but rather permits the federal government to assist the provinces by making direct contributions towards the cost of such a program. 50/

The Canadian Act allows the provinces to set up and operate their own programs, recognizing the request from farm organizations that both levels of government be involved, and also an idea that the provinces better understand their own problems.

Like the United States Act, the Canadian program recognizes the need for government assistance:

In Canada the Act provides that the federal government will pay 50 percent of the administrative costs of any crop

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49/ Canada Department of Agriculture, Prairie Farm Assistance Act, An information pamphlet, August, 1961. See also Halcrow, op. cit., pp. 24-25 for details of the operation of the program under the PFAA.

50/ Canada Department of Agriculture, Reference Paper on Crop Insurance in Canada, Information Division, January, 1963, page 5.



insurance program plus 20 percent of the premiums paid in any year. The contribution of 20 percent of the premiums is similar to that paid by Canada to the Unemployment Insurance Fund.

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The federal government is prepared also to make loans in any year to provincial crop insurance schemes up to 75 percent of the amount by which indemnities exceed the aggregate of premium income plus reserves plus \$200,000 in the same year. These loans are available because the financial resources of individual provincial governments could not cope with widespread crop failure or a series of failures. 51/

Insurance is limited under the act to 60 percent of the average yield per acre. "It is generally accepted that the 60 percent coverage is approximately equal to the 'out-of-pocket' costs of production." 52/

Insurance is not compulsory, except that 25 percent participation is required in any area covered by an insurance scheme before it can become operative. From the standpoint of the farmer, the operation is similar to that of the United States program.

#### Summary of Crop-Insurance History

As one reads through the Congressional Record of crop insurance, he cannot avoid being impressed by the fact that the program was developed during extremely distressing times for agriculture. The expressed purpose of the final Act clearly was to protect the farmer's investment in his crop, to keep him in business through periods of heavy crop loss from natural perils beyond his control, and to improve his ability to obtain credit in years of crop loss. However, mixed in with the expressed intent of the Act were arguments that it would decrease relief demands and even substitute to a certain degree for relief. The Congressional atmosphere was such that agricultural leaders were tending to push any measure that would make a contribution to stability of farm income and also to increases in real farm income. Certainly the crop insurance act was one of these

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51/ Ibid., page 6.

52/ Ibid., page 6.

measures. The pressure to bring cotton under insurance before a few years of experience could be compiled on wheat was evidence of submitting to political pressure to the detriment of a sound approach to the program.

During the less distressing times of the late 1940's and the 1950's, the pressure to continue the program came less from a desire to provide economic relief and more from a desire to enhance economic business stability. With the placing of the program on an experimental basis in 1947, it became vulnerable to political pressures and was forced more into the position of operating on a sound economic basis.

The intent (or goal) of using the crop insurance program to enhance economic stability through maintaining reserves in commodities became less meaningful when the crop supplies were in continuous surplus. Also the costs of handling commodity reserves were too great.

Some of the early promoters of crop insurance, such as Price and McNary, intended that the program eventually provide sufficient experience that private companies could build a private system of crop insurance. The charter of the FCIC contains such a provision. However, there is no indication that any private companies are interested in entering the field.

As far back as 1922, during the first Congressional efforts to enact the program, King and Price both recognized most of the problems that beset the crop insurance program today: How to eliminate the moral hazard; how to allow for the insured's control, both favorable and unfavorable, over the effect of insured perils; how to increase participation; how to avoid adverse selectivity; and how long a period should be considered in the actuarial base. The remainder of this study will be concerned with how these problems are being handled, and how methods can be improved.

Finally, a basic difference in general economic conditions in agriculture should be recognized: As noted, when the Act was originally passed agriculture was in desperate economic circumstances. An important change since the 1930's is that although many farmers are being forced out of business, they are now and have been able to sell out and be absorbed into

other parts of the economy. In the 30's the entire economy was economically distressed, whereas since that time the non-agricultural economy has been better able to absorb some of the agricultural population which would otherwise have been in distress. The demand for saving the "family farm" has all but disappeared. There will likely be less obvious justification for subsidy of farm programs than in the 30's. These changing conditions can be expected to have considerable impact on the ways the crop insurance program meets its problems. Chapter VIII will discuss these changes in more detail.

## CHAPTER IV

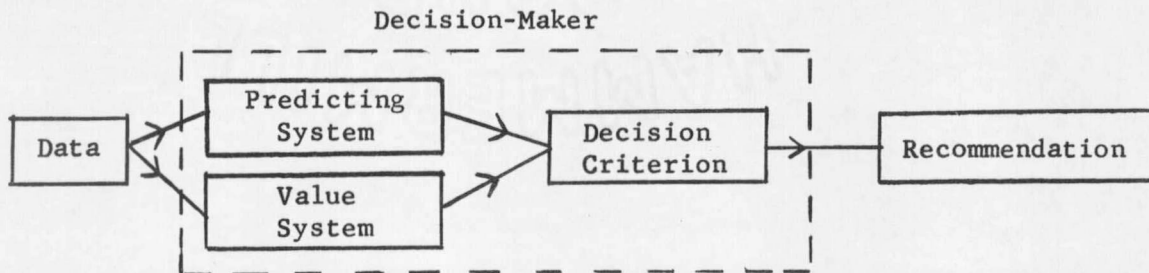
### DECISION-MAKING AND CROP INSURANCE

Large-scale participation in the crop insurance program is vital to the success of the program. Successful selling methods are vital to developing large-scale participation. And successful selling methods require an understanding of decision theory and the decision-making processes of farmers. A discussion of decision theory provides a transition from the theory of insurance and the history of the Federal crop insurance program to the discussion of the more specific crop insurance problems, such as coverage and premium levels, merit rating, and meeting the changes in agriculture.

#### Decision Theory

##### The General Theory

Decision theory is the intellectual tool for scientific decision-making. It provides a process by which data from past records and observations can be fed into a predicting system and into a value system. The predicting system provides a list of possible outcomes for alternative actions, with a probability for each outcome. The value system provides a second quantity, the desirability associated with each outcome. Finally a decision criterion is applied whereby a recommended course of action is obtained. This process between the data and the recommendation, Bross calls the Decision-Maker. <sup>1/</sup> He illustrates it with the following diagram:



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<sup>1/</sup> Bross, Irwin, D. J., Design for Decision, MacMillan, New York, 1953, page 28.

For an extremely simple example of the application of the Decision-Maker, assume the situation where an individual has a mutually exclusive choice between two alternatives: Alternative A, to buy insurance on his home, or alternative B, not to buy insurance. He is a very scientific individual, to the extent that he has obtained some data on similar situations over a period of years and finds that he can associate four a priori discrete probabilities with alternative A, assuming that he is planning for 20 years ahead: (1) There is one chance out of 100 that he will have a complete loss; (2) there are two chances out of 100 that he will have a 25 percent loss; (3) there are 10 chances out of 100 that he will have a 10 percent loss; and (4) there is finally 87 chances out of 100 that he will have no loss. 2/

In this particular example, his outcome probabilities for alternative B need be no different than for alternative A, since his choice would not necessarily have any effect on the outcomes. (In the real world, if he is a poor moral risk, his choice may have some effect on the outcome.)

The second step in the Decision-Maker is for him to assign values to the outcomes, derived from his value system: Assume that he is considering insuring the full value of the house and contents at \$10,000, and that the cost is \$100 per year. He's not very good at figuring interest, so he chooses to ignore it, at least for the time being. The first part of the Decision-Maker, then, will look like the following, derived from his predicting system and his value system:

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2/ In technical decision-theory terms, this example is the 'no-data' problem, where the states of nature are the a priori probabilities, and there are only two strategies, to insure or not insure. It should be recognized that the example illustrates the simplest case. It is apparent that the situation becomes considerably more complicated if the individual is granted the choice of different insurance levels at different costs. These complications are compounded if the states of nature are related to a posteriori observations, resulting in a large number of possible strategies among which a choice is to be made.

<u>Alternatives</u>	<u>Outcomes</u>	<u>Probabilities</u>	<u>Loss-Costs 3/</u>
A	1 - 100% Loss	.01	\$ 2,000
	2 - 50% Loss	.02	2,000
	3 - 10% Loss	.10	2,000
	4 - No Loss	.87	2,000
B	1 - 100% Loss	.01	\$10,000
	2 - 50% Loss	.02	5,000
	3 - 10% Loss	.10	1,000
	4 - No Loss	.87	00

The next step in the Decision-Maker is to set up a Decision Criterion to apply to the evaluated outcomes of the two alternatives, by which he can arrive at a recommendation or action decision. He might choose as a criterion (by use of a sub-Decision-Maker?) the alternative with the lowest loss-cost expectation:

<u>Outcomes</u>	<u>Probabilities</u>	<u>Loss-costs 4/</u>	<u>Loss-cost Expectations 4/</u>
A-1	.01	\$ 2,000	\$ 20
-2	.02	2,000	40
-3	.10	2,000	200
-4	.87	2,000	1,740
20-Year Total Expected Loss, Alternative A			<u>\$2,000</u>
B-1	.01	\$10,000	\$ 100
-2	.02	5,000	100
-3	.10	1,000	100
-4	.87	00	00
20-Year Total Expected Loss, Alternative B			<u>\$ 300</u>

Ignoring interest, alternative B has the lowest loss-cost expectancy at \$15 per year, as compared with \$100 per year for alternative A.

However, his Decision Criterion may be more complicated, and usually is. He may make a part of it the qualification that peace of mind is worth at least \$100 per year, under which condition his choice would be to buy the insurance.

3/ Loss-costs of alternative A in each case will be his premium payment, since his fire loss is indemnified by insurance.

4/ Ibid., page 88.

He may be in a financial position where he can stand a complete loss, and decide to choose the alternative with the lowest most-probable loss-cost, in which case he would decide not to buy any insurance.

If he were in a financial situation where he would seriously jeopardize his family's future if he lost his home to fire without any insurance, there would be no point in using the Decision-Maker (unless it relieved his mind to know a little more about what insurance costs him, taking account of loss probabilities). He would buy the insurance.

There are numerous other ways in which a Decision Criterion could be set up. The main point of this example is that it illustrates the systematic approach to decision-making in the face of uncertainty. The Decision-Maker has certain short-comings: It lacks exactness because the predicted probabilities are based on past history, evaluations of outcomes are prone to be subjective, and the criteria for decision require further decision analysis. The machine does not provide absolute answers; in the insurance example, it does not provide any answers as to how much better one alternative is than another, nor does it give much information as to how much insurance protection to buy.

However, the Decision-Maker has the big advantage of being applicable to the real world. It provides a system where no system previously existed. The system is neither based on absolute values, nor does it provide absolute values. Instead, it orders probabilities and values. In the example above, it is not as important that the probability of complete loss is .01 as it is that the probability of no loss in 20 years is many times as probable as a complete loss. It is not as important that the expected loss-cost with insurance is \$100 per year as compared with \$15 per year without it, as it is that there is only \$85 per year difference, which may not be worth worrying about as compared with the peace of mind obtained.

The Decision-Maker is not a panacea for making decisions. Generally, individuals such as farmers could not be expected to use the system, especially as a formal model, in most of their decisions. Assuming that

this is the case, the system is still of considerable value in providing a thought process or an intellectual tool, as a systematic approach where none was used before. In many cases, the system is used subconsciously--the individual is not aware of its use. Bross sums up the place of the Decision-Maker in practical decision-making:

When I say that Statistical Decision can play a role in personal decisions I do not mean that everyone will have to take courses in higher mathematics before he can decide whether or not to go to the movies. Very few everyday decisions would have sufficiently wide differences in the consequences of the possible actions to make it worth while to expend the time and energy necessary to construct a formal Decision-Maker. However, I do think that the principles which underlie the Decision-Maker can also be used, informally, to arrive at effective choices of actions to be taken in everyday situations. In fact, I think that most people with common sense have already used many of the principles in making their decisions. All that the statisticians have done is to borrow these notions and dress them up in the symbolic language. 5/

#### Decision Theory and All-risk Crop Insurance

Why is it necessary to understand the general decision theory model, as a contribution to the improvement of the Federal crop insurance program? First, the farmer is a decision maker. Farm management books usually begin with a definition of farm management that emphasizes decision-making as the center of good management; for example, Castle and Becker:

Successful farming, if we measure success in terms of profitability, is determined by the farmer's managerial ability. Used in this sense, farm management is concerned with the decisions that affect the profitability of the farm business. 6/

They list the usual five steps in the decision-making process, and later, in their eighth chapter, on risk and uncertainty, they present the simple decision-making model, which corresponds to Bross' Decision-Maker.

Second: The insurance salesman is in a position to furnish the data that is fed into the Decision-Maker. This data provides the basis for

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5/ Ibid., page 256.

6/ Castle, Emery N., and Becker, Manning H., Farm Business Management, MacMillan, New York, 1962, page 3.



prediction of probabilities and contributes to the evaluation of outcomes for the Value System. The salesman is also in a position to help the prospective insured become aware of the use of a Decision-Maker, and to set up criteria for decision. For example, the farmer usually has a reasonably accurate idea of his yields, and frequency of his good and bad years in the past. The salesman probably has supplemental data on yield trends, rainfall records, and county averages with which the farmer can check his own data. The salesman can help him to fit the data into a probability framework. He can also assist the farmer in fitting his yields and production costs into a framework that will better evaluate the farmer's possible financial loss under given yield conditions. A part of this evaluation is the cost of the insurance itself. Either by a systematic thought process, or actually writing down the Decision-Maker, the farmer, with the aid of the salesman, can derive a set of evaluated alternatives upon which he can base his decision to buy insurance and how much.

Third: At this point the salesman can assist the farmer in developing a set of decision criteria with which to make the choice between the evaluated alternatives. Here he can call the farmer's attention to the points he should consider in setting his criteria: His financial situation or liquidity position; alternative methods of meeting uncertainty, and how these alternatives will affect his plans and costs; and any other individual situations that would affect his decision criteria.

#### Insurance-Evaluation Model

A critical problem that must be solved by the farmer is his evaluation of insurance benefits and costs. The salesman enhances his success if he can contribute to the solution of this problem, which is a vital part of the Decision-Maker. The evaluation of a farmer's action alternatives in buying insurance depends to a large degree upon the relationship between two functions:

$$\text{The net insurance premium} = I + A + S$$

The buyer's evaluation of the utility of insurance to himself =  $L + U + X + Z$  where:

- I: The actuarial determination of indemnities expected, including reserves for unexpected perils.
- A: Administrative costs, including services, claim adjustment expenses, and normal profits.
- S: Sales or acquisition costs.
- L: The farmer's expected loss.
- U: The farmer's utility derived from protection or from converting the uncertainty of loss to a certain expense (including better planning, better sleep, concern with his liquidity situation, etc.).
- X: Margin of extra cost he is willing to accept because of his inability to accurately assess his expected loss (this could be a negative factor depending upon his attitude).
- Z: Other factors such as his desire to gamble, his aversion to government programs, his concern with his neighbor's situation, etc. (this also could be either positive or negative).

The first condition of the decision model is that a person will not consider buying insurance if the insurance premium is greater than the buyer's evaluation of his utility received, or:

$$(1) I + A + S \geq L + U + X + Z$$

But the buyer will not buy insurance, either, if the marginal return (or utility) of insurance (MRI) per marginal cost (MCi) is not at least as large as the marginal return (MRo) from an alternative expenditure per marginal cost (MCo), which becomes the second condition for the decision model:

$$(2) \frac{MRI}{MCi} \geq \frac{MRo}{MCo}$$

Combining the first condition with the second, since  $MCi = I + A + S$ , and  $MRI = L + U + X + Z$ , the condition for the decision model becomes:

$$(3) \frac{L + U + X + Z}{I + A + S} \geq \frac{MRo}{MCo} \geq 1$$

Moving to the specific case of the farmer buying Federal crop insurance, the assumption is made that the Z has been eliminated or minimized, and

therefore that he is willing to formulate his decision upon economic considerations. Also, the A and the S are eliminated, since they are subsidized by the Government. Therefore the farmer's condition for purchase becomes:

$$(4) \frac{L + U + X}{I} \geq \frac{MRo}{MCo} \geq 1$$

One final condition needs to be stated: The coverage upon which the premium (I) is based is assumed to be equal to the coverage upon which the buyer's loss expectancy and utility evaluation (L and U) are based. Therefore, coverage does not need to appear in the above condition formula. For instance, if the coverage is inadequate for the farmer's needs, the inadequacy will be reflected in U, with the relation between L and I remaining relatively constant.

The model condition (3) above can be illustrated by the following diagrams, representing (A) the "bundle" of factors making up the insurance premium; (B) the bundle making up the prospective buyer's evaluation of the insurance; (C) the bundle representing other wants of the buyer; and (D) the bundle representing the marginal costs of these wants:

(A)

(B)

(C)

(D)

S: sales or acquisition costs	Z: other factors	The want or bundle of wants other than insurance with highest marginal utility per dollar expended	The marginal cost of C
A: administrative costs	U: utility derived from protection, etc.		
I: expected losses from perils insured plus reserves	X: margin of extra cost		
	L: farmer's expected loss from perils insured against		

One part of condition 3 is that the size of bundle A is equal to or less than the size of bundle B. If this first part of the condition is met, then the second part is that the ratio of bundle (B) to bundle (A) is equal to or greater than the ratio of bundle (C) to bundle (D); i.e., that

the utility per dollar spent on insurance is equal to or greater than the highest utility received from the last dollar spent on any other commodity or service.

The differences between condition (3) and (4) is that S and A are eliminated from bundle (A) (FCI situation) and Z is eliminated from bundle (B), leaving the bundles as follows:

(A)

(B)

(C)

(D)

I: expected losses from perils insured against, plus reserves
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U: utility derived from protection, etc.
X: margin of extra cost
L: Farmer's expected losses from perils insured against

Wants other than insurance with highest marginal utility per dollar expended
--

The cost of (C)
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Note that there are two factors affecting the insurance premiums, which are omitted in the model: Income tax effect on the net premium paid, and experience and size credits. The income tax deductions depend upon individual situations, and in effect lower the net premium paid. If a farmer pays an income tax at least one-half of the years, he can figure that he can reduce his premium by at least half the average income-tax percentage. If his decision is considerably influenced by his aversion to paying a premium in a year when he receives no indemnity, then the reduction allowance in his premium because of taxes would be even more important.

Experience credits do not affect the decision-making of the farmer who is contemplating buying insurance for the first time, nor one who is continuing to buy while he is building an experience base. Experience and size credits should be considered as bringing I and L closer to equality.

Both the income-tax and experience-rate factors are therefore to be considered as tools of the salesman or problem-solver, to be used along with the decision model.

Using the Model

Much has been contributed to throw light on farmer decision processes. Ideas and hypotheses concerning farmers' reactions under uncertainty are gathered together in the Proceedings of Research Conference on Risk and Uncertainty, the results of a Great Plains Council Meeting at Bozeman, Montana, in 1953. Pertinent to this present study is Haver's hypothesis and proposal:

The proposed study provides the hypothesis, stated briefly, that there is a zone of indifference within which changes or decisions are not made. A rather "strong" stimulus or jolt is necessary to give rise to a decision-making situation. The existence and nature of the indifference zone under various conditions of risk and uncertainty or conditions with respect to size of business, equity position, family situations, etc., need investigation.

As a necessary step decisions should be classified according to type or manner in which decisions are made. Some decisions might well be made by a flip of a coin; another decision should be made only after additional information is acquired, etc. Also, a decision may hinge on a prime criterion or on two or more lesser criteria. The processes farmers use in arriving at decisions provide a basis for determining what information research can provide to assist in making decisions. 7/

If the problem-solver can proceed beyond the point of bias, custom, or habit as the farmer's basis of decision-making, he has the opportunity to use the decision model by which he can demonstrate the problem, or can produce the "jolt" that will move the decision-maker to a decision-making situation.

Condition (4) is repeated for convenience:

$$(4) \quad \frac{L \pm U \pm X}{I} \geq \frac{MR_o}{MC_o} \geq 1$$

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7/ Haver, C. B., "A proposal on Farm Decision-Making," Proceedings of Research Conference on Risk and Uncertainty in Agriculture, Bulletin 400, Agricultural Experiment Station, North Dakota Agricultural College, Fargo, 1955.

The FCIC's loss expectancy (I) can be taken as given, the quoted premium based on its actuarial determination for a given insurance group. The salesman's function then, is to analyze with the farmer, his evaluation of the (B) bundle ( $L + U + X$ ), as compared with the (A) bundle, hoping that the ratio is greater than the ratio of (C) to (D), or MRo to MCo.

A farmer with good records may be able to determine fairly accurately what his loss expectancy L may be. In a low-risk area, there is a high probability that his FCI-loss expectancy, especially based upon the past 25 years, may be nil, especially from drouth and perils other than hail. Even his expected FCI-loss from hail may be nil, based on past records, either because his unit is widely dispersed, or losses have not been severe enough to have lowered the total unit yield to a level that would have been indemnified under the FCI coverage. In this case, the difference between I and L would be extreme, particularly if the insured group included some higher-risk areas. The salesman's problem is to build the (B) bundle of utility by stressing the idea of the occurrence of an unknown peril (that it is always possible that things which have not occurred in the past can occur in the future); and the utility from protection, better planning, and safety of solvency.

More important for this situation is the analysis of the farmer's premium-cost. The low-risk farmer is more justified in reducing his premium by his average income tax percentage at the margin, because he is likely to have a higher proportion of tax-paying years. Further, and possibly even more important, is the fact that a low-risk farmer can be nearly assured of developing an experience credit which will reduce his premium by as much as 50 percent. As has happened in some of the lowest-risk areas, (I) has been reduced to the point where both (I) and (L) are so small that the difference between them is of little concern, and the size of (U) and (X) have thus become relatively much more significant.

If the good record keeper is located in a high-risk area, the difference between (I) and (L) is not likely to appear so pronounced (at least relative to total I). He will likely be more concerned with his management abilities as compared with his neighbor's. Because he does have a high loss expectancy, he will probably recognize and accept a higher value of (X). His (U) will likewise be considerably higher than for the low-risk operator. Though his expectancy of loss-free years will not be as high as for the low-risk operator, his potential for premium-saving will be just as high if not higher, as a result of good management. Since his premiums are considerably higher, it takes less loss-free years (under present formulas) to build an experience credit. Also the experience-credit percentage is applied to a much higher premium charge. The higher-risk operator may not be as interested as the low-risk operator in the reduction of premium due to income-tax deduction, since the former will likely have a smaller proportion of years when he will be paying income taxes.

The principal difference between the good record-keeper and the poor in their insurance-decision-making process would be in the emphasis they would place on their own individual loss expectancy. The farmer with less long-time records would likely be more concerned with his situation relative to his neighbors' current crop yields. If so, the salesman's emphasis on experience credits should be even stronger than for the good record-keeper. The poor record-keeper's (X) value will probably be considerably less, because he knows less about his actual loss expectancy. On the other hand, his L would likely be more nearly equal to I. If he knows less about his business, he will probably be below, rather than above average in management ability. This factor should tend to make his (U) value higher than for the above-average operator because he should be more uncertain of the future.

Special note should again be made of the fact that administration costs of FCI are not included in the premiums, but are subsidized by the government. If they were made a part of the (A) bundle of insurance costs,

the U and X values in the (B) bundle of farmers' utility must be increased accordingly in order to retain the same ratio. If the FCIC is called upon to assume the costs of administration (as discussed in Chapter 9), the addition of A and S to the (A) bundle will present a critical problem to the salesman problem-solver: He must be more ingenious than ever at analyzing the U and X values and helping the farmer to evaluate them in his decision-making process.

#### Some Observations

General decision theory provides a scientific tool for decision-making, the Decision-Maker. A model has been developed for evaluating and comparing the benefits and costs of all-risk crop insurance. Another step in understanding decision-making, and likewise improving communication between the insured and personnel involved in the Federal crop insurance program, is to analyze the nature of farmers' decision-making processes, derived from some observations.

#### General Observations

Some farmers make decisions on the basis of just a hunch or snap judgment, while at the other extreme are those who are scientific in their decision-making. The same farmer may at one time be very unscientific in making a decision, and then make another decision only after careful thought and analysis (don't we all?).

A cash-grain farmer located on the west side of the Montana Triangle was asked why he didn't participate in the crop insurance program. His answer was that two of his neighbors had been in the program for several years and collected for losses every year; he believes he hasn't had any losses that would have been paid if he had taken insurance and he isn't about to help pay for his neighbor's bad management. Upon further questioning, to determine if he had used any marginal analysis or any other scientific approach to making his decision, it was found that the above was apparently his only consideration in deciding not to buy crop insurance. The FCIC director in the area thought that very likely this farmer was uninformed, poorly informed, or even misinformed as to just



how much losses had been paid to his neighbors.

A survey of the Montana FCIC files reveals that there are many variations in participation history among those who are or have been insured. There are those operators, both large and small, who have participated in the program since its inception, or at least since 1948. Some of them have received practically no indemnities and some at the other extreme have received several sizable indemnities. There appears to be no obvious pattern. There are some who have been in and out of the program several times. Some of these have accumulated experience credits which they have given up when they dropped out. There are those who have been paid for large losses, and then dropped out of the program. Again there appears to be no obvious pattern.

One operator with a 400-acre wheat allotment has been in the program since its inception, and during that time has received total indemnities of less than \$500. He feels that his size and experience credits have lowered his premium to the point where he can't afford to drop his insurance. His neighbor has been in and out of the program several times, and probably would not have received any more indemnities had he stayed in throughout the history of the program; he again insured his crop in 1964 at the full rate with no experience credits, at which time he indicated that he was going to stay in the program.

Some operators in the Northwest Triangle of Montana, even after three consecutive years of losses, continue to stay out of the program, while some of their neighbors, with large and successful operations, have purchased Federal crop insurance for the first time. Northeastern Montana farmers have experienced two consecutive bumper crops, yet participation in the crop insurance program remains high and expanding. Southeastern Chouteau County has had no crop failures from drouth in recent years, yet participation continues at a high level. 8/

Studies that have been based on farmer surveys indicate that the major reason given for non-participation is that the premiums are too high

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8/ From information obtained from personnel in Montana State FCIC office.

and coverage too low. 9/ This reason appears to be of little value to an analysis of decision-making because it implies a relationship without providing a standard of comparison: The premium is too high and coverage is too low relative to what? In deciding whether or not the coverage is too low and the premium too high, a farmer is basing his decisions on many different things: He probably has in mind that the premium is too high relative to the coverage. Or he may feel that the premium is too high relative to the coverage and any peace of mind he derives from it; or to what his neighbor in the next county is paying; or to his loss expectancy; or to how much he is willing to gamble; or to the sort of a bargain that allows him to accept a government program contrary to his anti-government conviction; or to how much return he can obtain from the premium money if spent elsewhere. He may feel that the coverage is too low relative to his costs; or to what he needs for family living above cost; or to the coverage he gets from hail insurance (taking little account of the fact that hail insurance covers only one peril); or relative to the premium; or to the coverage his neighbor obtains on poorer land under poorer management; or to his own average yield.

#### An Analysis of the Observations

The first farmer who objects to what he believes to be excessive indemnities collected by his neighbors bases his decision upon whether he feels the benefits he can receive from crop insurance are greater than the disutility of accepting the cost of their poor management, and whether experience credits will sufficiently account for the difference.

The farmer who has a particular aversion to government programs may base his decision, consciously or unconsciously, upon whether he feels

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9/ Bray, Norman, Performance of Federal Crop Insurance in Western Nebraska, Unpublished Thesis, University of Neb., 1963, page 97;  
Starr, Gayle David, The Federal Crop Insurance Program in Eastern Nebraska--Saunders County, A Case Study, Unpublished Thesis, University of Nebraska, 1963, page 47;  
Moore, Jerry M., Economic Analysis of Crop Insurance in Eastern Colorado, Unpublished Thesis, Colorado State University, 1964, page 46.

that the benefits from crop insurance are greater than the disutility of making a decision counter to his conviction.

The excellent operator who has almost nil drouth-loss expectancy, but continues to carry both all-risk and hail insurance, is probably influenced by such factors as: He may be a "cooperator," one who tends to support programs he feels are generally good for agriculture, especially if his marginal cost for cooperating is relatively low; he is probably reluctant to give up a good experience credit, which also makes his cost relatively low, compared with his other farm costs. (The farmer of this type in Chouteau County, described above, is paying a premium of about \$240 per year for an insurance coverage of \$11,700 on a 400-acre wheat allotment.) He may also feel an awareness of the possibility of complete loss from hail and unknown perils, against which he can protect himself at a relatively small cost with Federal crop insurance.

The farmer who takes a scientific economic approach would tend to arrive at his decision through the process of the Decision-Maker and the insurance-evaluation model. He could be expected to analyze past records, derive some sense of probabilities, know something about his potential losses and farm costs, and, at least with the aid of a good salesman, arrive at a decision somewhat systematically. He probably gives more attention to whether his loss-cost expectancy is appreciably below the group average; whether he is financially able to withstand large and consecutive crop losses; to what extent he can use other methods of meeting uncertainty to advantage; and what relative value he can place upon peace-of-mind, as compared to the cost of insurance.

The insurance model includes a symbol U, which represents the farmer's utility derived from "protection" or from converting the uncertainty from loss to a certain expense (including better planning, better sleep, concern with financial liquidity, etc.). Here the term "protection" is used to refer to those benefits from insurance above the individual's loss expectancy arising out of perils covered. A large proportion of buyers of all types of insurance apparently are influenced by the value of this

"protection" as part of the insurance package. As evidence, a huge volume of fire and casualty insurance is purchased in the United States whereby the total premiums collected are at least 30 percent in excess of indemnities paid. <sup>10/</sup> This represents a willingness of insureds to pay substantially more for insurance than their expected loss cost.

#### Problem-Solving and Crop Insurance Sales

Whether to buy crop insurance is but one of the many decision problems confronted by the farmer. This places the FCIC in the position of the other problem-solvers, such as the machinery dealers, fuel dealers, feed retailers, grain and livestock buyers, and all the rest. Therefore, there is little reason for the FCIC to approach its sales and participation problems any differently than the other farm problem-solvers.

The usual procedure is to seek out the farmer's problem, and to figure out ways to help him to solve it. In most cases, the farmer may not be conscious of his problem, or perhaps he hasn't isolated it. For instance, because of the nature of his daily work, the farmer may not be aware of possibilities of saving labor and fuel, and of improvements in the work accomplished if he traded the old tractor for a new one. He may not be aware of a new breakthrough in formulating livestock feed, or of results from a new weed spray or fertilizer. He may not be aware of the fact that at a particular time feeder buyers are becoming active and paying considerably over the published markets, or the elevators are paying 10 cents over the market for certain grades of wheat.

Take, as an example, the first farmer, who is concerned about his two neighbors. He may have some problems of which he is not aware. The first step for the crop-insurance problem-solver is to seek out the problem which he can help to solve. It is impossible to communicate with the farmer concerning his own problem before resolving his feelings.

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<sup>10/</sup> Best, Alfred M. and Co., Best's Insurance Guide With Key Ratings, New York, 1964. From general analysis of company premiums collected and loss expenses.

concerning the two neighbors; does he have the facts: (1) Have the two neighbors, in fact, collected almost every year on their insurance? (2) Has the farmer himself, in fact, had no losses that would have been indemnified if he had been insured? (3) Is he aware of the fact that experience credits can go a long way toward making allowance for the differences in management? (4) Is he aware of the fact that FCIC underwriting methods are continually eliminating insureds who, because of continued poor management, collect an abnormal share of indemnities? Since the concern with the two neighbors is critical in this individual's decision-making process, this concern must be resolved before delving deeper into his insurance problem.

The next step is to determine how well informed he is regarding Federal crop insurance, and whether he has any deep-seated aversions to Federal programs. An approach to obtaining this information may be through arousing interest in the solution of uncertainty problems. This in turn can lead to an analysis of the farmer's need for insurance. There is no reason to believe that every single farmer needs insurance. This particular farmer may not need insurance. If this appears to be the case, this should be the end of this interview. After all, a wise implement dealer would not try to sell a beet digger to a farmer who had no sugar beets.

Assuming the need is established, the next step is to impress the farmer with the nature of his problem, and his alternatives in solving it. This is the point at which per-crop-acre costs can be combined with yield probabilities and alternatives of meeting the uncertainty situations. All of these fit into the decision models.

## CHAPTER V

### COVERAGE LEVELS

A high percentage of participation has been shown to be important to the success of an insurance program. The Federal crop insurance program is no exception. The main purpose of the GP-8 regional study is to find ways that the program can be improved, particularly how participation can be increased. It was noted in the previous chapter that the main reason interviewed farmers gave for non-participation was that premiums are too high and coverage is too low. 1/ The problem is relating the coverage to needs and relating the premiums to the risk. The needs for all-risk crop insurance are most often expressed in terms of protecting the "investment in the crop." Sales efforts also are directed more and more toward this goal.

#### Investment in the Crop

"Investment in the crop" has received considerable attention in development of the Federal crop insurance program. Investment was often mentioned as a critical and necessary coverage limitation during the debates in Congress. 2/ It was considered by Halcrow to be a definition of "insurable interest:"

In some other instances the insurable interest of the farmer has been defined as his investment in the growing crop. In some other cases attempts have been made to reduce the carrier's liability by restricting the yield coverage to a level not exceeding the average investment in the crop at time of abandonment of the crop. 3/

In a section titled "All-Risk Crop Insurance and Resource Utilization" he refers to investment in the crop when he relates farmers' reactions to expected yields and insurance coverage:

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1/ vide., footnote (9), Chapter IV.

2/ See "Review of the Congressional Record," Chapter III.

3/ Halcrow, Harold G., Theory of Crop Insurance, University of Chicago, 1948, pp. 30, 31.

If the discounted value of the insured yield is at least equal to the farmer's investment in the crop the farmer would avoid loss under any condition. <sup>4/</sup>

Though Halcrow attached importance to "investment in the crop" as a coverage limit and as a measure of insurable interest, he did not define the term.

Glendenin was one of few authors in the early crop insurance literature who set up a cost analysis and compared it with coverage. He was interested in measuring the adequacy of insuring 75 percent of the normal yield. His cost classification was labeled "Out-of-Pocket Costs of Producing Wheat on Debt-Free Farms of Typical Size and Fertility," and included the following items:

Hired labor ("Two-thirds of the farm labor is assumed supplied by the operator and his family in the North Dakota illustration, one-half in the other cases. Only hired labor is shown in costs, operator's labor and return on investment must be compensated from excess of selling price over costs.")

Horse work

Contract threshing

Commercial fertilizer

Sacks and Twine

Seed, etc.

Machinery ("Depreciation, insurance, and maintenance costs on machinery, fences, and barns are included in proper ratio.")

Miscellaneous

Taxes

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<sup>4/</sup> Ibid., page 54. Halcrow also quotes the 1947 amendment to the Federal Crop Insurance Act: ". . . if 75 per centum of the average yield on the insured farm represents generally more protection than the investment in the crop in any area, taking into consideration recognized farming practices, the Board shall reduce such maximum percentage so as more nearly to reflect the investment in the crop in such area. . ."

Clendenin apparently excluded interest and land costs from his estimate of out-of-pocket costs, but included harvest expenses. 5/

The writers and speakers on all-risk crop insurance had in mind some specific cost concept. The question is, which of the following cost items are included, and which are omitted in the term "investment in the crop":

Preharvest expenses: These include not only all variable costs incurred in summerfallowing, and preparations for and planting of the crop, spraying, and fertilizing, but also fixed costs such as insurance and machinery ownership. All costs (including those listed under "special costs") incurred each year regardless of crop conditions should be included in this category.

Harvest expenses: These include all costs that are obviated by complete crop failure. It should be remembered, however, that these costs are incurred on the harvestable acreage in case of partial loss.

Special expenses: These include large special items such as all-risk crop insurance and hail insurance (optional), taxes (deferrable), interest on land and buildings (no current cash outlay unless there are fixed debt payments) and family-living allowance.

The approach to the problem in this study is to select the expense items from some typical Montana farm budgets and reclassify them according to the above categories. These are used to analyze the results obtained by assuming various definitions of "investment in the crop." Also, the reclassified budgets can be used in analyzing and solving other crop-insurance problems. For example, in selling crop insurance, some of the Federal crop insurance salesmen use the "investment" approach; that is, they assist the prospective insured in determining his "investment" in the

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5/ Clendenin, J. C., "Federal Crop Insurance in Operation," Wheat Studies of the Feed Research Institutes, Stanford University, Vol. XVIII, No. 6, March, 1942, page 240.



crop so that he can visualize his potential loss and therefore be better able to make the best choice of coverage level. From the following tables an expense guide can be developed to serve as an aid to both the salesman and farmer during a sales approach.

The sources of costs for these expense tables are LeRoy Rude's cash-grain farm budgets for Northeastern, North Central and South Central Montana, for three sizes of farms in each area. <sup>6/</sup> (These three areas, outlined, in Figure 1 will henceforth be called "cash-grain areas.") Only the wheat-and-barley enterprise combination is selected, assuming that variations can be made to adjust to other types of enterprise combinations as the need arises.

Though these data are derived from Montana farm studies, the general relationships which the tables illustrate are adaptable to the other dry-land wheat areas of the United States. The conclusions drawn illustrate the importance of being specific when referring to "investment in the crop," whether the crop be wheat, corn, tobacco, cotton, fruit, or vegetables.

#### Classification and Definitions of Expenses

Tables VIIA, B, and C itemize the expense budgets for the three sizes of cash-grain enterprises, 830, 1,200 and 1,700 acres. Cost subdivisions are explained as follows, using major categories defined above:

##### Preharvest expenses

Hired labor: This item depends upon the size of farm, the size, age, and sex composition of the family, and how the family prefers to spend its income. Hired labor for the 830-acre farm is omitted, assuming that there is a member of the family besides the owner who can drive a truck during harvest.

It being a reasonable assumption that the family labor on the 830-acre farm is fully employed, labor hours in excess of

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<sup>6/</sup> Rude, LeRoy C., Land Use Alternatives for Dryland Cash Grain Operators (Northeastern Montana, North Central Montana, and South Central Montana) Dept. of Ag. Econ. and Rural Soc., Montana Agr. Exp. Sta., Bozeman, Mont., in cooperation with U.S.D.A., A.R.S., F.E.R., Div. 1959.

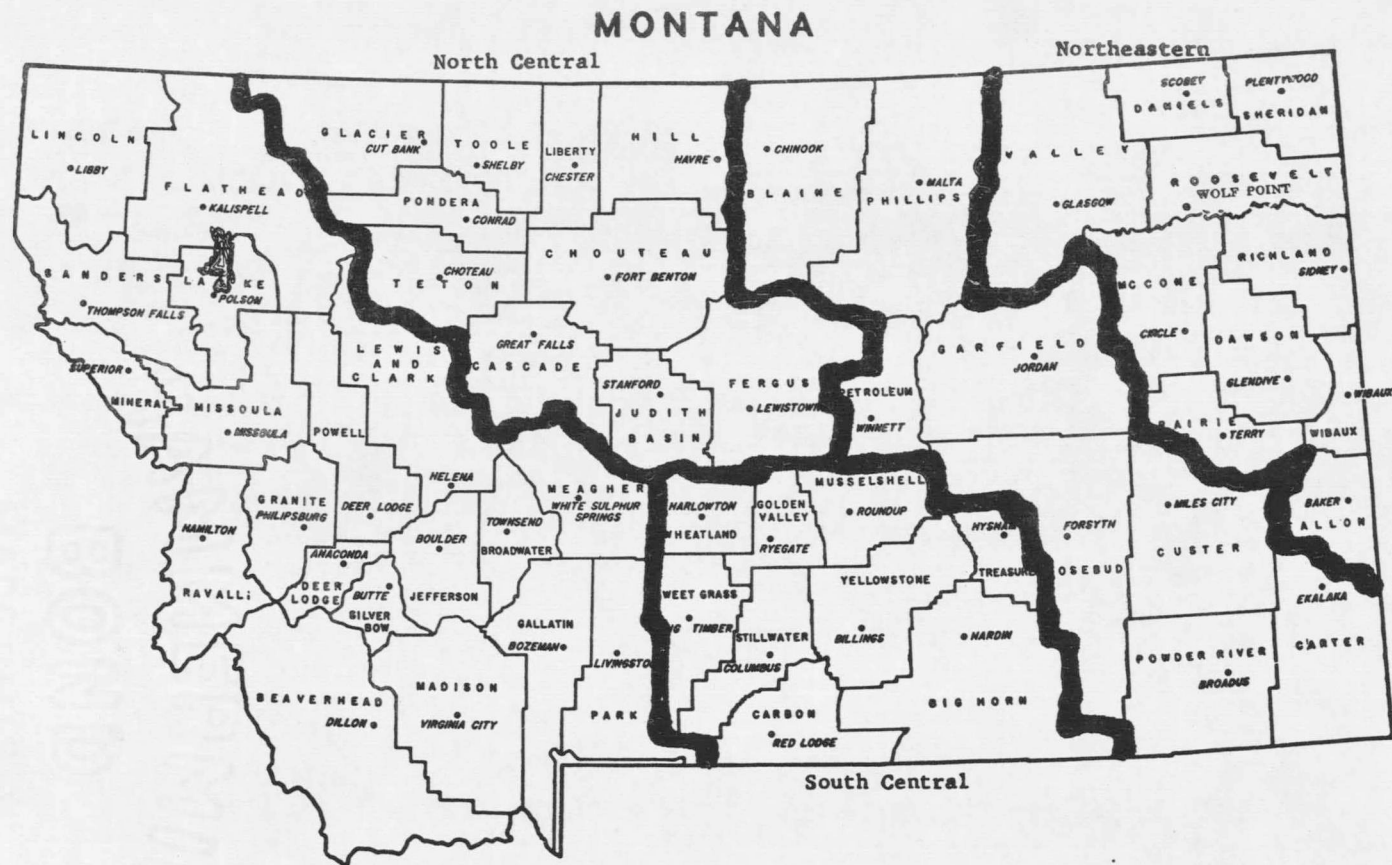


Figure 1. Montana "Cash Grain Areas".

those charged to the 830-acre farm are considered as hired labor, on the 1,200 and 1,700 acre farms. Table II is a summary of total hours of labor and hours of hired labor, estimated according to the above method.

Wages applied to the hours of hired labor are \$1.00 per hour, based on wages earned at farm work in the Western region in 1959. <sup>7/</sup> Wages earned were \$8.85 per day worked, which, assuming an 8-hour day indicates that \$1.00 per hour is a reasonable assumption.

Fuel, oil and repairs: Includes all expense, listed in Table 2 of Appendix of Rude's Reports except for combine and 1/3 of grease costs.

Seed and treatment: Treatment of seed is included in variable expenses in Rude's budgets, but seed was included as a deduction from an income item. However, for this report seed cost is more appropriately included as a pre-harvest expense item, and is calculated by multiplying planted acreage X amount seeded per acre X price per Rude's income budget.

Motor vehicles: Includes all expense, except truck mileage charged to harvest expense at 6¢ per mile. It is assumed that the portion of the pickup and car mileage used during harvest will balance with the portion of the truck mileage used in preharvest.

Insurance: All insurance (except all-risk crop and hail) is charged to pre-harvest expense because any that is obviated by crop failure is insignificant for purposes of this report.

Machinery ownership: Includes all depreciation and interest on equipment because investments in machinery cannot normally be varied according to success of the crop.

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<sup>7/</sup> Ruttan, Vernon W., "The Human Resource Problem in American Agriculture," Farming, Farmers, and Markets for Farm Goods, Committee for Economic Development, Supplementary Paper No. 15, Nov. 1962, page 87.

TABLE II. TOTAL AND HIRED LABOR HOURS FOR CASH GRAIN FARMS OF 830, 1200, AND 1700 ACRES, MONTANA CASH-GRAIN AREAS. \*

Area and Size of Farm	Total Labor Hours			Hired Labor Hours <sup>a/</sup>		
	Combining	Other	Total	Combining	Other	Total
	Hrs.	Hrs.	Hrs.	Hrs.	Hrs.	Hrs.
<b>Northeast</b>						
830-acre	208	472	680	---	---	---
1200-acre	258	641	899	50	169	219
1700-acre	420	894	1314	212	422	634
<b>North Central</b>						
830-acre	180	435	615	---	---	---
1200-acre	232	572	804	52	137	189
1700-acre	372	816	1188	192	381	573
<b>South Central</b>						
830-acre	206	465	671	---	---	---
1200-acre	232	754	986	26	289	315
1700-acre <sup>b/</sup>	232	927	1159	26	462	488

\* Source: Rude, LeRoy C., Land Use Alternatives for Dryland Cash Grain Operators, (Northeastern, North Central, and South Central Montana) Dept. of Ag. Ec. and Rural Soc., Mont. Ag. Expt. Sta., Bozeman, Mont. in cooperation with U.S.D.A., A.R.S., F.E.R. Div., 1959. Table 2 of appendixes.

<sup>a/</sup> Hired labor hours estimated by deducting hours for 830-acre farm from total hours for larger farms, per explanation in text.

<sup>b/</sup> Combining hours are same as for 1200-acre farm because in Rude's study a combination of one combine plus custom harvesting was employed on 1700-acre farm rather than 2 combines as for the other 2 areas.

Miscellaneous costs: This is an allowance for small expense items which were unclassified.

Harvest expenses

Hired labor: (See explanation under Preharvest expenses above)

Fuel, oil and repairs: Includes only expenses for the combine and 1/3 of grease.

Motor vehicles: Includes all of variable truck expense at 6¢ per mile. (See footnotes on Tables VIIA, B, and C.)

Custom combining: Rude allowed a certain number of manhours per combine for the harvest. Where it did not pay to own two combines, and one combine was not sufficient to complete the harvest in the allotted time, custom combining was charged at the rate of \$3.50 per acre with an allowance of 4¢ per bushel for hauling.

Grain storage: This item was included in Rude's reports, based on 3.5¢ per bushel. It is an item that would be incurred, but characterized by extreme variability between farmers and also over time.

Miscellaneous costs: This is an allowance consistent with the same item in preharvest expenses.

Special expenses:

All-risk crop insurance: This is an optional expense, the cost depending upon acreage, coverage, rates, experience, and size credits. The amount selected is a "best estimate" of an average for each of the three cash grain areas, within the limits of precision required for this study and for purposes for which it may be used. The basic rate was chosen from Tables IIIA, and B, which list the coverages available, price-level choices, and premium rates in each rate area of each county in the cash-grain areas of Montana. The rate selected for cost purposes was the lowest if there were two areas, and the second lowest if three or more areas in a county.

A simple average of rates selected for each county in each area was calculated and applied to the acreage of each crop in Table IV, to arrive at a cost for all-risk barley and wheat crop insurance on each size farm in each cash-grain area. These are the costs entered in Tables VIIA, B, and C.

Crop-hail insurance: This is another optional expense, the cost of which depends upon acreage, value-per-acre coverage desired, and rates. Like all-risk crop insurance, only a "best estimate"

TABLE IIIA. MONTANA FEDERAL WHEAT-CROP INSURANCE, BUSHEL GUARANTEE, AND PREMIUM RATES PER ACRE FOR VARIOUS PRICE LEVEL CHOICES, 1964, COUNTIES IN MONTANA CASH-GRAIN AREAS. \*

County	Area No.	Guarantee Per Acre	PRICES PER BUSHEL <sup>a/</sup>				
			\$1.25	\$1.50	\$1.75	\$2.00	\$2.25
			PREMIUM RATE PER ACRE				
		Bu.	Dol.	Dol.	Dol.	Dol.	Dol.
<u>Northeastern</u>							
Daniels	1	8.0		1.70	1.90**	2.20	
Dawson	1	6.5		2.00	2.30	2.60	
	2	7.5		2.00	2.30**	2.60	
	3	8.5		2.00	2.30	2.60	
Fallon	1	6.5		1.70	1.90	2.20	
	2	8.0		1.70	1.90**	2.20	
McCone	1	7.0		2.10	2.50	2.80	
	2	8.5		2.00	2.30**	2.70	
Richland	1	9.0		1.80	2.10	2.40	
	2	8.0		1.80	2.10**	2.40	
Roosevelt	1	8.5		1.60	1.80**	2.10	
Sheridan	1	7.0		1.20	1.40	1.60	
	2	8.0		1.20	1.40**	1.60	
	3	9.5		1.50	1.70	2.00	
Valley	1	7.5		1.80	2.10	2.40	
	2	8.0		1.50	1.70	2.00	
	3	9.0		1.70	2.00**	2.20	
Wibaux	1	7.0		1.60	1.90	2.20	
	2	8.0		1.60	1.90**	2.20	
<u>North Central</u>							
Cascade	1	11.0	1.00		1.50		1.90
	2	13.0	1.00		1.50**		1.90
Chouteau	1	9.0	.90		1.20		1.60
	2	10.0	.90		1.20		1.60
	3	11.0	.90		1.20**		1.60
	4	13.0	.90		1.20		1.60
Fergus	1	8.0	1.20		1.60		2.10
	2	10.0	1.20		1.60**		2.10
	3	11.5	1.10		1.50		1.90

See footnotes on following page.

TABLE IIIA. (Cont.) MONTANA FEDERAL WHEAT-CROP INSURANCE, BUSHEL GUARANTEE, AND PREMIUM RATES PER ACRE FOR VARIOUS PRICE LEVEL CHOICES, 1964, COUNTIES IN MONTANA CASH-GRAIN AREAS. \*

County	Area No.	Guarantee Per Acre	PRICES PER BUSHEL <sup>a/</sup>				
			\$1.25	\$1.50	\$1.75	\$2.00	\$2.25
			PREMIUM RATE PER ACRE				
		Bu.	Dol.	Dol.	Dol.	Dol.	Dol.
Glacier	1	9.0	1.30		1.80**		2.40
	2	11.0	1.60		2.30		2.90
Hill	1	7.0		1.90	2.30	2.60	
	2	9.0		1.90	2.30**	2.60	
Judith Basin	1	8.5	.80		1.20**		1.50
	2	10.0	1.00		1.40		1.80
Liberty	1	8.5		2.00	2.30**	2.60	
	2	10.0		2.10	2.50	2.80	
Pondera	1	12.0	1.10		1.50**		1.90
Teton	1	9.5	1.00		1.40**		1.80
	2	12.5	1.10		1.50		1.90
Toole	1	9.0	1.30		1.80**		2.40
	2	11.0	1.60		2.30		2.90
<u>South Central</u>							
Big Horn	1	7.0	1.30		1.80		2.30
	2	10.0	1.30		1.80**		2.30
	3	12.0	1.30		1.80		2.30
Stillwater	1	8.0	1.00		1.30		1.70
	2	10.0	1.10		1.50**		2.00
	3	11.0	1.20		1.70		2.10
Yellowstone	1	12.0	1.30		1.90**		2.40

\* Source: Montana--Wheat Crop Insurance--1964 and Succeeding Crop Years, (FCIC Rate Schedule).

<sup>a/</sup> The premium rate chosen for Table IV is indicated (\*\*).

TABLE IIIB. MONTANA FEDERAL BARLEY-CROP INSURANCE, BUSHEL GUARANTEE, AND PREMIUM RATES PER ACRE FOR VARIOUS PRICE LEVEL CHOICES, 1964, COUNTIES IN MONTANA CASH-GRAIN AREAS. \*

County	Area No.	Guarantee Per Acre	PRICES PER BUSHEL <sup>a/</sup>		
			\$0.60	\$0.80	\$1.00
			PREMIUM RATE PER ACRE		
		Bu.	Dol.	Dol.	Dol.
<u>Northeastern</u>					
Daniels	1	11.0	1.00	1.40**	1.70
Dawson	1	7.0	.90	1.20	1.60
	2	8.0	.90	1.20**	1.60
	3	9.0	.90	1.20	1.60
Fallon	1	8.0	.90	1.20	1.50
	2	10.0	.90	1.20**	1.50
McCone	1	8.0	1.00	1.30	1.70
	2	9.0	1.00	1.30**	1.70
Richland	1	10.5	1.00	1.30	1.60
	2	9.5	1.00	1.30**	1.60
Roosevelt	1	10.5	.90	1.20	1.40
Sheridan	1	9.0	.80	1.10	1.40
	2	12.0	1.00	1.40**	1.70
	3	13.0	1.10	1.50	1.90
Valley	1	7.0	.70	.90	1.10
	2	10.0	.90	1.10**	1.40
	3	11.0	1.00	1.30	1.60
<u>North Central</u>					
Cascade	1	12.0	.80	1.00	1.30
	2	15.0	.80	1.00**	1.30
Chouteau	1	10.5	.70	1.00	1.20
	2	12.5	.70	1.00	1.20
	3	13.5	.70	1.00**	1.20
	4	15.5	.70	1.00	1.20
Fergus	1	8.5	.70	.90	1.20
	2	11.5	.70	.90**	1.20
	3	14.5	.70	.90	1.20

See footnotes on following page.



TABLE IIIB. (Cont.) MONTANA FEDERAL BARLEY-CROP INSURANCE, BUSHEL GUARANTEE, AND PREMIUM RATES PER ACRE FOR VARIOUS PRICE LEVEL CHOICES, 1964, COUNTIES IN MONTANA CASH-GRAIN AREAS. \*

County	Area No.	Guarantee Per Acre	PRICES PER BUSHEL <sup>a/</sup>		
			\$0.60	\$0.80	\$1.00
			PREMIUM RATE PER ACRE		
		Bu.	Dol.	Dol.	Dol.
Glacier	1	12.0	.90	1.20**	1.50
	2	15.0	1.20	1.50	1.90
Hill	1	8.0	1.20	1.50	1.90
	2	12.0	1.20	1.50**	1.90
Judith Basin	1	11.5	.60	.80**	1.00
	2	13.5	.70	1.00	1.20
Liberty	1	12.0	1.30	1.70	2.10
	2	13.5	1.30	1.70**	2.10
Pondera	1	16.5	.90	1.20**	1.60
Teton	1	13.5	.80	1.10	1.40
	2	15.5	.80	1.10**	1.40
Toole	1	12.0	.90	1.20**	1.50
	2	15.0	1.20	1.50	1.90
<u>South Central</u>					
Big Horn	1	8.0	.80	1.10	1.30
	2	11.0	.80	1.10**	1.30
	3	13.0	.80	1.10	1.30
Stillwater	1	9.0	.70	.90	1.20
	2	12.0	.70	.90**	1.20
	3	14.0	.70	.90	1.20
Yellowstone	1	14.0	.80	1.10**	1.40

\* Source: Montana--Barley Crop Insurance--1964 and Succeeding Crop Years, (FCIC Rate Schedule).

<sup>a/</sup> The premium rate chosen for Table IV is indicated (\*\*).

TABLE IV. COST OF FEDERAL CROP INSURANCE FOR CASH GRAIN FARMS OF 830, 1200, AND 1700 ACRES, MONTANA CASH-GRAIN AREAS.\*

Farm Size	Crop	Acres In Crop	X	Rate Per Acre <sup>a/</sup>	=	Premium
<u>Acres</u>		<u>Acres</u>		<u>Dol.</u>		<u>Dol.</u>
<u>NORTHEASTERN</u>						
830	Wheat	280		1.88		526
	Barley	120		1.26		151
1200	Wheat	405		1.80		729
	Barley	173		1.26		218
1700	Wheat	574		1.76		1010
	Barley	246		1.26		310
<u>NORTH CENTRAL</u>						
830	Wheat	280		1.59		445
	Barley	120		1.16		139
1200	Wheat	405		1.53		620
	Barley	173		1.16		201
1700	Wheat	574		1.49		855
	Barley	246		1.16		286
<u>SOUTH CENTRAL</u>						
830	Wheat	280		1.66		465
	Barley	120		1.03		124
1200	Wheat	405		1.59		644
	Barley	173		1.03		178
1700	Wheat	574		1.56		895
	Barley	246		1.03		254

\* Source: Acres in crop from Rude, LeRoy C., Land Use Alternatives for Dryland Cash Grain Operators, (Northeastern, North Central, and South Central Montana) Dept. of Ag. Ec. and Rural Soc., Mont. Ag. Exp. Sta., Bozeman, Mont., in Cooperation with U.S.D.A., A.R.S., F.E.R. Div., 1959. Rates are taken from "Montana--Wheat Crop Insurance--1964 and Succeeding Crop Years--Bushel Guarantee, Prices Per Bushel and Premium Rates," FCIC.

<sup>a/</sup> Size discounts are applied as follows:

830-acre farm: 4%  
 1200-acre farm: 8%  
 1700-acre farm: 10%

can be made. Private insurance company rates are used, choosing what appears to be the average in each cash-grain area. The insured value was assumed to be 80 percent of the crop value, calculated by multiplying the average yields by the average price received for each crop in each area. Table V presents the details for calculating the premium used for each size farm in each cash-grain area.

Taxes: All taxes are included as a special item because they may deserve special treatment in different phases of the study.

Interest on land and buildings: This study accepts Rude's values for land and buildings as the best approximation for crop-insurance study purposes. His method was to obtain the best estimate of market values of land in the particular areas. This represents the opportunity cost of farmer's investment in his real estate. Likewise, no significant reason is found to deviate from his interest rate of 4.5 percent.

However, Tables VIIA, B, and C show that the real estate item is a sizable portion of the total expenses, and consequently the use of other interest rates and land values will appreciably affect the figures for total investment in the crop. Here again, adjustments can be made where necessary to fit individual situations.

Family-living allowance: A definition of family-living allowance is guided by two considerations: First, providing for family living is necessary to the solvency of the farm enterprise. Providing for a minimum or subsistence amount of family-living expense takes precedence over meeting all other expenses. Second, family-living allowance includes the value of labor contributed by the family to the farm operation.

The definition of family-living allowance is an amount that best approximates these two considerations. Three methods were

TABLE V. COST OF HAIL INSURANCE FOR CASH GRAIN FARMS OF 830, 1200, AND 1700 ACRES, MONTANA CASH-GRAIN AREAS, 80 PERCENT COVERAGE.\*

Farm Size	Crop	Acres in Crop	Av. Yield	Percent Coverage	Price Per Bu.	Ins. Rate	Premium
<u>Acres</u>		<u>Acres</u>	<u>Bu.</u>	<u>%</u>	<u>Dol.</u>	<u>%</u>	<u>Dol.</u>
<u>NORTHEASTERN</u>							
830	Sp. wheat	280	13.0	80	1.73	8	403
	Barley	120	17.4	80	.79	8	106
1200	Sp. wheat	405	13.0	80	1.73	8	533
	Barley	173	17.4	80	.79	8	152
1700	Sp. wheat	574	13.0	80	1.73	8	826
	Barley	246	17.4	80	.79	8	217
<u>NORTH CENTRAL</u>							
830	Wtr. wheat	252	20.2	80	1.61	7	459
	Sp. wheat	28	15.7	80	1.62	7	40
	Barley	120	25.0	80	.59	7	99
1200	Wtr. wheat	365	20.2	80	1.61	7	665
	Sp. wheat	40	15.7	80	1.62	7	57
	Barley	173	25.0	80	.59	7	143
1700	Wtr. wheat	517	20.2	80	1.61	7	943
	Sp. wheat	57	15.7	80	1.62	7	81
	Barley	246	25.0	80	.59	7	203
<u>SOUTH CENTRAL</u>							
830	Wtr. wheat	280	17.3	80	1.61	10	624
	Barley	120	19.2	80	.58	10	107
1200	Wtr. wheat	405	17.3	80	1.61	10	902
	Barley	173	19.2	80	.58	10	154
1700	Wtr. wheat	574	17.3	80	1.61	10	1,279
	Barley	246	19.2	80	.58	10	219

\*Source: Acres in crop, average yield, and price per bushel are from Rude, L. C., Land Use Alternatives for Dryland Cash Grain Operators (Northeastern, North Central, and South Central Montana) Dept. of Ag. Ec. and Rural Soc., Mont. Ag. Exp. Sta., Bozeman, Mont., in Cooperation with U.S.D.A., A.R.S., F.E.R. Div., 1959.  
Insurance rates are selected as the best approximations to the average rate, from a map on which are plotted the rates listed in Rates and Rules for Crop-Hail Insurance, Montana, Crop-Hail Insurance Actuarial Association, Chicago, 1962-CHIAA No. 135.

used as guides to determining an appropriate allowance, of which the following appeared to be the most useful:

- (1) Average net residual returns after deducting all costs from gross farm income are sometimes considered returns for family living. Rude's reports are again used to illustrate results that can be obtained this way. Since his reports include hired labor in the residual results, the allowances for hired-labor hours (from Table II above) are deducted, with the results shown in Table VI.

The significant variation from \$740 on the 830-acre Northeastern farm to \$4,687 on the 1700-acre North Central farm indicates that the residuals are functions of factors other than the value of family-labor contribution and family-living needs. A constant land value and interest rate were used on all three sizes of farms in each area. Thus, the residual reflects differences due to scale, between the various size farms. The residual returns are highest for the higher-yielding North Central area, and lowest for the lower-yielding Northeastern area. An average of all the "net returns to family living" of Table VI is about \$2,200, which will be used to substantiate our final choice of family-living allowance in the conclusions to follow.

- (2) The opportunity-cost approach is another guide for choosing a figure for family-living allowance. This involves assumptions regarding the type of employment for which the farm operator may be qualified. For example, because of the high degree of farm mechanization, Montana farm operators should be qualified as equipment-operator and mechanic positions with a minimum of special training. The average weekly earnings in the contract highway and street construction industry in the

TABLE VI. SUMMARY OF RESIDUAL RETURNS TO LABOR AND MANAGEMENT AND ALLOWANCES FOR HIRED LABOR ON CASH GRAIN FARMS OF 830, 1200 AND 1700 ACRES, WHEAT AND BARLEY ENTERPRISE, MONTANA CASH-GRAIN AREAS. \*

Farm Size	Montana Cash Grain Areas		
	Northeastern	North Central	South Central
	Dol.	Dol.	Dol.
<u>830-acre farm</u>			
Residual return (No hired labor assumed)	740	1,741	1,177
<u>1200-acre farm</u>			
Residual return	1,431	3,249	2,048
Less hired-labor allowance	219	189	315
Net return to family-living	1,212	3,060	1,733
<u>1700-acre farm</u>			
Residual return	2,792	5,260	3,693
Less hired-labor allowance	634	573	488
Net return to family-living	2,158	4,687	3,205

\* Source: Rude, L. C., Land Use Alternatives for Dryland Cash Grain Operators, (Northeastern, North Central, and South Central Montana) Dept. of Ag. & Econ. and Rural Soc., Montana Agr. Exp. Sta., Bozeman, Montana, in cooperation with U.S.D.A., A.R.S., F.E.R. Div., 1959, Table 2, 3, and 4 of each report. Hired-labor allowance is from Table II of this report.

United States for 1962 was \$118.37 per week, or approximately \$6,000 per year. <sup>8/</sup> This figure must be adjusted to a farm basis: A rental allowance of \$100 per month should be deducted, plus a travel adjustment of \$50 per month, and also

<sup>8/</sup> U.S. Dept. of Labor, Monthly Labor Review, Vol. 86, No. 12, Dec., 1963, page 1482, Table C. If Montana industry is used as a base, the estimate should possibly be discounted for seasonality. However, the data already has some seasonality built into it, and other factors, such as higher hourly earnings tend to balance the seasonality factor.

\$100 per month for farm-produced food. The total of these adjustments is \$250 per month, leaving a net annual opportunity allowance for management labor of \$3,000.

Another guide for estimating the opportunity cost is an average of non-farm annual income for the Western region. Ruttan used such a figure in his analysis of farm, rural non-farm, and urban incomes. <sup>9/</sup> The median urban income for 1960 was \$6,564 per family. After making the allowances for rent, travel, and farm food contribution, the net opportunity allowance would not differ appreciably from the \$3,000 estimated by the method above.

Brewster, in a study of resources needed for specified income levels in 1954, chose an annual income of \$3,500 for wheat farms in the Triangle-Judith Basin of Montana. <sup>10/</sup> He chose this level because it "approximated the 1954 median earnings of semi-skilled workers in nonfarm employment in each of the states considered." <sup>11/</sup>

The consumer price index has risen about 12 percent (from 93 to 105) from 1954 to 1963, so the \$3,500 in 1954 would be equivalent to nearly \$4,000 in 1963. <sup>12/</sup> Apparently no adjustments were made for rent, travel, and farm-produced food, so this figure would be considerably lower than the \$6,500 median urban income of Ruttan's study, or the figure of \$6,000 derived from the weekly earnings in contract highway and street construction.

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<sup>9/</sup> Ruttan, Vernon W., "The Human Resource Problem in American Agriculture," Farming, Farmers, and Markets for Farm Goods, Sup. paper No. 15, Committee for Economic Development, Nov. 1962, Table 4 page 80.

<sup>10/</sup> Brewster, John M. Farm Resources Needed for Specified Income Levels, Agric. Res. Serv., U.S.D.A., Ag. Info. Bulletin No. 180, Dec., 1957.

<sup>11/</sup> Ibid., page 5.

<sup>12/</sup> Federal Reserve Bulletin, Oct. 1963, "Selected Business Indexes" page 1450.

(3) The minimum essentials approach is a third guide that can be used in selecting a figure for family-living allowance. Protection of the solvency of a farm enterprise is a basic purpose of crop insurance. Family-living necessities are non-deferrable expenses during crop preparations. These could be considered a minimum estimate of returns to the operator's labor that must be covered as part of the complete investment in the crop. A study of cash family-living expenses on farms is complicated by assumptions regarding the use of farm-produced food, levels of recreation, education, and material possessions. A study of account-keeping families in Minnesota showed an expenditure of about \$2,000 in 1961 for clothing, medical care, furniture and equipment, and food. <sup>13/</sup> Since Montana cash grain farms commonly have little or no livestock and usually little farm-produced food, cash expenditures would be higher than those for the Minnesota farms where mixed enterprises prevail. Whereas the \$2,000 in the Minnesota study does not include recreation and education, an estimate of \$3,000 to \$4,000 is more in line for expenses that must be met each year for family living on Montana farms.

A conclusion from the above discussion is that the following family-living allowances are reasonable and allow arbitrary differences between sizes of farms: \$3,000, \$3,500, and \$4,000 for the 830, 1,200 and 1,700-acre farms respectively. The tables in this study are set up to facilitate substitutions appropriate to individual situations in the field, or pertinent to other studies.

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<sup>13/</sup> U.S.D.A., Agricultural Statistics, 1962, Table 808, page 683.



### Levels of Investment

The following questions are raised when the undefined term "investment in the crop" is used:

1. Does it include interest and depreciation on machinery and equipment?
2. Does it include harvest expense, crop insurance and taxes?
3. Does it include family-living allowance?
4. Does it include interest on the investment in real estate?

The expenses listed in Tables VIIA, B and C are progressively totalled at various levels corresponding to various concepts that individuals have in mind when using the term "investment in the crop":

Variable preharvest expenses: This includes expenses of operations and excludes capital expenses. It is comparable to what is meant by some when they refer to "out-of-pocket" expenses.

Total preharvest expenses: This item contains the above variable preharvest expenses plus the interest and depreciation on machinery and equipment (machinery-ownership expense).

Total expenses less family-living and land: For this item crop insurance, taxes and variable harvest expenses are added to total preharvest expenses.

Total expenses except land: The allowance for family living is added to the above expenses.

Total expenses: This is the total of all expenses which must be met to maintain solvency of the enterprise, including a return of 4.5 percent on the investment in land, and a family-living allowance related to opportunity cost.

All expense items are summarized on a per-acre-in-crop basis in Table VIII for convenience in making comparisons with the available levels of crop insurance, or with yield records in the various wheat areas. One observation is that the expenses are evenly divided between the five main levels of "crop investment." The variable preharvest expenses are relatively

TABLE VIIA. EXPENSES FOR MONTANA CASH GRAIN AREA FARMS OF 830 ACRES.\*

Expense Items	Northeastern		North Central		South Central	
	Total	Per-Acre <sup>a/</sup> in Crops	Total	Per-Acre <sup>a/</sup> in Crops	Total	Per-Acre <sup>a/</sup> in Crops
	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.
<u>Preharvest</u>						
Fuel, oil and repairs	610	1.53	511	1.28	780	1.95
Seed and treatment	637	1.59	576	1.44	571	1.43
Weed spraying	500	1.25	500	1.25	500	1.25
Motor vehicles <sup>b/</sup>	445	1.11	357	.89	307	.77
Insurance	127	.32	152	.38	150	.38
Miscellaneous costs	50	.12	50	.12	50	.12
Total variable preharvest	2,369	5.92	2,146	5.36	2,358	5.90
Machinery ownership (Combine)	1,861 (525)	4.65 (1.31)	2,631 (663)	6.58 (1.66)	2,271 (609)	5.68 (1.52)
Total preharvest	4,230	10.57	4,777	11.94	4,629	11.58
<u>Variable harvest</u>						
Fuel, oil and repairs	215	.54	196	.49	213	.53
Motor vehicles <sup>b/</sup>	130	.33	100	.25	119	.30
Grain storage	201	.50	298	.75	252	.63
Miscellaneous costs	25	.06	25	.06	25	.06
Total variable harvest	571	1.43	619	1.55	609	1.52
All-risk crop insurance	677	1.69	584	1.46	589	1.47
Hail insurance	509	1.27	598	1.50	731	1.83
Taxes	315	.79	409	1.02	304	.76
Total expenses except family-living and land	6,302	15.75	6,987	17.47	6,862	17.16
Family-living allowance	3,000	7.50	3,000	7.50	3,000	7.50
Total expenses except land	9,302	23.25	9,987	24.97	9,862	24.66
Interest on land	2,094	5.23	3,038	7.59	2,452	6.13
Total expenses	11,396	28.48	13,025	32.56	12,314	30.79

Source: Adapted from Rude, L.C., Land Use Alternatives for Dryland Cash Grain Operators (Northeastern, North Central, and South Central Montana) Dept. of Ag. Ec. and Rural Soc., Mont. Ag. Exp. Sta., Bozeman, Mont., in Cooperation with U.S.D.A., A.R.S., F.E.R. Div., 1959.

a/ Based on 400 acres in crop, the total insurable acreage.

b/ For the Northeastern and the North Central areas, one-half of the truck mileage is charged to harvest expense at 6¢ per mile, since a pickup truck is not included in the inventory. For the South Central area, the full truck mileage is charged to harvest at 6¢ per mile, since a pickup is included.

TABLE VIIB. EXPENSES FOR MONTANA CASH GRAIN AREA FARMS OF 1200 ACRES.\*

Expense Items	Northeastern		North Central		South Central	
	Total	Per-Acre in Crop <u>a/</u>	Total	Per-Acre in Crop <u>a/</u>	Total	Per-Acre in Crop <u>a/</u>
	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.
<b>Preharvest</b>						
Hired labor	169	.28	137	.24	289	.50
Fuel, oil and repairs	703	1.22	644	1.11	868	1.51
Seed and treatment	922	1.60	833	1.45	827	1.44
Weed spraying	723	1.25	723	1.25	723	1.25
Motor vehicles <u>b/</u>	401	.70	342	.59	413	.71
Insurance	155	.27	157	.27	179	.31
Miscellaneous costs	75	.13	75	.13	75	.13
<b>Total variable preharvest</b>	<b>3,148</b>	<b>5.45</b>	<b>2,911</b>	<b>5.04</b>	<b>3,374</b>	<b>5.85</b>
Machinery ownership (Combine)	2,572 (627)	4.45 (1.08)	3,214 (663)	5.56 (1.15)	3,159 (567)	5.46 (.98)
<b>Total preharvest</b>	<b>5,720</b>	<b>9.90</b>	<b>6,125</b>	<b>10.60</b>	<b>6,533</b>	<b>11.31</b>
<b>Variable harvest</b>						
Hired labor	50	.09	52	.09	26	.04
Fuel, oil and repairs	278	.48	251	.43	252	.44
Motor vehicles <u>b/</u>	258	.45	196	.34	187	.32
Custom combining	193	.33	221	.38	175	.30
Grain storage	290	.50	431	.74	364	.64
Miscellaneous costs	25	.04	25	.04	25	.04
<b>Total variable harvest</b>	<b>1,094</b>	<b>1.89</b>	<b>1,176</b>	<b>2.02</b>	<b>1,029</b>	<b>1.78</b>
All-risk crop insurance	947	1.64	821	1.42	822	1.42
Hail insurance	735	1.27	865	1.50	1,056	1.83
Taxes	447	.77	577	1.00	433	.75
<b>Total expenses except family-living and land</b>	<b>8,943</b>	<b>15.47</b>	<b>9,564</b>	<b>16.54</b>	<b>9,873</b>	<b>17.09</b>
<b>Family-living allowance</b>	<b>3,500</b>	<b>6.06</b>	<b>3,500</b>	<b>6.06</b>	<b>3,500</b>	<b>6.06</b>
<b>Total expenses except land</b>	<b>12,443</b>	<b>21.53</b>	<b>13,064</b>	<b>22.60</b>	<b>13,373</b>	<b>23.15</b>
Interest on land	3,014	5.21	4,393	7.60	3,533	6.11
<b>Total expenses</b>	<b>15,457</b>	<b>26.74</b>	<b>17,457</b>	<b>30.20</b>	<b>16,906</b>	<b>29.26</b>

\* Source: Adapted from Rude, see Table VIIA.

a/ Based on 578 acres in crop, the total insurable acreage.

b/ The total variable truck expense is charged to harvest expenses at 6¢ per mile.

TABLE VIIC. EXPENSES FOR MONTANA CASH GRAIN AREA FARMS OF 1700 ACRES.\*

Expense Items	Northeastern		North Central		South Central	
	Total	Per-Acre in Crop <u>a/</u>	Total	Per-Acre in Crop <u>a/</u>	Total	Per-Acre in Crop <u>a/</u>
	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.
<u>Preharvest</u>						
Hired labor	422	.52	381	.47	462	.56
Fuel, oil and repairs	1,099	1.34	1,088	1.32	1,071	1.31
Seed and treatment	1,306	1.59	1,179	1.44	1,186	1.45
Weed spraying	1,025	1.25	1,025	1.25	1,025	1.25
Motor vehicles <u>b/</u>	486	.59	415	.51	389	.47
Insurance	204	.25	206	.25	205	.25
Miscellaneous costs	90	.11	90	.11	90	.11
Total variable preharvest	4,632	5.65	4,384	5.35	4,428	5.40
Machinery ownership (Combine)	3,220 (886)	3.93 (1.08)	4,228 (1,275)	5.16 (1.56)	3,437 (627)	4.19 (.77)
Total preharvest	7,852	9.58	8,612	10.51	7,865	9.59
<u>Variable harvest</u>						
Hired labor	212	.26	192	.23	26	.03
Fuel, oil and repairs	478	.59	398	.49	251	.31
Motor vehicles <u>b/</u>	303	.37	229	.28	363	.44
Custom combining <u>c/</u>	---	---	---	---	970	1.19
Grain storage	411	.50	611	.75	518	.63
Miscellaneous costs	35	.04	35	.04	35	.04
Total variable harvest	1,439	1.76	1,465	1.79	2,163	2.64
All-risk crop insurance	1,320	1.61	1,141	1.39	1,149	1.40
Hail insurance	1,043	1.27	1,227	1.50	1,498	1.83
Taxes	610	.74	784	.96	561	.68
Total expenses except family-living and land	12,264	14.96	13,229	16.15	13,236	16.14
Family-living allowance	4,000	4.88	4,000	4.88	4,000	4.88
Total expenses except land	16,264	19.84	17,229	21.03	17,236	21.02
Interest on Land	4,231	5.16	6,182	7.53	5,035	6.14
Total expenses	20,495	25.00	23,411	28.56	22,271	27.16

\* Source: Adapted from Rude, see Table VIIA.

a/ Based on 820 acres, the total insurable acreage.

b/ The cost of operation of the 2-ton truck is charged to harvest for its total mileage at 6¢ per mile; or where there are two pickups plus one truck, the larger pickup and truck are charged to harvest at 6¢ per mile.

c/ The Northeastern budget includes two combines, a self-propelled and a pull-type; the North Central, two self-propelled; and the South Central, one self-propelled.



























































































































































































































































































































































































