

Assessing Risk in Production Agriculture

A Self-Study Course for Finance Professionals

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Chapter 1

The Setting

INTRODUCTION

Risk is the hot topic today in business, agriculture, and banking. Let's sit in as a banker and a producer consider the everyday realities of the risks they face.

OBJECTIVES

The objectives of this chapter are to:

1. Describe a typical scenario that illustrates the challenges lenders face in assessing borrower risk and managing credit risk.
2. Describe a typical scenario that illustrates the challenges farmers have in assessing and managing operating, financial and strategic risk.

MADISON NATIONAL BANK

John Anton sat at his desk and thought about the task before him. He had just been hired by Madison National Bank to be the Senior Vice President for Agricultural and Commercial Loans. Madison National was a locally owned community bank located in a county seat town of approximately 50,000 people in a historically prosperous farming community in the Great Plains. John was part of a new management team that had been brought into the bank when it was acquired by new owners from the family of the bank founders. Previous management had not been particularly progressive in managing the loan portfolio, and John inherited the dual problems of lower-than-desirable credit quality as well as declining loan volume. His immediate challenge was to make a presentation to the Board of Directors that would outline Madison National's strategy to expand loan volume and at the same time improve credit quality by cleaning up the current portfolio and putting in place policies and procedures that would manage the risk of expanding their loan portfolio. The task would not be easy for a number of reasons.

The first challenge was that the loan market in which Madison National had historically participated was in major transition. The \$250 million bank was located in a rural community that had historically had a strong agricultural base with traditional, independent family farmers as its prime agricultural customers. Agricultural loans were expected to continue to be a major part of the portfolio in the future, but the farming industry was changing dramatically from one of modest-sized family-based grain and livestock operations to more specialized grain or livestock businesses that were much larger in scale. Many of the livestock operations in the area required credit requests of \$750,000 or more, and grain operations with lines of \$500,000 or greater were rapidly becoming the norm. Many of the grain operations involved significant acreages of cash-rented land, and the cash-rent market was very aggressive. On the livestock side, the larger scale operations needed not only more credit, but they were operating with higher leverage positions than had been typical for the industry. Some producers had lost significant equity because of low prices, but they still felt the need to expand and adopt new technology, obtain economies of size, and be players in the new more consolidated livestock markets. In fact, Madison National had financed the expansion plans of some of these

Chapter 2

Risk Concepts and Terminology

INTRODUCTION

Risk and risk analysis and assessment are complex concepts and processes. The purpose of this chapter is to present some of the terminology of risk analysis and assessment so that the discussion of analyzing producer's risk and credit risk in the agricultural portfolio can be accurately anchored and framed. This framework is essential to differentiate between a common perspective that risks are unexpected surprises that one can do nothing about, and a more analytical perspective that risks can be measured, analyzed, and managed. Thus, the focus in this chapter will be to develop the concepts essential to a more analytical perspective of risk and risk assessment.

OBJECTIVES

The objectives of this chapter are to:

1. Introduce various definitions and measurements of risk.
2. Introduce the concept of potential loss exposures as an important indication of financial and credit risk.
3. Categorize risks faced by farmers including operational risk and strategic risk.
4. Identify the various strategies for managing risk.
5. Describe the importance of the concept of risk aversion and the trade-off between risk and return.

RISK DEFINITION

Everybody talks about it. Farmers and their lenders say it is increasing in agriculture. Lenders lose sleep over it. What is this phenomenon called risk?

Most lenders and farm and agribusiness managers think about potential losses when they think about risk. These losses can be in various forms, but the common denominator in most cases is a significant financial loss or setback. Some people define risk as a peril or a hazard, whereas others perceive risk to be any outcome that is different than the one expected. Some distinguish between situations where probabilities are known (risk) and where they are not known (uncertainty); we will not worry about that distinction. Economists tend to worry about variability or variation when they think of risk, although variability as typically measured by economists includes potential gains as well as potential losses. Most businessmen and lenders focus their attention on the loss dimension of variability rather than the gain dimension.

One often hears managers or lenders say that a particular option involves more risk compared to other options or strategies. What does that mean? There are three possible interpretations of that phrase. First, more risk might refer to a higher likelihood of an adverse outcome, a hazard or peril, or a potential loss. Second, it might refer to the magnitude or size of the loss if it were to occur; some future events might result in relatively modest losses, whereas other events could result in bankruptcy of the firm. A third meaning of more risk might be the expected

Chapter 3

Analyzing Risky Decisions

INTRODUCTION

Making decisions in an environment of risk and uncertainty is difficult, but one way to reduce that difficulty is to use a structured decision process that organizes the components or elements of a decision problem and applies appropriate tools and techniques to solve that problem. The focus of this discussion is to describe that decision structure and to identify various tools and techniques that can be used within that decision structure to make the best decision. These tools include probability distribution techniques, control charts, risk scorecarding, decision trees, scenario analysis and stress testing, value at risk, preemption and options procedures. Although the decision tools discussed here will not guarantee success in risky decision-making (that is, in fact, one of the characteristics of a risky decision—there are no guarantees), they do improve the chances of capturing all the information available and making a sound decision.

OBJECTIVES

The objectives of this chapter are to:

1. Identify and describe the critical components of a risky decision problem.
2. Introduce the concepts of probability distribution techniques and illustrate their usefulness in risky decision-making.
3. Illustrate the use of control charts in separating uncontrollable from controllable risk or variability.
4. Describe the potential use of risk scorecarding as a tool for analyzing risk.
5. Illustrate the use of decision trees as a mechanism for structuring and analyzing a risky decision.
6. Describe the concept of value at risk and its use in analyzing potential loss exposures.
7. Describe the use of options and option concepts as a mechanism for evaluating and managing risk.

COMPONENTS OF A RISKY DECISION PROBLEM

To better understand decision-making in an environment of risk and uncertainty, it is useful to identify the different components of a risky decision problem. The first component is the states of nature or possible future events that might occur but are not known with certainty. For example, this might be the uncertain price, yield, or quality characteristics that a pork producer or tomato grower might encounter. Each potential price, yield, or quality attribute would be defined as an event or state of nature. The second component is the probabilities that are associated with each of these states of nature. These probabilities might be obtained from historical information and would consequently be described as objective probabilities, or they might come from the judgments of the decision-maker and thus be described as subjective probabilities. In either case, to adequately analyze a risky decision problem, a probability must be associated with each possible uncertain event or state of nature.

Chapter 4

Other Risk Topics

INTRODUCTION

Most of the critical concepts with respect to risk assessment and management have been discussed. Here we introduce some important but relatively abstract ideas that can provide further assistance in framing how we might view the assessment and management of risk. First, since many decisions that involve uncertainty also have a critical timing dimension (either time is of the essence or a delay can be orchestrated before a choice is made), the critical issue of managing time in a risky decision environment is discussed. Our attention then turns to how individuals and businessmen perceive risk, and how perceptions not only influence decisions, but how those perceptions can be managed to improve decision-making in a risky decision environment. Finally, we focus on the critical issue in agriculture of who bears the risk—whether the farmers bear the risk of their production, marketing and other business decisions, or whether the public through government policy is the major bearer of risk in production agriculture.

OBJECTIVES

The objectives of this chapter are to:

1. Understand the importance of managing time in a risky decision environment.
2. Understand the role of risk perceptions and managing those perceptions.
3. Appreciate the role of the public through government policy in bearing the risk of the agricultural sector.

TIME AND RISK

In a decision environment characterized by risk and uncertainty, timing of decisions and managing time are critical to effective decision-making. Timing is particularly important in decisions that involve technological innovations and market positioning. Most new innovations involve a high degree of risk in terms of the potential payoff, but the innovator or early adaptor also typically has the highest potential to capture the most revenue or benefit from that innovation—when everyone else is doing it, the incremental benefits from the new technology are marginalized. So adopting new technology earlier typically results in higher returns, but also higher risk if the technology is inefficient or ineffective. Adoption late has lower risk, but the payoff is typically small. In fact, the reason for adopting by late adopters may not be to increase profitability, but to just stay in business—to survive.

Likewise in market positioning there is typically a first-mover advantage whereby the first to enter a market can establish a position that is difficult for competitors that follow to overcome. A quick follower may not lose a lot to a first-mover in market share and market positioning, but a late entrant typically can only grow volume and gain market share by offering superior products and services (which typically cost more and thus have lower margins), or by price cutting to “buy” market share which also pressures margins. Again timing is important in

Chapter 5

Sources of Risk Exposure

INTRODUCTION

The general categories of operational risk and strategic risk were introduced in Chapter 2. The purpose of this chapter is to identify the specific sources of operational and strategic risk faced by agricultural producers. Although it would be impossible to identify all of the risks that might be faced by an individual farm business, the discussion here will first attempt to identify specific events that create various types of operational risk for a typical farm business. Following the identification and discussion of operational risk, various sources and forms of strategic risk will be identified, and examples given to illustrate what events might cause those strategic risks. Finally, the risk factors that farmers face will be classified into fourteen categories that comprise the universe of risk.

OBJECTIVES

The objectives of this chapter are to:

1. Identify various categories of operational risk exposure faced by farmers and the specific events that create those risks.
2. Describe the various sources of strategic risk exposure faced by farmers and illustrate potential causes of those strategic risks.
3. Describe the universe of risk faced by farmers.

The operational risk exposures that producers face have various origins. We will discuss these sources using the taxonomy typically used by farm management specialists and the USDA Risk Management Agency (RMA). Table 1 provides specific examples of the different sources of operational risk that farmers face, although the list is certainly not exhaustive.

Chapter 6

Agricultural Industry Overview

INTRODUCTION

To understand the risks in any industry requires a fundamental appreciation for the operating characteristics, the technology, the market position and environment and the regulatory climate faced by the firms in that industry. This discussion will provide an overview of these characteristics of U.S. crop and livestock production agriculture with an emphasis on first describing that sector or industry, and then assessing the major risk exposures that sector faces in terms of production, prices/markets, human, legal/regulatory, relationships, technology and casualty risks. For a more detailed discussion of the agricultural industry see Chapter 1 in “Financial and Credit Analysis of Farm Businesses,” the first notebook in this self-study series.

OBJECTIVES

The objectives of this chapter are to:

1. Provide front-end guidance for major U.S. crop and livestock production enterprises in terms of market size and volume, technology, operating characteristics and future challenges and opportunities.
2. Identify and briefly assess the major sources of risk that producers of each of these livestock and crop products and their lenders face.

CROP PRODUCTION

There are hundreds of different crops produced in the U.S., generating around \$183 billion annually in cash receipts. For this discussion, we are only focusing on the primary crops produced in the U.S.

Corn/Soybeans

The U.S. is a major producer of corn and soybeans, producing approximately 36% of the world’s corn and 34% of the world’s soybeans in 2014. In the U.S., corn and soybean production is geographically centered in the Midwest.

Tables 1 and 2 show the five leading corn and soybean producing states that accounted for 59.7% and 54.9% of the U.S. production in 2014. To diminish the effects of the drought in 2012, these percentages are averages over the past three years.

**Table 1—Leading Corn
Producing States**

State	Percent Produced
Iowa	16.4
Illinois	14.8
Nebraska	11.6
Minnesota	9.9
Indiana	7.0
Total	59.7

**Table 2—Leading Soybean
Producing States**

State	Percent Produced
Illinois	14.9
Iowa	14.2
Minnesota	9.4
Indiana	8.5
Nebraska	8.0
Total	54.9

Chapter 7

Government Policy in Agriculture

INTRODUCTION

Producers of agricultural commodities face numerous risks as outlined in Chapter 5. Both state and federal policies and programs have been implemented to help producers reduce or offset these risks. Because state policies and programs to modify or offset agricultural risks vary widely and because they tend to have less impact than federal programs, our focus here will be only on federal programs.

While there are a multitude of federal policies and programs that directly or indirectly affect agriculture, we will concentrate on the following:

- Federal Farm Programs
- Crop Insurance
- Environmental Regulations
- Food Safety
- International Trade and Global Market Access
- Worker Safety
- Monetary Policy and Interest Rates

OBJECTIVES

The objectives of this chapter are to:

1. Understand the key federal programs that impact agriculture.
2. Recognize how these programs shift, reduce or eliminate risks for agricultural producers.
3. Illustrate how federal programs alter the risks faced by agricultural lenders.

FEDERAL FARM PROGRAMS

Federal farm program payments to agricultural producers date back to 1933 and have continued in some form through the present time. While the nature of the programs has changed over time, the objective has always been to stabilize and/or improve farm income thereby lowering risks for agricultural producers. Often the programs required producers to take land out of production to qualify for program payments. Quite often, the programs were criticized because the benefits of the program were capitalized into land values, therefore, benefiting landowners (many of which no longer farmed), and not the intended recipient, the agricultural producer.

Chapter 8

Marketing Alternatives

INTRODUCTION

Agricultural producers, particularly crop producers, continue to identify price and income risk as one of their greatest management challenges. Managing crop price risk is complicated by the fact that while crops are harvested one time per year, the window of pricing opportunities for that crop spans at least a two-year period. Prices can and do vary considerably during that window of pricing opportunity. It is typical, for example, for corn prices to vary by \$0.75 to \$1.25 per bushel and soybean prices to vary by \$1.00 to \$2.25 during the marketing window. Price changes are influenced by a large number of factors and are not easily predictable.

Beyond the pricing decision, both crop and livestock producers are seeing significant structural changes in the relationship with buyers of agricultural commodities. These changes include a wide array of production and marketing contractual opportunities and opportunities to form production and marketing alliances. The challenges associated with marketing are now extended beyond the pricing decision to include concerns about maintaining market access.

OBJECTIVES

This chapter includes an overview of the traditional price risk management issues and tools available for producers, and a look at some of the more recent developments in contracting and producer alliances. The emphasis for crops is on the corn and soybean markets since these crops are most widely grown in the U.S. The contents, however, are relevant for other crops that have actively traded futures and options markets—wheat, rice, and cotton. The discussion is not generally applicable to fruit and vegetable crops, which have very different, market structures and different price discovery mechanisms.

The objectives of this chapter are to:

1. Describe pre-harvest price risk management tools, such as hedging, cash contracts and put and call options.
2. Identify and discuss storage pricing alternatives such as basis contracts and delayed pricing contracts.
3. Discuss alternative selective hedging and calendar-based marketing strategies.
4. Describe the concept and importance of the material hedge.
5. Discuss contracting, qualified supplier and producer alliance programs and other non-traditional arrangements to market agricultural products.

Chapter 9

Crop Insurance

INTRODUCTION

Crop insurance provides a means for farmers to protect themselves against low gross revenues resulting from crop production. Traditionally, crop insurance reduced risks by protecting against low yields. Since 1995, crop revenue products have become available that provide protection not only against yield losses but also protection against downward price movements. The goal of this chapter is to show how crop insurance products impact production and price risks faced by farmers. Lowering these risks will typically increase the probability that farmers will repay loans.

OBJECTIVES

The objectives of this chapter are to:

1. Describe crop insurance products available to farmers.
2. Show how specific products reduce risks.
3. List general guidelines for making crop insurance decisions.

BASIC TERMS OF CROP INSURANCE

Crop insurance is a contractual agreement between a farmer and insurance company. The farmer pays the insurance company a premium. In exchange, the insurance company bears risks associated with yield losses and, in some cases, downward movements in market prices. In some form or another, all crop insurance policies will deal with the following:

- Premiums
- Guarantees
- Payments
- Insurable units
- Actual production history yield
- Perils covered

Premiums

A premium is the amount a farmer pays to the crop insurer in exchange for protection against potential losses. Insurers set per acre premiums using rating procedures that consider the risks of insuring the crop. Premiums are higher for policies that have more risks.

Chapter 10

Other Operational Risk Management Topics

INTRODUCTION

The production organization of any business including a farm business will have important impacts on the risk that business faces. Production organization issues in farming include number of farm activities, off-farm employment, and production practices used on the farm. Moreover, recent advances in information technologies may impact operational risks faced by farmers. This chapter describes how production organization impacts operational risk.

OBJECTIVES

The objectives of this chapter are to understand:

1. Diversification impacts on risk.
2. Off-farm employment impacts on risk.
3. Production practice impacts on risk.

This chapter also includes a case study that illustrates the impacts that diversification has on risk.

NUMBER OF ACTIVITIES AND DIVERSIFICATION

Farms typically engage in more than one income producing activity. Engaging in more than one activity diversifies a farm's income sources, potentially leading to risk reductions in total income for a farm. Diversification works as a risk management strategy when below average income from one activity is offset by above average income from other activities. For example, income from one activity may be low, but this activity's low income may be totally or partially offset by high income from another activity, thereby leading to more stable total income for the entire operation.

The effectiveness of diversification depends on three factors. The first is the profitability of the various activities. Generally, combining an unprofitable activity with a profitable activity does not lead to a superior risk position. Hence, all activities of the farm must be profitable before diversification works as a strategy. The second factor is the income variability from the activities. An activity with high income variability tends to increase total farm income variability even if the high variability activity is combined with activities with lower variability.

The third factor is correlation between activity incomes. Correlation can range between two extremes: perfect positive correlation and perfect negative correlation. Perfect positive correlation means that the incomes from two activities move up and down in lock step with one another. When one activity has 5% above average income, the other activity's income also is 5% above average. The other extreme of perfect negative correlation means that the two activities' incomes move opposite one another. When one activity's income is 5% above average, the other activity's income is 5% below average.

Chapter 12

Lending Practices and Approaches

INTRODUCTION

A thorough understanding of the risks faced by the borrower and the techniques that can be used to manage those risks are critical for the lender to assess the debt servicing and credit risks of individual customers and for the agricultural portfolio. This chapter focuses on the practices and procedures that can be used by the lender to manage the risks in extending credit to agricultural borrowers. This discussion will emphasize sound lending practices including the essential components of loan documentation, proper procedures for loan review and credit risk detection, alternative problem loan resolution strategies and standard lending practices and procedures for different types of loans and enterprises. Note that adequate financial analysis of risk-bearing ability and income generating and debt servicing capacity should have been completed to verify that the borrower is creditworthy.

For a review of loan structuring issues, see Chapter 17 in “Financial and Credit Analysis of Farm Businesses,” the first notebook in this self-study series.

OBJECTIVES

The objectives of this chapter are to:

1. Describe the critical components of credit analysis and loan documentation.
2. Identify the elements of a properly structured credit arrangement.
3. Describe the proper procedures for loan review and credit risk detection.
4. Identify specific problem loan resolution strategies.
5. Describe standard lending practices and procedures for different types of loans and enterprises.
6. Identify various procedures to manage portfolio risk and monitor borrowers' risk management strategies.

MANAGING DEBT SERVICING/CREDIT RISK

Managing debt servicing and credit risk involves a number of tasks. The first task is proper credit analysis and loan documentation. The second task is proper structuring of credit terms. Third is periodic reviews combined with policies and procedures for credit risk detection. Finally, specific problem loan resolution strategies should be identified prior to encountering a specific debt servicing problem.

Chapter 13

Loan Guarantees and Securitization

INTRODUCTION

Lenders have the opportunity to reduce and/or shift credit and default risk through loan guarantees or through securitization of loan receivables. Normally, these measures to modify risk are negotiated at the time the loan is being put in place. However, there also may be opportunities to strengthen the risk position of the lender even after the loan is made.

Loan guarantees are also referred to as “third party enhancements.” This means a third party has undertaken a contingent obligation to strengthen the credit or reduce the risk of loss for the lender. The third party obligation is normally a “contingent” claim meaning it is only enforceable if the primary borrower fails to perform according to the terms of the loan agreement. The most common circumstances for third party enhancements are:

1. A beginning farmer with limited net worth and a large loan request relative to collateral available to secure the loan.
2. An established farmer whose net worth has been eroded by adverse financial events beyond his/her control.
3. A farmer making large capital investments in specialized agricultural buildings such as hog facilities, feedlots, or milking parlors, etc. Immediately upon completion, the market value of such facilities may be much lower than the cost of construction.
4. Loans to corporations or limited liability companies. Lenders often ask for personal guarantees when lending to such business entities. In these situations, the purpose of the guarantee is to increase the security for the loan and to prevent the owner of the business from shifting business assets to personal assets which would then shield them from the obligations incurred by the business.

OBJECTIVES

The objectives of this chapter are to:

1. Identify the types and sources of guarantees.
2. Describe the main features of the Farm Service Agency (FSA) guarantee program.
3. Identify the key features of the Small Business Administration (SBA) and state level agricultural loan and guarantee programs.
4. Discuss participation and consortium lending and the use of asset securitization in agriculture.

Chapter 14

Documenting and Monitoring Strategic Risks

INTRODUCTION

It is harder to manage and monitor strategic risk compared to operational risk, but it is no less important. One of the most significant strategic risks in agriculture is environmental risk, so we will begin this discussion with a review of the environmental audit and managing environmental risk. We will then discuss regulatory compliance risk and provide a checklist to monitor regulatory compliance. Finally, our attention will turn to the challenge of assessing strategic and operational risk by introducing a graphical representation of risk assessment linked to the earlier discussion in Chapter 5 on the universe of risk.

OBJECTIVES

The objectives of this chapter are to:

1. Understand the importance of environmental risk and the components of an environmental audit to reduce that risk.
2. Identify and describe regulatory risk and provide a checklist to evaluate regulatory compliance.
3. Introduce a visual technique to evaluate the total risk exposure of a farm business and how well those risks are being managed.

ENVIRONMENTAL RISKS

Environmental rules and regulations have a significant impact on agricultural lending. For many agricultural lenders, environmental risk may be a larger potential source of cost and losses in their agricultural loan portfolio than traditional sources of credit risk. Most environmental regulations do not enhance revenue. They typically increase cost and reduce the cash flow generating capacity of the business. Furthermore, environmental compliance investments will typically not be financially self-sustaining and will drain revenues from other sources. Thus, investments and loans for environmental compliance must typically be subsidized from revenues generated elsewhere in the farming operation. And even if funds are not borrowed, compliance investments will typically reduce cash flow and income to service currently outstanding debt. Consequently, investments to comply with environmental regulations will almost invariably reduce the cash flow and debt servicing capacity of the business and may, thus, increase credit risk.

In addition to the credit risk, a second risk of environmental regulation is that of environmental liability. It should be recognized that environmental liability can occur in all types of agricultural lending, not just in loans made for environmental compliance. A general rule of thumb is that any real estate or facility loan may result in environmental liability, so appropriate analysis and documentation of that prospect should occur.

Chapter 15

Credit Scoring and Portfolio Stress Testing

INTRODUCTION

Lenders are increasingly using more comprehensive and formal methods to evaluate agricultural producers. A major evolution in credit evaluation methods has been the assessment of risk through credit scoring models. Credit scoring is a numerical method of evaluating credit risk of loan applications based on a borrower's repayment history, financial condition, management ability and other applicant characteristics. The numerical credit score ranks the applicant's likelihood of delinquency or default. Credit scoring provides a quick risk assessment tool and permits the rank ordering of applicants by the relative amount of credit risk they represent. Analyzing risk at the portfolio level is important to assess capital adequacy, loan loss reserve allocations and long run viability of the financial institution. Use of stress testing models that build on credit scoring systems to evaluate portfolio risk will also be discussed in this chapter.

OBJECTIVES

The objectives of this chapter are to:

1. Introduce and improve the understanding and limitations of credit scoring applied to agricultural borrowers.
2. Describe methods for evaluating credit risk impacts on the agricultural portfolio through stress testing.

CREDIT SCORING

History

Bill Fair, an engineer, and Earl Isaac, a mathematician, first implemented credit scoring as a tool to evaluate consumer credit in the 1950s. Fair, Isaac, and Co., Inc., a northern California company, is now the leading developer of credit scoring models for consumer, residential mortgage, and small business credit. The growing role of technology and the current level of consumer credit in the U.S., over \$2.4 trillion, have led to expanded use of automated credit scoring systems in the credit card application process in addition to the automobile loan and home-equity lending markets. Credit scoring systems have the advantage of being able to handle a large volume of credit applications quickly.

Since the early 1990s, credit scoring has also been incorporated in the mainstream of residential mortgage underwriting. Both the Federal Home Loan Mortgage Corporation (Freddie Mac) and the Federal National Mortgage Corporation (Fannie Mae) have encouraged originators to use credit scoring models to evaluate mortgage applicants. Furthermore, security analysts account for the credit scoring policies of mortgage lenders as a factor in their valuation of mortgage-backed securities.