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Adjusting land installment contract terms to meet the needs of low-equity farmers

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by

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CHAPTER I. INTRODUCTION

Since World War II, the land installment contract has become increasingly popular in Iowa as a means of financing the purchase of farm land. Today it is more commonly used than is the traditional mortgage. As a method of low equity financing of farm land, it has filled an important gap that the mortgage could not fill. Previous studies, as well as the nature of the land contract, suggest that it has often enabled farmers to become owner-operators earlier than they otherwise could have. In so doing, it has contributed to the goal of land ownership for farmers as the Homestead Act did after its passage in 1862, and as the Federal Farm Loan Act of 1916 and the Farmers Home Administration Act of 1946 have done in more recent times.

Present trends in Iowa agriculture suggest that the land installment contract will continue and perhaps expand its role as a method of financing the purchase of farm land. However, rapid changes in the agricultural sector since 1972 raise serious questions about the eficacy of land installment contracts in the future. This study examines some of these questions which relate to the economic implications of land installment contracts for low equity buyers in their efforts to achieve land ownership.

Nature of the Land Installment Contract

The land installment contract (hereafter referred to as land contract) differs in several respects from the mortgage. The land contract is

financed by the seller of the land, while the mortgage is usually financed by a third party as shown in Table I-1. The down payment for a mortgage is usually greater than that for the land contract according to the data in Table I-1, especially when mortgages held by sellers, the Farmers Home Administration, and "others" are not considered. The down payment with a contract usually is less than thirty percent of the purchase price which is motivated in part by the impact of Federal tax regulations on the seller and in part by the limited down payment ability of the buyer.

Table I-1. Financing of land transfers in the United States in 1973[a]

Lender	Percentage of land transfers financed	Debt-to-Price ratio
Land Contract by Seller	27.6	73.8
Mortgage by Seller	13.3	74.4
Mortgage by Other Individual	3.0	66.4
Mortgage by Commercial Bank	10.1	67.4
Mortgage by Insurance Company	9.8	64.3
Mortgage by Federal Bank	28.4	72.3
Mortgage by Farmers Home Administration	3.9	87.0
Mortgage by Others	3.9	80.3

[a]Source: (49, p. 6).

The greatest difference between the mortgage and the land contract arises from a legal concept. Associated with land ownership are two elements:

beneficial interest and security interest. The beneficial interest in land entitles the buyer to the income produced by the land and the right to proceed towards full ownership (25, p. 11). The security interest gives the seller or financing party a reasonable assurance the the principal to be amortized, as well as the interest on the principal, will be paid (25, p. 11). With a mortgage, the legal title is passed to the buyer and the security interest of the seller or other lender is guaranteed by a mortgagee's "lien" on the land (3, p. 88). The land contract leaves the legal title with the seller to guarantee his security interest, but protects the beneficial interest of the buyer by a contract requiring the seller to convey the legal title to the buyer when the terms as stated in the contract have been fulfilled (25, p. 13).

Enforcement of the financing party's rights varies greatly between the two instruments. Under Iowa law, the buyer's interest in land bought by land contract is forfeited thirty days after the seller serves notice that the terms of the contract have been broken (25, p. 51). Unless the buyer fulfills the defaulted contract terms within those thirty days after the seller's notification, he loses his entire interest in the land (25, p. 51). Iowa law regarding defaulted mortgage payments, including principal and interest, requires the lender to initiate a judicial proceeding called foreclosure by judicial sale in order to get the payments due to him under the terms of the mortgage (25, p. 46). If the court finds that the mortgage provisions have been defaulted upon by the buyer, it directs that the land be sold to pay the unpaid principal, and the costs of the

foreclosure proceeding (25, p. 46). Once this has been done, the mortgage buyer is allowed one year by Iowa law in which to pay the amount found due by the court (25, p. 47). If after this period, the mortgage buyer has not made payment to the lender, the land is sold by judicial sale and both parties no longer have any rights in the land unless one party purchases the land at the sale (25, p. 47). If the proceeds from the sale of the land by judicial sale exceed the amount due to the lender, the residual is granted to the mortgage buyer (25, p. 47). The results of the differing enforcement procedures are that: 1) the seller may proceed more quickly and cheaply in the case of a defaulted land contract than a lender can in the case of a defaulted mortgage, and (2) the buyer loses all his interest in the land when he forfeits a land contract, no matter how much principal has been amortized. However, under a mortgage the buyer is entitled to the residual remaining after the seller's claims against the land have been satisfied.

The land contract may contain clauses pertaining to the rights and obligations of the buyer and seller while the contract is in force which would not be found in a mortgage. Such clauses are included at the option of the buyer and seller in order to further define or protect their respective interests in the land. The seller's security interest may be further protected by requiring the buyer to insure the buildings on the land, forbidding the buyer from altering, removing, or selling existing buildings, and giving the seller the right to inspect the property or participate in its management (9, pp. 56, 68, 62). These provisions protecting the

seller's security interest under a land contract may substitute for the protection provided by the buyer's higher equity in the land under a mortgage. Provisions in the contract that lengthen the statutory period of grace during which the buyer may correct defaulted contract terms after receipt of the seller's notice or allow the contract to be replaced by a mortgage after a specified portion of the principal has been paid give added protection to the buyer's beneficial interest (9, pp. 71-76, 85-89). Such provisions may effectively substitute for the increased protection provided to the buyer on a mortgage by the foreclosure regulations.

Use of Land Contracts in Iowa

Although the land contract was used for farm land transfers in Iowa since its settlement, it wasn't until after World War II that its use began to expand. Table I-2 shows the rapid growth of land contract use since that time. In the late 1940's, land contracts were used in seven percent of the farm land transfers that were financed. Use grew rapidly during the 1950's reaching forty-two percent of financed land transfers in 1960. The data for the 1960's show contract usage gradually increasing reaching a high of 65 percent in 1971.

Possible Explanations for Increasing Use of Land Contracts

Various reasons have been cited for the increasing popularity of land contracts. A survey of Iowa land contract buyers in 1956 found that the

reason for using the land contract was lack of cash for a higher down payment in forty percent of the cases, the seller wanting the tax advantages of sale by land contract in twenty-one percent of the cases, and a combination of the two preceding factors in six percent of the cases (9, p. 15). Constantly rising farm land prices since that time would suggest that these two reasons have continued in importance.

Increasing farm land prices with the same fixed percentage down payment would make the actual down payment parallel the change in land prices. Also contributing to the increase in size of down payment is the trend towards larger farm units in terms of acreage. Substitution of capital for labor and intensified use of non-farm produced inputs would contribute to increased use of land contracts by reducing the amount of cash that a buyer could commit to land resources.

The continual rise in farm land prices also implies that sellers realize increased capital gains associated with selling their farm land. Federal tax law allows sellers to pay taxes only on that proportion of the capital gain received in a given year if no more than thirty percent of the purchase price is received in any given year (50, pp. 45-46). Tax regulations require that the entire capital gain is subject to taxes if more than thirty percent of the purchase price is received in a year (50, pp. 45-46). This suggests that with increased capital gains, the potential tax savings associated with land contract sales have also increased. Working against increased seller use might be the increased overall rate of price inflation in recent years. The land contract converts an asset that

Table I-2. Use of land contracts in Iowa, 1946-1973

Year(s)	Percentage of financed farm land transfers by contract[a]	Percentage of all farm land transfers by contract[b]
1946-1949	7	--
1950-1954	11	--
1955-1959	21	--
1960	42	--
1961[c]		
1962	--	39
1963	--	36
1964	--	38
1965	--	42
1966	--	44
1967	--	52
1968	--	47
1969	--	48
1970	--	60
1971	--	65
1972	--	56
1973	--	58

[a]For the period 1946 to 1960 inclusive: (6, p. 31).

[b]For the period 1962 to 1973, inclusive: (19).

[c]Data not available.

has a favorable growth in value over the past decade (11) into a fixed annuity whose purchasing power declines over time if combined with price inflation (14).

Questions Raised by Increased Use of Land Contracts

The nature of the land contract may well increase the amount of risk faced by both the buyer and the seller. The buyer typically has less time to meet the requirements of the contract before the seller can take action which would erase all of his equity in the land if he is unable to meet the contract terms. This increased risk, as well as other aspects of the contract, have far-reaching economic consequences for the buyer, especially the low-equity buyer. The land contract imposes an annual fixed cost which must be met in order to retain the right to use the land. It may affect acquisition of variable inputs investment in intermediate term assets such as machinery and buildings. It may also affect the availability of credit, and thus have an additional impact on investment decisions. In turn, the type and level of investment, as well as the risk involved, may affect enterprise selection. This may determine annual income from which the fixed cost of land ownership as well as other financial obligations must be paid.

These interrelationships raise serious questions in light of rapidly increasing land prices, changes in the size of farm operating units, changes in resource use, increasing farm costs, and high commodity prices in 1972, 1973, and 1974. Are traditional land contract terms still adequate to assure that the buyer can successfully complete the terms of the land

contract without undue hardship? What amount of equity is necessary to insure ownership success of the buyer? Can the land contract still serve the needs of low-equity farmers? Most importantly, the importance of land contract usage suggests that an examination of alternative contract terms be made to find those combinations of terms which can increase the buyer's chances of successfully completing the terms of the contract. Answers to these questions contribute to answering the larger question of what the future ownership structure of Iowa agriculture will be.

While the discussion has focused on the buyer's side of the problem, the questions raised have important implications to sellers. A buyer who defaults necessarily involves a seller, and in many cases the seller is depending on the contract payments as a major source of retirement income.

Objectives of the Study

In proceeding with this study, the following objectives will be pursued:

1. The use of land contracts will be examined on an ex ante basis to discover success and failure elements as experienced by low-equity land buyers.

2. A farm firm growth model will be developed in order to conduct the analysis.

3. Suggestions will be made to improve the use of land contracts by low-equity farmers.

4. Suggestions will be made for further research into the use of land contracts by low-equity farmers.

Organization of the Report

This report will proceed in the following manner. In Chapter II, the problem is discussed in more detail. The method of analysis is described in Chapter III. Chapter IV describes the dynamic linear programming model that will be used in this study. The model is applied to a farm synthesizing a typical farm in north-central Iowa that might be bought on contract by a low-equity farmer. The assumptions made concerning the model, its structure, and the parameters within it are specified. The production organization of the firm that is obtained by solving the model under different sets of conditions is discussed in Chapter V. Chapter VI analyzes the impact of different beginning equity levels on the representative farm firm. The effects of different sets of the contract terms is discussed in Chapter VII. Chapter VIII compares the firm's ability to meet its financial obligations under two different sets of prices. The concluding chapter reviews and summarizes the study in terms of the objectives that were previously stated.

CHAPTER II. FORMULATION OF PROBLEMS INHERENT IN LAND CONTRACT USE

Goals of Land Installment Contract Buyers

The land contract may be a means to achieve several goals of land contract buyers. Ownership of land as opposed to tenancy eliminates several sources of uncertainty for the firm. Because of the speed with which many contracts can be forfeited, these sources of uncertainty are not reduced as much as when the land is mortgaged or owned outright. Since land is the major input in crop production, ownership guarantees the continuity of the firm and future employment of the firm's other resources. A 1956 study of land contract buyers found that: "In many cases the impression was strong that the buyer was forced into purchasing a farm by economic necessity. The tenant farmer who could not renew his lease or obtain another tenancy either bought a farm or quit farming" (9, p. 11).

Ownership of land also reduces uncertainty of expectations which typically arises in leasing situations. Because of short term leases and uncertainty with respect to the landlord's retirement or death, the planning horizon faced by the firm is less than the payback period for most profitable investments. Investments such as drainage systems, buildings, and other livestock facilities require payoff periods of several years. Such investments may be very profitable for a farmer who owns his land, but not for the tenant who has insecure occupancy on the land.

Land ownership also reduces operating leverage, the amount of fixed costs that the firm must pay each year, from what it would be in a rental

situation, especially a cash rental situation. The contract terms will determine the magnitude of the fixed costs and whether they change during the life of the contract. The level of fixed financial charges is increased while the contract is in effect. If the contract has decreasing annual payments, at some point financial risk will be reduced below what it would be if land were rented. Land ownership via the contract does not reduce financial risk initially because it increases financial leverage. Thus the benefit of reduced financial risk is not realized until some future time.

Another benefit of land ownership is that it augments the amount of credit available to the firm. Baker argues, "Using modifications already suggested in optimizing criteria in production organization, it is not difficult to demonstrate that a farmer dependent on credit, either directly (by borrowing) or indirectly (for a source of liquidity) may be well advised to use some of his scarce resources to finance the purchase of land instead of leasing land" (1, p. 1568). However, he then goes on to point out that, "Preliminary research at the University of Illinois suggests that equity acquired with a land purchase contract generates little or no credit that can be used for non-real estate borrowing" (1, p. 1568). As in the last case, this benefit accrues in the future when the contract is paid off or converted to a mortgage.

Aside from these advantages for the firm, land ownership may also provide more direct benefits to the owner. First, it provides an attractive asset in which to invest his savings. It is an asset over which he

will have control and with which he is familiar. Furthermore, as pointed out in Chapter I, land has had a favorable record of earnings and growth in value during the past decade. Land ownership may also provide psychic benefits such as a sense of goal accomplishment or status in the community.

All of these benefits may be goals which the contract buyer hopes to achieve. Some of these goals, those relating to the firm, are means to achieving higher goals. The relative importance of each will differ in each individual case. The combination of these goals may motivate an individual to buy land on contract.

Economic Trends Relevant to the Performance of Land Contracts

Four economic trends have important implications for the future use of land contracts in Iowa. These trends relate to farm land prices, size of operating units, changes in relative resource use, and farm costs. The trends will be discussed in this section. Later in this chapter, their implications for the future use of land contracts in Iowa will be discussed in the section entitled "The Future for Land Contracts."

Land prices

The value of Iowa farm land as reflected by its market price has risen consistently during the past decade, and dramatically in the past few years. Table II-1 shows this trend for the state average. The row entitled "Land Value Per Acre" in Table II-2 shows this trend in central Iowa. In some areas of the state, average farm land values now exceed $1,000 per acre.

Table II-1. Average Iowa farm land prices, 1960-1974

Year	Value Per Acre
	(dollars)
1960[a]	237
1961	237
1962	241
1963	250
1964[b]	265
1965	293
1966	331
1967	362
1968	375
1969	382
1970	385
1971	395
1972	440
1973	579
1974[c]	756

[a]For the period 1960 through 1963 inclusive: (24, pp. 3-4).

[b]For the period 1964 through 1973 inclusive: (33).

[c]For 1974: (23, p. 22).

There are a number of explanatory variables for the changes in farm land values, and their relative importance varies from year to year. An annual survey of Iowa real estate brokers has recorded these variables and their relative importance (27, pp. 3-4; 8, pp. 3-4; 24, pp. 3-4; 10, pp. 3-4; 26, pp. 7-8; 7, pp. 3-4; 28, pp. 3-6; 29, pp. 3-6; 30, pp. 7-9; 31; 32; 33; 23, p. 22). For the years shown in Table II-1, the most important variables contributing to price increases were the pressure for farm enlargement, increased use of land contracts, and scarcity of listings. Important factors that worked against land price increases were the cost-price squeeze of the late 1960's which caused net incomes to decline, increasing property taxes, and shortages of funds with which to make the necessary down payment. Favorable crop harvests, high commodity prices, and easy credit conditions in certain years contributed to land price increases while the reversal of these factors in other years worked against price increases.

Size of operating units

In terms of acreage, the average size of Iowa farms has been increasing. Table II-3 shows this for the entire state, while the row entitled "Acres Per Farm" in Table II-2 shows this for central Iowa in several years. In terms of the amount of labor used on farms, there has been a decline as shown in the "Labor" row in Table II-2. However, since 1970 this decline has halted and labor use has increased slightly.

The size of farms in Iowa has also increased in terms of the dollar value of assets for the average farm. Part of this increase is due to

Table II-2. Changes in farm business structure in Central Iowa, 1950-1973

	Years[a]		
	1950	1960	1964
Acres Per Farm	260	224	261
Labor (months)	22	15	15.7
Livestock & Feed	$16,854	$17,281	$25,441
Machinery & Equipment	$ 7,090	$ 6,658	$ 9,468
Land & Buildings	$37,573	$74,600	$92,601
Total Assets	$61,517	$98,539	$127,510
Land Value Per Acre	$ 144	$ 333	$ 355
Operating Expenses	$ 5,500	$ 5,134	$ 7,730
Fixed Expenses	$ 1,513	$ 4,171	$ 6,311
Total Expenses	$ 7,013	$ 9,305	$14,041
Op. Expenses divided by Total Expenses	.78	.55	.55
Fixed Expenses divided by Total Expenses	.22	.45	.45
Net Farm Income	$13,653	$ 9,489	$12,321
Management Return	$ 8,700	$ 3,142	$ 4,515
Net Farm Income Per Acre	$ 52	$ 42	$ 47
Crop Acres Per Man	116	172	199
Power & Equipment Cost Per Acre	$16.71	$20.00	$23.71
Gross Profit Per Acre	$ 86	$ 84	$ 99
Gross Profit Per Man	$12,211	$14,915	$19,689
Gross Profits Per $100 Invested	$ 46	$ 19	$ 20

[a]Sources: 1950--(40); 1960--(41); 1964--(42); 1970 and 1973--(43).

1970	1973	1950 as % of 1973	1960 as % of 1973	1970 as % of 1973
281	312	83	71	90
13.5	15	147	100	90
$36,041	$65,225	26	27	55
$13,394	$17,062	41	39	78
$142,100	$218,788	17	34	65
$191,531	$301,075	20	33	64
$ 506	$ 701	21	47	72
$12,729	$19,551	28	26	65
$10,904	$14,708	10	28	74
$$23,633	$34,259	20	27	69
.53	.57	136	96	92
.47	.43	51	104	109
$61,228	$61,228	22	15	20
$-2,795	$34,458	25	9	7
$ 45	$ 196	27	21	23
249	235	49	73	106
$32.06	$46.93	36	43	68
$ 130	$ 245	35	34	53
$32,359	$76,390	16	20	42
$ 19	$ 32	143	59	59

Table II-3. Number and average size of farms in Iowa, 1957-1974[a]

Year	Number of Farms	Average Size
		(acres)
1957	191,000	182
1958	189,000	184
1959	187,000	186
1960	183,000	190
1961	178,000	195
1962	172,000	202
1963	167,000	207
1964	162,000	214
1965	158,000	219
1966	155,000	223
1967	152,000	227
1968	149,000	231
1969	147,000	234
1970	145,000	237
1971	143,000	241
1972	141,000	243
1973	139,000	247
1974	137,000	250

[a](16).

increases in the physical stock and part of it is due to price inflation of the assets. Table II-2 shows the changes for livestock and feed, machinery and equipment, land and buildings, and total assets for an average farm in central Iowa in the years 1950, 1960, 1964, 1970, and 1973. The values consistently increased with the exception of the value of machinery and equipment between 1950 and 1960. Much of the increase of value in each category occurred between 1970 and 1973. This is not surprising since land values increased rapidly in those years, farm commodity prices rose sharply in 1972 and 1973, and general price inflation for non-farm produced inputs was significant in those years.

Relative changes in resource use

Changes in relative resource use and productivity between 1950 and 1973 for central Iowa farms are also shown in Table II-2. The changes in magnitudes of resource use during this period have already been discussed. Crop acres per man more than doubled in this period. Power and equipment costs per acre nearly doubled in this period. While less than half the labor that was used in 1950 was used on an acre in 1970, almost double the capital in the form of machinery and equipment costs was used.

The combination of increased use of capital and land and decreased use of labor was caused by and affected several aspects of the average business as can be seen in Table II-2. Net farm income per acre declined, but the increase in the land base partially offset the impact of this on net farm income. In terms of changes in productivity of resources during this period, gross profits per acre increased, gross profits per man rapidly

decreased between 1950 and 1960 and then leveled off. The substitution of capital for labor on an increasing land base increased land and labor productivity and initially decreased capital productivity.

For Iowa and the other Corn Belt states, indexes of productivity increased during the 1950's, 1960's and into the 1970's. Farm production per hour increased the most during this period (47, p. 28). Crop production per acre also made significant increases during this period (47, p. 11). Output per unit of input rose consistently until 1965 after which it fluctuated up and down from year to year. It was above the 1967 level only in 1971 and 1972 (47, p. 31). Technological change combined with changes in resource use caused these measures of productivity to increase.

Farm costs

Operating and fixed expenses increased for farms in central Iowa from 1950 to 1973 as shown by Table II-2. Furthermore, between 1950 and 1960 the relative magnitude of the two categories changed. Fixed expenses increased from 22 percent to 45 percent of total expenses and remained near this level through the 1960's and early 1970's. The implication of this is that operating leverage increased, and with it financial risk for some farmers.

Between 1960 and 1971, the quantity of farm produced inputs used increased approximately 30 percent, the price paid for them rose 20 percent, and the total expenditures rose 60 percent. During the same years, the quantity of non-farm produced inputs used increased about 4 percent, the price paid for them rose 45 percent, and total expenditures rose 50 percent

(48, p. 8). The rate of price increase for physical inputs during the 1960's was modest compared to the changes in 1972 and 1973. The "Prices Paid by Farmers" index with 1910-1914 as the base of 100 increased from 410 in 1971, to 432 in 1972, and to 496 in 1973 (46, p. 8).

Prices received by Iowa farmers during this same period did not follow the same pattern of change. Instead, commodity prices fluctuated, but showed no sharp trend during the 1960's. Starting in 1970, there was an upward trend culminating in sharp increases in 1973 (46, pp. 6-7).

The result of the price and cost trends was that during most of the 1960's Iowa farmers were caught in a price-cost squeeze. Increases in productivity partially offset the results of it. Table II-2 shows that net income did not increase significantly during this period. Return to management was negative in 1970. The 1973 values for both of these were many times larger than the 1970 values due to the high commodity prices received in that year.

Impact of Land Contract Terms on the Farm Business

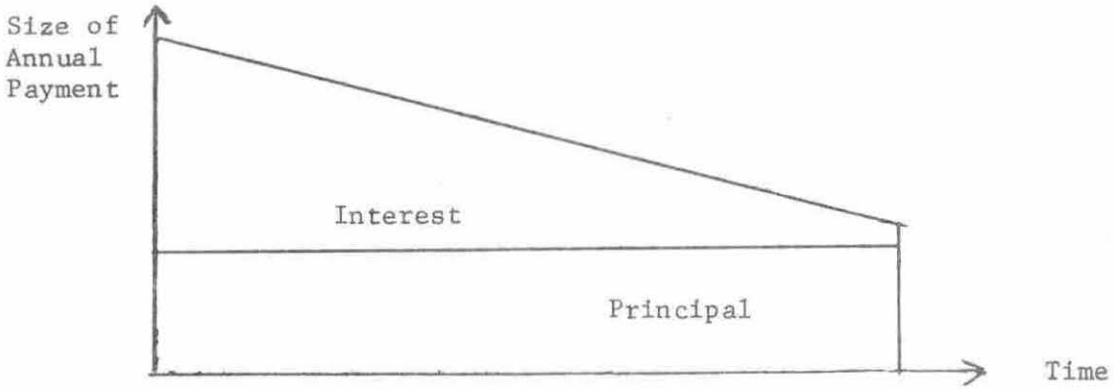
The proportion of the purchase price paid down, the length of the amortization period, and the plan of amortization will affect the buyer's business in a number of ways. The size of the annual payment is a function of all three as is the total amount of interest paid. The amount of capital available to the firm in the first year depends upon the size of the down payment, and the amount available in subsequent years depends upon the size of the annual payments. The down payment and annual payments

affect the level of credit availability. Finally, the amount of interest paid affects future income tax liabilities since interest is deductible from income subject to taxes.

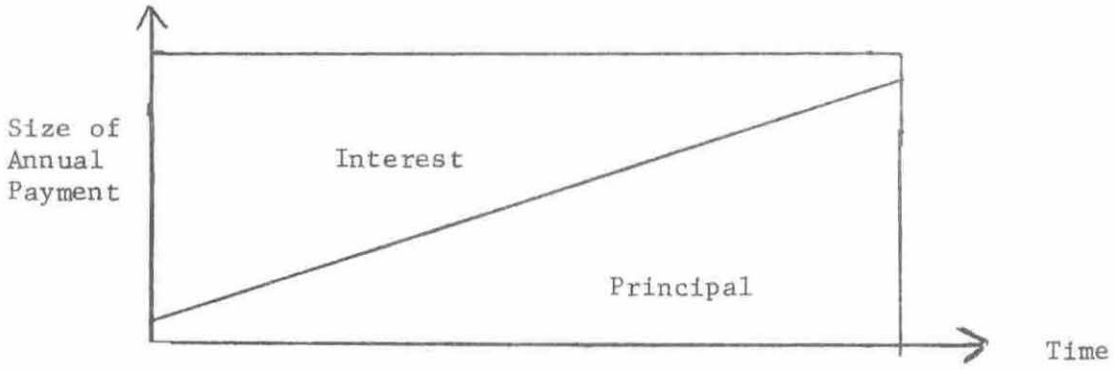
As the proportion of the purchase price paid down decreases, the size of the annual payments and the amount of interest paid increase. This creates a tradeoff for the buyer between the size of down payment and annual payments. Involved in this tradeoff are rising interest costs as the size of the down payment decreases. The buyer may also reduce his potential loss from default in the first few years by decreasing the down payment, while possibly increasing his chance of default because of higher annual payments. The following example shows the impact of changing the size of the down payment. The buyer pays $1,000 with terms of 7 percent interest, 20 years of amortization, and amortization on the Standard Plan. With a 15 percent down payment the annual payments would be $80. Annual payments would be $75 if he paid 20 percent down.

Increasing the length of the amortization period decreases the size of the annual payments and increases the total amount of interest paid. By doing this the buyer lessens his potential loss from default in every year, and probably decreases his chance of default. He also pays more interest. This relationship can be illustrated with the example of the previous paragraph by holding the down payment constant at 15 percent. With amortization for twenty years, the annual payment is $80. It is decreased to $73 if the amortization lasts for twenty-five years.

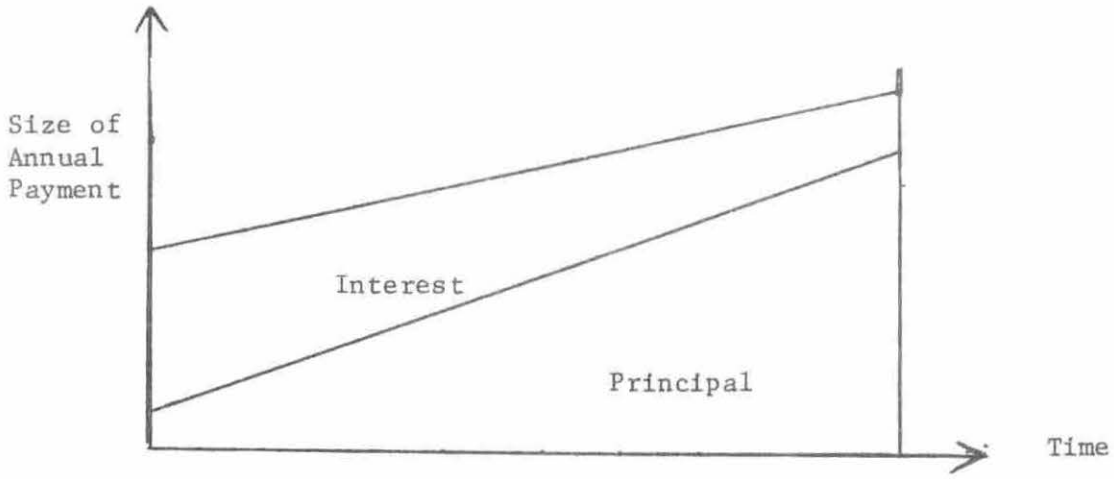
Many plans exist for amortizing the principal. Three are shown in Figure II-1. The Springfield Plan which is the most widely used in Iowa



Springfield Plan



Standard Plan



Increasing Payment Plan

Figure II-1. Amortization Plans.

consists of equal annual principal payments with annual interest on the unpaid balance. The total annual payment declines with time. The total interest paid on this plan is less than for the other two plans. The Standard Plan has equal annual payments consisting of interest and principal. Interest is the largest component of the payment in the first years, but it declines as the principal payments decrease the unpaid balance, and thus the principal payments increase in each year. The total interest paid is less than that paid for an Increasing Payment Plan. The Increasing Payment Plan is similar to the Standard Plan except that the annual payment increases with time. The interest component declines more slowly, and the principal payments increase at a faster rate than with the Standard Plan. Using the previous example with a twenty year term and a 15 percent down payment, the annual payment in the first year would be $102 on the Springfield Plan, $80 on the Standard Plan and $68 on an Increasing Payment Plan where payments of principal increase by 40 percent of the first year's principal payment in each year.

The combination of land contract terms also affect the amount of credit available to the buyer from other sources. First, the equity a buyer has in land bought on contract is not desirable collateral since the equity can be forfeited easily and quickly to the seller if the buyer defaults on the terms. Second, the annual payments required by the contract constitute a prior claim on the repayment capacity of the firm. The higher the payments, the less repayment capacity that is left for repayment of loans for other assets, especially loans for assets that are not

self-liquidating. A study done at the University of Illinois in 1968 investigated the reaction of non-real estate lenders to a simulated loan request from a low-equity land contract buyer (36, pp. 1-6). All factors except the contract terms were kept constant. In general, the lenders reacted most favorably to a situation where the applicant had paid 29 percent down with amortization on the Standard Plan for twenty years. The second most favorable situation was with a 29 percent down payment, amortization on the Springfield Plan for 10 years, and a balloon payment of 50 percent of the principal. Next favorable was a situation with a 20 percent down payment and repayment in twenty years on the Springfield Plan. The least desirable situation was with a 29 percent down payment to be paid in 10 years on the Springfield Plan. These preferences seem to indicate that lenders are most affected by the size of the annual payments.

The interest paid on the contract is deducted from the income subject to income taxes. The principal paid is not deducted. If the firm is earning income subject to taxes the impact is to reduce the cost of interest on the contract and to increase the amount of before-tax earnings needed to pay the principal.

The impact of these tax issues is that the package of contract terms will affect the income tax liability in each of the years and that the tax liability will affect the amount of before-tax profits that must be generated in order to pay the interest and principal on the land contract.

Performance of Land Contracts, 1951-1969

During the past twenty years, the performance of land contracts, in terms of facilitating the transfer of farm land from sellers to buyers, appears to have been satisfactory. Their use has greatly increased during this time, and there is no evidence of widespread forfeitures. A sample of 154 Iowa land contracts that were entered into between 1951 and 1956 was analyzed twice, in 1962 and 1969. The 1962 study found that of this group, 51.9 percent were still paying on the contract, 22.1 percent had refinanced the contract, 9.7 percent had paid the contract in full, 14.3 percent had sold their interest in the contract, and 1.9 percent could not be found (34, p. 29). There were no forfeitures, although it is possible that the buyers who could not be located might have forfeited. Of those who sold, 36.4 percent, or 5.2 percent of the total sample were forced to sell because of poor management, too many expenses, or losses in other businesses (34, p. 31). By 1969, 20.8 percent of the sample had paid the contract in full, 30.5 had refinanced, 14.9 percent were still paying, and 33.8 percent had sold their interest in the contract or the farm, or could not be found.[1] The 1962 study could find no differences in the contract terms among those forced to sell, those who sold, and the whole sample to explain being forced to sell (34, p. 32).

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[1]D. Panagides, Economics Dept., Iowa State University. Unpublished data, 1969.

Table II-4 shows some indicators of the financial progress of the contract buyers in the sample. The average assets per farm increased between the different surveys, nearly tripling by 1969. Much of this increase cam from the rise in land values. Liabilities decreased between the year of purchase and 1962, but increased from 1962 to 1969. Net worth doubled from the year of purchase to 1962, and then doubled again from 1962 to 1969. The ratio of net worth to total assets increased from .44 in the year of purchase to .72 in 1962 and .74 in 1969. The lack of great change in this ratio between 1962 and 1969 does not by itself signify a lack of financial improvement. The significance of land value appreciation suggests that in 1962 terms, the ratio may have declined by 1969. If this is so, it implies that either farmers found it more desirable to use debt financing or that the farmer's financial situation deteriorated. The ratio of current assets to current liabilities increased between the year of purchase and 1962 indicating an improvement of the farmers' liquidity position. The increase of the ratio of fixed assets to fixed liabilities from the year of purchase to 1962 indicates that the difference between the value of these assets and the liabilities secured by them increased. The excess of current assets over current liabilities which is called working capital also increased from the start of the contract until 1962. The change in net worth from the start of the contract until 1962 was 140 percent. If the change in net worth is adjusted for land value appreciation and the gain realized by buyers who bought the land for less than its market value from a relative, the change is only 14.9 percent.

Table II-4. Average financial progress of 1956 land contract sample

	Year Farm Purchased[a]	1962[a]	1969[b]
Assets	$49,440	$73,002	$145,449
Liabilities	$27,660	$20,605	$ 36,892
Net Worth	$21,780	$52,397	$108,555
Working Capital	$ 6,382	$10,766	N.A.[c]
Net Worth Divided by Total Assets	.44	.72	.74
Current Assets Divided by Current Liabilities	3.11	3.34	N.A.[c]
Fixed Assets Divided by Fixed Liabilities	1.63	3.60	N.A.[c]
Change in Net Worth, Year of Purchase to 1962	--	1.40	--
Change in Adjusted New Worth, Year of Purchase to 1962[d]	--	.15	--

[a](34, pp. 34, 36, 44, 45, 47).

[b]D. Panagides, Economics Dept., Iowa State University. Unpublished data, 1969.

[c]Not available.

[d]Adjusted by deflating 1962 value of land and buildings and deducting gain that arose through lower purchase price due to buyer and seller being related.

This information indicates that, on the average, this group of contract buyers were fairly successful. Much of their financial progress was due to the increased value of their land. The data does show an improvement in the current ratio and an increase in adjusted net worth from the time of purchase until 1962. These two changes were not influenced by land value appreciation.

The 1956 sample was also asked to assess their contract terms, as well as whether the contract affected the availability of credit to them and whether they used off-farm employment income in their business. These results are shown in Table II-5 and show that most of those interviewed were content with their contract terms and desired no changes in them. Only 5 percent had credit problems they attributed to the contract and 11 percent used off-farm income in their business. Unfortunately, these responses represent the experience of 102 contract buyers who were still on the farm in 1969 that they had purchased in the early 1950's. The 52 buyers who were not interviewed would probably answer these questions with a greater percentage of affirmative answers.

The Future for Land Contracts

The trends discussed earlier in this chapter raise questions concerning the future use of land contracts as a method of financing farm land purchases for low-equity farmers. The situation facing contract buyers today is quite different than that facing the contract buyer in the 1950's or 1960's. While the use of land contracts may

Table II-5. Assessment of contract terms by 1956 land contract sample[a]

Question	Percent Yes	Percent No
Would you have preferred the size of the payments to increase over the term of the contract?	6	94
Would you have preferred to have no payments on the principal for the first two or three years after you bought the farm?	17	83
If you could rewrite your contract would you change the size of down payment?	9	91
If you could rewrite your contract would you change the amount of the annual payment?	13	87
Did you limit your operating capital by making too large a down payment?	12	88
Have you ever felt handicapped in obtaining credit, or in financing machinery by chattel mortgage, because you bought your farm under contract?	5	95
Did you work off the farm in order to obtain operating capital or contract payments?	11	89

[a]Source: D. Panagides, Economic Dept., Iowa State Univeristy. Unpublished data, 1969.

continued, it may be limited to established farm firms that are expanding. The average contract buyer in the 1956 sample paid $5,861 down (9, p. 23). If he bought the same farm in 1974 with the same percentage down, the down payment would be approximately $31,000. In many areas of the state it would be much larger.

Increased land prices not only increase the size of the down payment at a given percentage, but they also increase the amount to be amortized. The Murray studies have found that the high commodity prices of 1972 and 1973 have been capitalized into farm land values. Farmers who buy their first land on contract typically depend on the land to provide sufficient net income to meet most of the annual payment. If commodity prices were to return to a level that is closer to their historical trend, the low equity farmer would be hardpressed to generate the income needed for the annual payment.

Increased farm size in terms of land and capital also has an impact on today's low-equity contract buyer. First, he must control more land than his counterpart in the 1950's did. If he does not, he may underutilize his own labor and have problems generating enough income. The need for a larger farm implies that he must either have a secure source of land he can rent or he must buy a larger farm. Renting requires less capital investment, but more insecurity of tenure. Buying requires a larger down payment and larger fixed annual obligations.

Larger farm size in terms of capital implies that the buyer must be able to control the nonland resources necessary to combine with the land and his own labor and management in the production process. Control of

nonland resources requires that the farmer either own them himself, be able to borrow the money needed to buy them, or be able to hire or rent their services. Nonland assets depreciate and lose liquidity in terms of sale value after being placed in use by a farm firm. Because of this, the people or institutions advancing credit require collarteral and repayment capacity before they make loans for such assets. Larger down payments on the land contract divert more of the buyer's liquid capital from use in buying nonland assets. Since the land contract does not initially generate additional collateral in most cases, this implies that the farmer will have less collateral than he would have otherwise. The higher annual contract payments will also reduce repayment capacity. The farmer's ability to control nonland resources is being constrained under these circumstances, while his need to control such assets is increasing.

Related to the need for control of more nonland resources is the shift to capital-using, labor saving technologies. This shift increases the need to control nonlabor resources if the farmer's own labor is to be efficiently used. The use of less of the farm operator's labor and of more resources which must be bought also may add to the financial risk he faces since in many cases he finances the acquisition of nonlabor resources with credit.

Increasing farm costs also affect the future for contract buyers. If they continue to increase, net income will fall unless prices received increase or resource productivity increases. Commodity prices of 1972 and 1973 which are above the historic trend may not stay at this level

in the future. Increasing productivity usually requires the adoption of capital-using technologies which may be unavailable to the low-equity contract buyer who has used most of the credit and repayment capacity available to his firm. In a cost-price squeeze such as occurred in the 1960's, the low-equity contract buyer would be at a disadvantage due to the high level of fixed financial obligations on his firm.

Throughout the preceding discussion, it has been implicitly assumed that contract terms were not changed. In another section the implications of changing contract provisions were examined. Within the restrictions imposed by the seller, the buyer may be able to improve his flexibility and chance of success by any number of contract provisions. In addition to the three provisions discussed earlier, balloon payments, payments tied to price or yield levels, variable interest rates, payment in commodities, provision for transfer to mortgage at a future date, extended period of grace, and others could be varied to suit his financial position. These possibilities may be expecially available for intra-family transfers by contract. Contracts that met the needs of buyers in the past may not necessarily do so for buyers at the present. Adherence to traditional contract terms may benefit neither the seller nor the buyer. On the other hand, changes in contract terms will have multiple implications for the buyer and his business.

The amount of resources controlled by the buyer when he enters into the contract will also have a great effect on whether or not he succeeds. The greater his initial equity, all other things equal, the greater will be his chance of success.

Delimitation of the Problem

The problem is whether or not the use of land contracts in Iowa can continue to successfully finance the acquisition of farm land by low-equity farmers in the future. Society sanctions the use of the land contract in order to balance the rights of the buyer and seller. Forfeiture of land contracts is not considered to be beneficial to society. This is partially evidenced by the fact that the courts have in several cases gone out of their way to uphold the idea that ". . . equity abhors a forfeiture (25, p. 48). The forfeiture of a contract usually involves a loss by the buyer, but if land prices were to ever decrease, it could create a monetary loss for the seller also. The failure of a firm involves wasted resources when the sales value of the assets is less than their combined value as a firm. The success or failure of low-equity contract buyers would also affect the future structure of agriculture in Iowa.

To work with this issue, it is necessary to focus the attention of this study on a smaller set of issues at a lower level for purposes of analysis. While the prior discussion has dealt with Iowa agriculture as if it were the same throughout the state and among farms, a meaningful analysis requires attention to the diversity of Iowa agriculture. This study will proveed to focus on one farm in a particular Iowa county. The options for a low-equity farmer would be large in terms of how many acres he bought initially and how he organized his business. This study will constrain these options by considering only one farm size and a

limited set of farm enterprises. It will also abstract from the many potential combinations of economic conditions and the random elements associated with these conditions. This study will also focus on the first five years of the farm business after the contract is entered into.

The large set of contract terms that could be studied will also be limited. The term and plan of amortization, as well as the proportion of the purchase price paid down will be varied in several combinations of terms.

By restricting the scope of this study, a meaningul analysis is permitted with the resources available. The objectives outlined in Chapter I can be pursued, and the hypotheses posed below can be tested.

Hypotheses to be Tested

The purpose of the subsequent analysis is to provide insight into the following hypotheses.

1. What will be the ability of land contract buyers to generate sufficient income to fulfill the terms of the contract, meet personal income needs, and pay other financial obligations with:
   a) farm product prices realized in 1973? or
   b) farm product prices based on an extrapolation of the previous years?
2. What is the critical beginning equity level in order to generate sufficient income to meet the buyer's annual needs and obligations?

3. How sensitive is the buyer's business to stress such a crop yield reduction or drastic price reduction in a given year?
4. For the same and different levels of beginning equity, what will be the effect on performance of the contract terms and growth of net worth when the following are varied:
   a) size of down payment? or
   b) amortization plan? or
   c) length of amortization?

By testing these hypotheses, success and failure elements in land contract use will be discovered. Once this is done, suggestions can be made for improvements in land contracts by emphasis on success elements and elimination of failure elements.

CHAPTER III. METHOD OF ANALYSIS

This chapter will develop the method of analysis by which land contract use by an individual farmer will be examined. The analysis consists of four general steps. First, a model of the farm business is constructed that embodies the crucial relationships involved in a firm's production of output and its financing of the resources used in production of the output. Next the model is used to predict the outcome in future periods given an initial set of resources, a set of production alternatives, future financial obligations, and a set of future prices. The data obtained can then be used to tell how successful the firm was in fulfilling its financial obligations under a particular set of circumstances. Finally, the outcomes generated by varying the initial circumstances can be compared to ascertain why one set of circumstances produced a different outcome than another, and which set of control variables gives the best outcome in a given set of environmental conditions.

Factors Involved in Specifying a Model for a Low-Equity Farm Firm

The impact of a land contract on a farm business will vary according to the relation of the contract to the business. If land bought on contract is being added to an established business that already controls or owns a substantial amount of assets and is capable of generating

large amounts of savings, the impact on the overall business and the decisions involved in it may be minimal. On the other hand, a low-equity buyer who owns no other land and is attempting to gain control of land via the land contract may find that his options and decisions are largely dictated by the land contract. It is to this latter case that the development of this model is directed.

Figure III-1 shows some of the interrelationships between the land contract and other decisions involved in the farm business. The first impact is that the land contract depletes the buyer's cash reserve when the down payment is made. The residual is available for investment in nonland assets or for meeting various business expenses. Some of this must also be set aside for consumption by the buyer. The buyer's available cash can be supplemented by the use of credit. Especially in the case of intermediate term borrowing, the level of residual cash, the legal nature of the land contract, and the fixed obligations imposed by the contract on the cash flows of future years will greatly affect the potential lenders' decisions. If the lender requires the buyer to have a fixed percentage equity in an asset in order to obtain credit for the remainder of its value, the amount of residual cash will fix the amount of intermediate term credit available. The legal nature of the land contract may make lenders extremely wary of advancing credit for constructing buildings or other improvements that become part of the real estate. The collateral value of the building is reduced since the borrower does not have a security interest in the land on which the

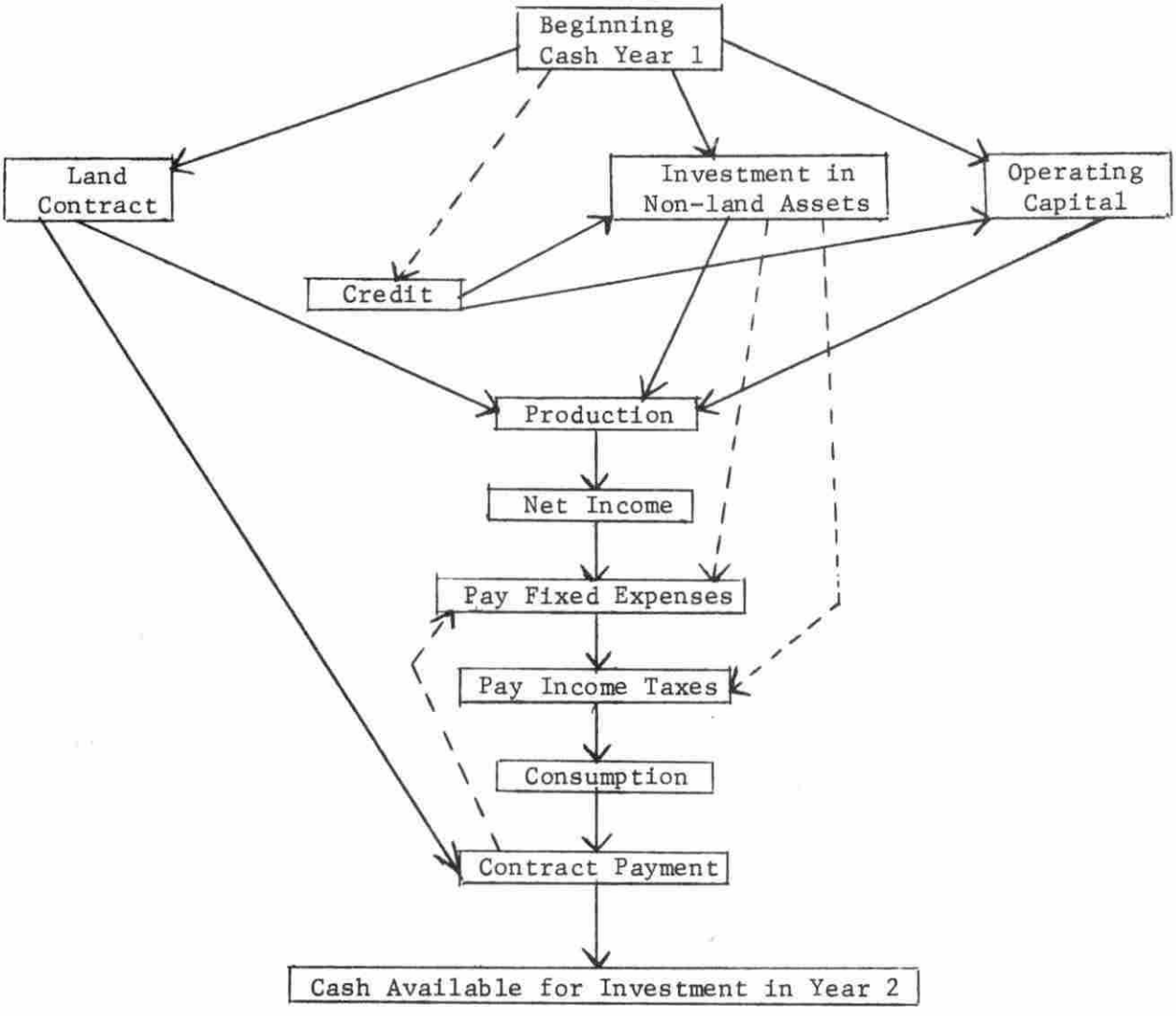

Figure III-1. Effect of a land contract on a farm business.

building is constructed. The lender would require a second mortgage on the building secured by an assignment of the contract. The assignment allows the lender to take over the contract in case the buyer defaults, but the lender must fulfill the defaulted provisions and in some cases pay the outstanding balance of the contract prior to the end of the thirty day period of grace. This arrangement may have serious disadvantages to many lenders and thus affect their lending policies to contract buyers. Finally, the contract imposes a claim on future cash flows of the firm and thus affects its capacity to meet additional claims imposed by intermediate term borrowing. Lenders' concern with the ratio of current assets to current liabilities and cash flow budgets is an indication of their reaction to this problem. This problem is especially important when the repayment period for the intermediate term asset is less than the time needed for it to generate sufficient cash flows to pay back for itself.

The combination of investments will influence the production decisions made by the buyer. The annual fixed obligations imposed by the contract, by intermediate-term borrowing, and by other fixed expenses as well as for consumption needs will require the production process to generate sufficient net revenues. Fixed expenses will be increased by investments made in productive assets. Income tax liability will be greatly affected by the land contract, by other borrowing, by investment in productive assets, and by the net income generated by production activities. The interest on both the contract and on the borrowing reduces

taxable income. The fixed expenses incurred by productive assets owned by the firm are also deductible. In addition, depreciation on these assets also reduces taxable income over the life of the assets. Certain of these assets also create an investment tax credit when they are bought which can be used to reduce the actual tax liability. The net income generated by the production activities determines whether an income tax liability will be created and what its magnitude will be.

Once the income tax liability has been satisfied, the requirements for consumption and the contract payment must be met. If the contract payment is not met, the contract would be forfeited and the buyer would no longer have an interest in the land. After meeting these two requirements, any cash remaining would be available for allocation in the following year. Obligations incurred by intermediate term borrowing in the previous year would carry over into future years. The services of productive assets that were bought in a previous year would also be available for future use depending on the length of its productive life. Inputs such as corn and gilts might also be carried forward for use in the next year's production.

The model to be developed will embody these important relationships. It will also represent the alternatives and restrictions faced by the firm in its particular setting.

Type of Analytical Model

A number of studies have analyzed the production and financial aspects of farm firms in a multi-period context by using the dynamic

linear programming technique (20). The appeal of this type of approach is that some measure of the farmer's goals is maximized subject to a set of constraints. Discounted net income, terminal net worth, and discounted consumption have been used as maximization criterion. Typically, the constraints limit resource use to that amount which is owned or acquired by the firm in each of the periods. They also limit resource acquisition to that which the firm can internally finance plus that which the firm can internally finance plus that which the firm can externally finance. External financing is also restrained by the amount of credit which the firm would be able to obtain based on its financial structure and the behavior of lenders. The restraint set also requires the payment of various financial obligations such as fixed costs, debt repayment, income taxes, and consumption. Activities can be specified for production, borrowing, resource acquisiton, investment, and satisfaction of financial obligations. The different periods are tied together in several ways. The criterion function may be affected by activities in each year as with discounted net income and discounted consumption, or in only the final period as with terminal net worth which is a function of the activities in the earlier periods. Outputs from one year can be transferred to the next year for use as inputs. Retained earnings can be reinvested in the firm in subsequent periods. Assets with useful lives longer than one period are available for use in the future. Debts incurred in one period produce liabilities which must be repaid in future periods.

The flexibility of this type of model, as well as the fact that it optimizes along lines suggested by economic theory gives it strong appeal for use in analyzing the problem at hand. Once a basic model is constructed, certain elements within it can be changed to obtain different solutions. These changes will allow comparisons of different sets of contract terms, different beginning equities, and different commodity price levels.

The major drawback of this type of approach is that it is difficult to incorporate the problems of risk and uncertainty, which are major influences on the behavior of farmers. Certain models have been developed which deal with these problems (20). The model to be developed here will also abstract from these elements. Prices and yields will be known with certainty within the model. Analysis of the model output can, however, give some indications as to the sensitivity of the firm to income fluctuations.

Variables in the Analysis

Prices

Two sets of commodity prices will be used in the analysis. These are shown in Table III-1. The first set of prices is the actual set of prices received for farm commodities in Iowa in 1973. The second set of prices, which is much lower, is based on a trend projection of past prices. The first set has already been partially capitalized into land

Table III-1. Commodity prices used in model

Commodity	Unit	Set 1[a]	Set 2[b]
Corn	bushel	$ 2.30	$ 1.58
Soybeans	bushel	$ 5.50	$ 4.17
Hogs	cwt.	$38.60	$28.41

[a](46, pp. 12, 18, 34).

[b](52).

prices. The second set, which is used by a governmental agency for planning purposes, is what future prices will be if they conform to the time trend. It can be hypothesized that in some cases land contract buyers would be successful with the first set of prices, but not with the second set.

The prices of nonfarm produced inputs are held constant at the 1973 level. Their behavior in the past has been more consistent than that of commodity prices. Since 1964 they have risen in every year, and prior to that their trend was upward (46, p. 9). The model does abstract from this upward trend, but the effect of this trend will be looked at in another way as explained later in this chapter.

Contract terms

Three contract terms will be varied in the analysis. These are down payment, amortization plan, and length of amortization. Table III-2

shows the twelve different sets of contract terms that will be analyzed. By varying the contract terms, this study can compare the effect of changing one of these terms and holding the others constant on the progress of the firm.

Table III-2. Contracts to be analyzed

Contract	Down Payment	Amortization Plan	Length of Amortization
	(percent)		(years)
1	20	Springfield	14
2	20	Standard	14
3	20	Increasing[a]	14
4	20	Springfield	20
5	20	Standard	20
6	20	Increasing	20
7	15	Springfield	20
8	15	Standard	20
9	15	Increasing	20
10	15	Springfield	25
11	15	Standard	25
12	15	Increasing	25

[a]Principal payments increase by 40 percent of the first year's payment in each year. For example, to amortize $1,000 for five years, principal payments are: Year 1-$111, Year 2-$155, Year 3-$199, Year 4-$244, and Year 5-$288.

Initial capital

The third variable is initial capital available for use in the first year for uses other than the contract down payment. As previously mentioned, the level of this variable will be crucial to the success of the firm. By varying its level with a given set of contract terms and output prices, the crucial level below which the firm cannot be successful can be ascertained. In addition, the improvement in the firm's financial position can be determined for each additional amount of capital.

Changing this variable can be done by setting the initial level, and having the computer reduce it by $10,000 after each solution. When the model is no longer feasible, no more solutions will be computed. The last solution will be at the critical beginning equity level. This will be so because any further reduction in the beginning equity level of the firm would violate one of the financial obligation restraints making a solution impossible.

Statistics Used for Analyzing Data

Once solutions are generated by applying the model, five statistics can be computed for use in comparing the different solutions. These are the ratio of current assets to current liabilities, the ratio of debt to equity, the coverage ratio, the rate of return on equity, and the rate of growth for net worth.

The ratio of current assets to current liabilities, the current ratio, gives a measure of the current liquidity of the firm. Current

assets include cash and assets that will become cash through the normal operation of the firm during the business year. Current liabilities are those which must be paid during the course of the year such as notes, accounts, taxes, and the annual contract payment. If this ratio is greater than one, then the firm has liquidity. The greater it is, the greater is the liquidity of the firm. Movement away from one would be an indicator of financial progress. The closer the ratio is to one, the greater would be the risk exposure of the firm due to income fluctuation.

The ratio of debt to equity gives an indication of the long run liquidity of the firm. This ratio was approximately .23 for United States agriculture in 1973 (45, p. 77). For low-equity land contract buyers it will be much higher initially. Declines in this ratio represent an improvement of the financial situation of the business, especially declines from high levels to more moderate levels.

A coverage ratio indicates the relation between the fixed financial obligations of a firm and its ability to service them from the income it generates in a year. The following cash-flow coverage ratio will be used:

$$\frac{CF}{I + FC + P + MC + T}$$

where:

CF = annual net cash flows after variable costs

I = annual interest payments for land contract and intermediate term borrowing

FC = fixed costs on assets

P = principal repayment for land contract and intermediate term borrowing

MC = minimum consumption

T = income tax liability

The higher this ratio is, the greater is the ability of the firm to service its fixed obligations out of its net cash flows. An increase of this ratio over time would be indicative of financial progress.

A rate of return on equity can also be computed. This is:

$$\frac{CF - (D + I + MC)}{NW}$$

where:

CF = annual net cash flows after variable costs

D = annual depreciation

I = annual interest payments for land contract and intermediate term borrowing

MC = minimum consumption

NW = net worth

This rate of return can be meaningfully compared only when some alternative rate of return that the firm might earn is specified. In this case, the rate of return will be compared only to the rate of return obtained under different sets of conditions.

A growth rate for net worth can also be computed with the output generated by the solution of the model. This statistic is computed as follows:

$$G = \frac{NW_t - NW_{t-1}}{NW_{t-1}}$$

where:

G = rate of growth

NW_{t-1} = net worth in the previous year

NW_t = net worth in the present year

A positive change in net worth indicates that the firm has increased the amount of assets it controls or has decreased its debt which would lower financial leverage. The firm would have to pay proportionately smaller fixed charges in the future. If the rate of return on assets remains the same, the firm will have higher future earnings. Positive changes arise from decreasing liabilities or increasing the amount of assets controlled faster than liabilities increase. Rapid changes can be considered a sign of financial progress for the low-equity contract buyer, while smaller growth rates would be indicative of less financial progress.

These five statistics will provide the basis for a comparative analysis of different sets of variables. In addition, the first three will provide an indication of the firm's ability to withstand income fluctuation under different conditions. Changes in each of the first five years after buying on contract will also be observed by using these statistics. For a given beginning net worth and commodity price set, the various contracts can be compared. For a given contract and commodity price set, the effect of increasing the buyer's beginning equity can be specified. Finally, for a given contract and beginning equity, the impact of higher commodity prices can be obtained.

CHAPTER IV. DESCRIPTION OF THE ANALYTICAL MODEL

An Overview of the Model

The model to be used will incorporate the issues discussed at the beginning of the previous chapter and the setting described later in this chapter into a dynamic linear programming model. The criterion function maximizes discounted net income for the length of the model. Activities are included for production, investment, obtaining inputs, short and intermediate term borrowing, transferring cash within the model, and paying fixed expenses and obligations. Restraints which specify the amount of certain resources available, impose restrictions on the level of certain activities, and require the payment of certain expenses and income taxes are also included.

The model includes the first five years of operation after possession of the land is obtained. These would be the crucial years for the firm with respect to organizing its production to provide enough income to meet fixed expenses and obligations. In addition, the firm might be able to expand the options available to it if the first five years were successful. The activities and restraints are broken down into five groups, each of which represents one year. The year is defined as lasting from December 1 to November 30.

The years are linked together in several ways. In the criterion function, the income and expenses are discounted by a factor of 1.07 in Year 2, $(1.07)^2$ in Year 3, and so on. The output of corn in one

year can be transferred to the next year for feeding hogs. Investment in machinery and livestock facilities in a given year provides capacity as well as fixed cost obligations in future years. Cash income not used for paying fixed obligations can be allocated among the various activities in the following year. Investment tax credits can also be transferred into future years until exhausted by income tax liabilities. Intermediate term borrowing creates financial obligations in subsequent years.

The Setting of the Firm

Although a statistical survey could have been used to obtain data, it was decided that this was too expensive in terms of the resources available to this study. Instead, a farm firm was synthesized along the physical and the institutional lines of the North Central region of Iowa. Since in certain instances parameters had to be obtained for a particular county, Boone County was used as the location of the synthesized farm. This is true of the average land contract terms found in Contract 1 in the previous chapter. However, the synthesized farm firm could have been located in other counties of the North Central region since their physical and institutional parameters would be very similar to those found in Boone County.

The typical soil in the area in which the synthesized farm is located is the Nicollet-Webster soil, and the crop activities in this model reflect this in their yields and their fertilizer requirements.

Most of the cropland in this area is used for growing corn and soybeans. The average farm size in 1973 for Boone County was 251 acres (15, p. 1). The 1970 Iowa Farm Census found that 67 percent of the farms in this county raised livestock. Grain fed cattle were marketed by 34 percent of all farms, and 33 percent of all farms were farrowing sows (14, pp. 7-10). Other livestock enterprises existed on a much smaller percentage of the farms.

Reynolds' 1962 study of land contracts found that the average size of the farms bought on contract was somewhat smaller than the average for all farms (34, pp. 7, 10). Low-equity buyers can initially gain control of a farm via the contract and then expand later. The size of the farm to be considered in this study is 229 acres, of which 189 acres can be used for row crops, 22 acres can be used for pasture, and 18 acres is used for the farmstead, roads, or wasteland. This size and breakdown is the same as for the average of the 0 to 239 acre group in Boone County that are summarized by the Iowa Farm Business Records. The pasture can be used for certain beef and hog technologies. Beef activities will not be included in the model due to the greater price uncertainty and capital requirements associated with them. Therefore, the pasture will be used for hog activities to be included in the model.

The farm is assumed to be bought on contract with possession taken by the buyer at the beginning of the first year in the model. All land contracts entered into between October 23, 1973, and October 24, 1974, were examined at the Boone County courthouse. Sixteen contracts were

found whose average terms were used in this study. The average price paid per acre was $839, which would give a purchase price of $192,130 for a farm the size of the one being considered in this study. The average interest rate was slightly over seven percent. Seven percent interest on the unpaid balance will be used in this study for the contract interest rates. Other contract terms' averages were 19.7 percent down payment, 14 years amortization, and Springfield Plan of amortization for all but one contract. These average terms are reflected in Contract 1 in Table III-2.

The farm is assumed to have a residence, a shelter for farm machinery, grain storage, and a building capable of farrowing eleven litters of pigs twice a year.

The hypothetical land contract buyer has agricultural experience in the area, but has not farmed on his own previously. Such experience might have been as a hired worker or in a family farm arrangement. His management ability is average and his crop and livestock yields are the recent historical average for the area. His beginning equity position is low.

Activities

The activities that are included in this model, the unit in which they are defined, and the years in which they appear are summarized in Table IV-1.

Table IV-1. Activities included in model

Activity	Unit	Years
Corn 1 - Use Equipment 1	1 acre	all
Corn 2 - Use Equipment 2	1 acre	all
Corn 3 - Use Equipment 3	1 acre	all
Corn-Corn-Soybean Rotation (CCS-1) Use Equipment 1	3 acres	all
CCS-2 Use Equipment 2	3 acres	all
CCS-3 Use Equipment 3	3 acres	all
Hog 1	Sow + 2 litters	all
Hog 2	Sow + 2 litters	2,3,4,5
Hog 3	Sow + 1 litter	all
Hog 4	30 pigs	all
Buy Equipment 1	1 unit	all
Buy Equipment 2	1 unit	all
Buy Equipment 3	1 unit	all
Swine Expansion 1	1 sow	2,3,4,5
Swine Expansion 2	10 pigs	all
Swine Expansion 3	1 sow + 1 litter	all
Selling corn	1 bushel	1,2,3,4
Rent machinery	189 acres	all
Rent machinery	1 acre	all

Table IV-1. Continued.

Activity	Unit	Years
Rent land	1 acre	all
Buy gilts	1 gilt	all
Buy corn	1 bushel	all
Hire labor in Period 2	1 hour	all
Hire labor in Period 4	1 hour	all
Short term credit	1 dollar	all
Intermediate term credit	1 dollar	all
Pay fixed costs	1 dollar	all
Pay income taxes	1 dollar	all
Pay consumption and principal	1 dollar	all
Transfer cash to operating capital	1 dollar	all
Transfer cash to investment capital	1 dollar	all
Pay marginal consumption	1 dollar	1,2,3,4
Transfer cash to savings account	1 dollar	all
Transfer cash into tax payment row	1 dollar	all
Transfer tax credit	1 dollar	1,2,3,4

Production activities

Three activities in each year allow the firm to grow corn. Each is defined as a one acre unit. The difference between the three arises from the type of equipment used. Corn 1 uses a relatively labor intensive machinery unit. Corn 3 uses a relatively labor extensive unit, and Corn 2 is intermediate between the other two. Yields are 108 bushels per acre in each year for all three activities. Variable costs are the same with the exception of machinery repair costs which increase as labor intensity decreases. Table A-1 in the Appendix shows the variable costs for each of these activities. Labor requirements are shown in Table A-2.

A corn-corn-soybean rotation is specified in three more activities. The unit consists of two acres of corn and one acre of soybeans with corn yields at 108 bushels per acre and the soybean yield at 36 bushels per acre. Each activity uses a different system of equipment and thus repair costs and labor requirements vary in the same manner as the corn activities, as shown in Tables A-1 and A-2. The machinery requirement for these activities is slightly less than that for the corn activities.

Four hog-raising activities are specified in each year. The first two are the same except for the farrowing months. The unit is a sow and two litters farrowed and finished. Hog Activity 1 has the first litter farrowed in December and the second in June. Hog Activity 2 specifies March and September as the farrowing months. It uses less labor than the first activity as shown in Table A-2. Both activities

produce the same amount of pork and incur the same variable costs. Table A-3 shows the variable costs. Each activity utilizes one gilt which is sold after the second farrowing and retains one gilt from the first litter for use in the next year. Both activities require a central farrowing facility. Since the existing facility is only capable of two farrowings a year, the second activity becomes available for selection only after the first year because the business can then invest in central farrowing facilities which can be used for both activities. After weaning the pigs are finished in portable units on pasture. Both activities require 202 bushels of corn.

The third hog activity consists of a sow farrowing in June in a portable pasture facility. The gilt is sold after weaning the litter, and one is retained for use in the following year. Tables A-2 and A-3 show respectively the labor requirement and the variable costs for this activity. Portable facilities used for farrowing in this activity are also used for finishing the pigs. The corn requirement is 102 bushels.

The last hog activity is growing feeder pigs. Ten pigs are bought in each of the months of December, April, and August, and sold in March, July, and November. The same type of pasture equipment that is used for finishing pigs in the first two activities is used here. Labor requirements and variable costs are given in Tables A-2 and A-3. This activity uses 321 bushels of corn.

Investment activities

The first set of investment activities is available in each year and allows the firm to invest in crop equipment. Equipment 1 is the least expensive, gives the lowest capacity, and uses the most labor per acre of use. Equipment 3 is the most expensive, gives the largest capacity, and uses the least labor, while Equipment 2 is intermediate in all three aspects. Capacity is measured in terms of how many acres the equipment could be used on in the most restrictive month, taking into account the days suitable for fieldwork, a six day work week, and potential use of twelve hours per day on days suitable for fieldwork. The calculation for a given month is:

$$\frac{\text{No. of 6-day work weeks} \times \text{Avg. days suitable for fieldwork}}{\text{Machine hours per acre}} = \text{Capacity}$$

November was the most restricting month for all three systems. The capacities for growing corn of the three equipment systems are 378 acres, 452 acres, and 770 acres respectively for Systems 1, 2 and 3. The capacities are slightly larger for the corn-corn-soybean rotation. Table A-4 contains the information pertaining to these activities.

The model also provides three activities for augmenting hog facilities. Two of these activities buy pasture equipment in any of the five years and the other allows the firm to purchase central farrowing facilities starting in Year 2. These types of facilities conform to what buyers and their non-land lenders would prefer to invest in. The portable pasture facilities are not attached to the land and

thus could be easily removed in case of contract forfeiture. They also have a relatively short payback period and require less capital. The central farrowing facilities does not have these advantages, but after the first year is allowable. If the first year was successful, the confidence of the buyer and potential lenders would make this a reasonable investment. Other types of permanent hog facilities such as confinement finishing buildings are not considered in the first five years.

Swine Expansion 1 buys central farrowing facilities in one sow units. While such a unit could be used for six farrowings a year by a superior manager, the assumption of average management ability is reflected in the model by limiting its use to four times a year. Its cost is $720 per unit with fixed costs of $41 per year and an expected life of twenty years.

Swine Expansion 2 buys portable pasture finishing equipment that can be used for finishing pigs after weaning or for finishing feeder pigs. A unit of investment creates a capacity of ten pigs at once and can be used for two groups of weaned pigs in a year or three groups of feeder pigs as defined in Hog Activity 4. This equipment costs $69, incurs annual fixed costs for repairs, insurance, and property taxes of $3.92, and has a life of five years.

Swine Expansion 3 buys portable pasture facilities that can be used for farrowing and finishing pigs. It is used for Hog Activity 3, and is used only once a year. Its life is ten years, the investment cost is $274, and the annual fixed costs are $15.61. The swine expansion activities are summarized in Table A-5.

Selling activities

Soybean and hog outputs are sold directly through the production activities. Hog Activities 1, 2, and 3 transfer one gilt ahead to the next year. Corn may be transferred forward for use in the next year or sold in the current year. An activity is available in the first four years to sell one bushel units of corn. This activity is not available in the final year when the corn is sold directly through the production activities.

Input acquisition activities

This group of activities can be split into two broad groups. One group acquires physical inputs such as corn, gilts, land, machinery services, and labor while the other group secures credit.

As mentioned earlier, machinery may be rented in any year by the use of two activities. The cost is $23 per acre for the machinery services which are equivalent to those of Equipment 2. The farmer supplies the fuel and labor. Actual costs for these activities are adjusted since the crop raising activities include machinery repair costs. The first activity hires sufficient capacity for 189 acres which can be used to satisfy the constraint requiring purchase of Equipment 1 in each year. The second activity can lease additional machinery capacity in units of one acre.

Land may be rented in one acre units on a cash rent basis. The cost per acre is $60 which is paid in two equal payments prior to planting the crop and after its harvest.

Gilts may be bought for use in the hog activities in any of the five years. They must be paid for when bought. Another activity allows corn to be bought in one bushel units in any of the years. This activity should be significant only in the first year when no inventory of corn exists for feeding hogs. If this activity is used in later years it may indicate cash flow problems to the extent that corn is sold to meet fixed obligations at the beginning of the year and the inventory must be replenished for feeding hogs. The cost of a bushel of corn is fifteen cents greater than what the farm receives in order to reflect transportation and transactions costs.

Labor may be hired for the spring and fall fieldwork periods. This labor is hired on a part time basis and is assumed to be for operating field machinery. It can be hired at $2.10 an hour, but it is limited to not more than 250 hours in each period.

Obtaining parameters for lending activities proved to be difficult. The local PCA indicated that it would make credit available to this type of farmer based on their past experience with the individual or his family and on what the repayment capacity of the business was projected to be. Repayment would be very flexible. No repayment schedule would be set up, but rather repayment would be made as the business had the cash available to do so. While the PCA is allowed to make loans for a maximum of seven years, it will refinance unpaid loans at that time. This agency also indicated that it had no specific equity requirement for assets such as machinery and buildings.

A commercial bank in the area indicated that it would lend to a low-equity contract buyer provided that the business had sufficient repayment capacity. The bank required repayment in four years and a twenty-five percent equity in these assets. Interest rates for this type of loan would be nine percent. The bank would also extend short term credit for expenses associated with growing crops and livestock. This type of credit would have to be repaid within a year, would have no equity requirement, and would have an annual interest cost of eight and one half percent. This bank's terms are used in the two borrowing activities in this model. These credit terms are probably more restrictive than those of the PCA.

The first borrowing activity obtains short term funds which are assumed to be borrowed for eight months at a cost of $.056 per dollar borrowed. Longer term funds can be borrowed for a term of four years with four equal annual principal payments at an interest cost of nine percent on the unpaid balance. For each dollar borrowed in this activity, the model requires a $.33 transfer of the firm's own cash into the investable funds row. Although other collateral could be used in a real world situation, it is not used in this model. The equity in the land contract is usually a poor source of collateral. Collateral from investment in farrowing facilities for other investments would be of doubtful value to lenders because of the legal nature of the land contract as was previously discussed. The other assets depreciate more rapidly and thus would be losing collateral value over time. Again,

this formulation may tend to restrict the amount of credit available to the firm. Principal rep yment is assured for the first activity by including the obligation in the following year's cash availability row. The obligation for the second activity is included in the consumption and principal repayment rows of subsequent years. The interest charge for short term funds is deducted from the cash availability row of the next year and is deducted from the current year's taxable income. The interest charge for intermediate term funds is included in the fixed costs rows of subsequent years which are deducted from taxable income for the year in which they are paid.

Activities for paying expenses and obligations

Three activities fall into this class in each year. The first pays fixed costs associated with various assets. This consists of real estate and personal property taxes, insurance premiums, repair and maintenance costs, and the interest on the contract and on intermediate term borrowing. The initial level for this activity is $3,498 plus the contract interest. Intermediate term borrowing and investment activities add to this liability. The various costs are summarized in Table A-6 and the annual interest obligation on the different land contracts is shown in Table A-13. Payment of these expenses is required by an equality restraint. Payment is deducted from the cash available at the start of the current year. Taxable income is reduced by an amount equal to this payment. There is no contract interest payment in the first year of

this activity since the contract would not have been in force for the prior year.

The second of these activities pays income taxes. This payment includes Federal and Iowa income taxes as well as the self-employment tax. The combined tax rate will be varied according to the level of minimum consumption and contract principal repayment specified. This will be done by calculating the minimum amount of after-tax income the firm would need to pay the owner's minimum consumption and the contract principal payment in each year. Once this is done the proper tax rate can be selected for each year for each contract. The combined tax rates are shown in Table A-11. The income tax rates used with each land contract in each year are shown in Table A-12. Taxable income consists of gross income minus expenses of production, depreciation allowances, fixed costs, and interest paid on debt. The tax liability can be paid from investment tax credits generated by investment in machinery or from net income generated by the year's activities.

The third activity requires payment of the buyer's consumption, half the previous year's rent, and principal repayment. These payments are deducted from the cash available to the firm at the beginning of the year. The down payment for the land contract is included in this activity in the first year and the amortization of the principal begins in the second year. This payment is not deducted from taxable income. Information concerning this activity is summarized in Table A-7.

Transfer activities

Five activities transfer cash within the model or investment tax credits to other years. Each of these activities is available in each year, with the exception of the tax credit transfer which does not appear in the final year. The first of these transfers units of one dollar from the cash row to the operating capital row of the same year. The second activity is similar, except that it transfers cash into a row for investment capital. The third activity is a savings account which saves one dollar from the cash available in the current year. The dollar plus a five percent interest dividend is transferred to the next year's cash row. Another activity transfers cash into a row where it can be used to pay income taxes. A final activity transfers investment tax credits not used in one year into a row where it can be used in paying the next year's taxes.

Restraints

There are four general groups of restraints which restrict the activities in each year. The first group requires the use of resources to be less than or equal to some level of availability. The second group sets certain limits on resource acquisition and investment activities. Another group restricts the amount of cash available to the activities in a year. The final group of equality constraints requires payment of the firm's financial obligations. All restraints are summarized in Table IV-2.

Table IV-2. Restraints incorporated into model

Description	Units	Initial Level	Years	Type[a]
Cropland	acres	189	all	GE
Equipment 1	acres	0	all	GE
Equipment 2	acres	0	all	GE
Equipment 3	acres	0	all	GE
Labor-Period 1	hours	730	all	GE
Labor-Period 2	hours	705	all	GE
Labor-Period 3	hours	635	all	GE
Labor-Period 4	hours	473	all	GE
Corn	bushels	0	all	GE
Corn Transfer	bushels	0	1-4	GE
Winter/Summer Farrowing	sow + 2 litters	11	all	GE
Spring/Fall Farrowing	sow + 2 litters	0	2-5	GE
Finishing Facilities	pigs	0	all	GE
Pasture Farrow/Finish	sow + 1 litter	0	all	GE
Gilts	gilts	0	all	GE
Labor Hiring-Period 2	hours	250	all	GE
Labor Hiring-Period 4	hours	250	all	GE
Equipment 1 Investment	equipment	1	all	E

[a]GE = Greater than or equal to.
E = Equal to.

Table IV-2. Continued.

Description	Units	Initial Level	Years	Type[a]
Cash	dollars	varies	1-6	GE
Operating Capital	dollars	0	all	GE
Investment Capital	dollars	0	all	GE
Income Tax Payments Row	dollars	0	all	GE
Taxable Income	dollars	0	all	E
Fixed Expenses	dollars	3498	1-6	E
Consumption and Principal Repayment	dollars	5014	1-6	E
Marginal Consumption Accounting Row	dollars	0	1-4	E

Resource and input restraints

The first of these restraints restricts the acres of cropland used in each year to less than or equal to 189 acres. This can be augmented in any year by renting land which is added to the 189 acres.

The next three restraints involve equipment capacity for each of the three equipment systems. The capacity will be the same in each of the years after an investment is made unless augmented by machinery rental.

The year is divided into four periods of labor use. These four restraints limit the amount of labor used in each period to not more than what the farm operator can provide, but the availability in the spring and fall can be supplemented by labor hiring in these periods. The operator's labor availability is calculated on the basis of a six day work week with twenty-five hours a month deducted for overhead activities such as buying inputs, selling outputs, or doing the paperwork associated with the business. Information relating to this restraint is summarized in Table A-14.

Constraints also limit selling and feeding of corn. A row exists in each of the first four years in which corn that is produced is accumulated. This corn may be sold or transferred to the next year. Another row exists in each year that accumulates corn that is transferred from the previous year or that is bought. This corn may be used for the hog activities. Corn must be bought in the first year if hogs are to be fed since there is no carryover of corn from the previous year.

Four rows restrict the use of hog activities in each year. One, winter-summer farrowing, has an initial capacity of farrowing eleven sows

twice a year. The rest have no initial capacity. All four may be augmented by investment. Farrowing facilities can be bought after the first year while portable pasture farrow to finish and finishing facilities can be bought in any year. Investment in any of these facilities adds capacity to the same row in each of the subsequent years.

The availability of gilts is limited to the sum of those bought and those transferred from the previous year. There is no transfer into the first year so that gilts must be bought for use in that year. Every unit of the first three hog activities transfers a gilt forward for use in the following year.

Restraints on labor hiring and machinery investment

Two restraints in each year restrict the labor hiring activities to not more than 250 hours in each period. These restraints reflect the limited availability of part time labor within a given community. Another restraint requires the firm to invest in one unit of Equipment 1 or to hired machinery to operate 189 acres. Since the capacity of Equipment 1 is a prerequisite for investment in Equipment 2, and the capacity of Equipment 2 is a prerequisite for investment in Equppment 3, this constraint effectively limits owned Equipment 2 capacity to a maximum of 452 acres, owned Equipment 3 capacity to a maximum of 770 acres, and owned Equipment 1 capacity to 378 acres.

Cash rows

A row exists in each year which contains cash. In the first year this cash is given from outside the model, but in subsequent years the row is supplied with the gross income from the sale of crops and livestock in the previous year. Withdrawals are made from this row for payment of the current year's consumption, fixed expenses, contract obligation, and principal and interest repayment for short and intermediate term borrowing. The previous year's income tax liability and half of the rent obligation are also deducted from this row. The remainder can be transferred into rows for investment or operating expenses, or can be allocated to a savings account.

Two rows exist for operating and investment capital. Variable costs for production activities, cost of gilts, and one half of land rent are withdrawn from the annual operating capital row. Investment capital is required for the purchase of machinery or hog facilities. Either row may be supplemented by borrowing or from the cash row.

Investment tax credit from the purchase of machinery in any year is stored in another row. The purchase price of the machinery bought multiplied by seven percent gives the amount of tax credit. If the credit is not used up in the first year, it can be transferred into future years for use. Cash may also be transferred to this row in the case where there is not enough tax credit to satisfy the tax liability.

Financial obligation restraints

Four equality restraints in each year require the payment of income taxes, minimum and marginal consumption, principal repayment on loans, interest on loans, and fixed costs of insurance, repairs, and property taxes. Minimum consumption and principal repayment on the contract are fixed in the initial level for this constraint. The initial level is increased by the use of intermediate term credit in the previous years and by land rented in the previous year. Taxable income is initially zero, but is increased by all activities that generate income. All expenses of production, fixed costs, and interest on debt are deducted from taxable income. Depreciation of machinery and hog facilities also reduces taxable income. For every dollar of taxable income in this row, the model requires payment of the tax liability in tax credits or cash.

The restraint on fixed costs has an initial level of $3,498 plus contract interest, but this is increased by investments in machinery or buildings and by intermediate term borrowing. These costs include insurance, property taxes, and repair costs for the buildings owned by the firm. The costs for fixed expenses, minimum consumption, and contract payments are summarized in Tables A-6, A-7, and A-13.

A final equality constraint collects net income above variable costs for all activities in the year. From this is deducted fixed costs and minimum consumption for the following year, as well as the current income tax liability. For every dollar remaining, the following period's consumption is increased by $.175. This coefficient's derivation is explained in Table A-7.

Objective Function

The net contribution or reduction of net income by each activity is entered in the objective function. These values are shown in Table IV-3. The entries are discounted by seven percent according to the year in which they occur. A low-equity land contract buyer could be expected to discount income fairly heavily for two reasons. First, the risk of losing the land due to forfeiture of the land contract would tend to place a lower value on future returns. The importance of this factor would depend on what the buyer thought the probability of forfeiting the land contract was and the buyer's level of risk aversity. Second, the marginal rate of return on equity would be relatively high for a low-equity farmer which would mean that present income would have a high value over future income. The discount rate used here is somewhat higher than that used in another farm firm growth model of four years ago (22, p. 95). Increasing the rate above seven percent would have meant that the value for selling corn in one year was greater than the absolute value for buying corn in the following year. Under such circumstances the model would sell all of its corn production and buy all the corn it needed in the following year which would be unrealistic. The fixed financial obligations in the constraint set of this model will reduce the range over which the objective function can influence the firm's activities, especially in solutions at or close to the critical equity level.

Annual fixed costs incurred by assets that the model invests in are discounted back to the year in which the investment is made and entered

Table IV-3. Objective function values

Value	Corn 1	Corn 2	Corn 3	CCS 1
(Trend Prices)				
Year 1				
Real	$-43.18	$-44.90	$-48.87	$ 39.69
Discounted	-43.18	-44.90	-48.87	39.69
Year 2				
Real	-43.18	-44.90	-48.87	39.69
Discounted	-40.35	-41.96	-45.67	37.09
Year 3				
Real	-43.18	-44.90	-48.87	39.69
Discounted	-37.71	-39.21	-42.68	34.66
Year 4				
Real	-43.18	-44.90	-48.87	39.69
Discounted	-35.24	-36.65	-39.89	32.39
Year 5				
Real	127.46	125.74	121.77	380.97
Discounted	97.23	95.92	92.89	290.64
(1973 Prices)				
Year 1				
Real	-43.18	-44.90	-48.87	87.57
Discounted	-43.18	-44.90	-48.87	87.57
Year 2				
Real	-43.18	-44.90	-48.87	87.57
Discounted	-40.35	-41.96	-45.67	81.84
Year 3				
Real	-43.18	-44.90	-48.87	87.57
Discounted	-37.71	-39.21	-42.68	76.48
Year 4				
Real	-43.18	-44.90	-48.87	87.57
Discounted	-35.24	-36.65	-39.89	71.48

Table IV-3. Continued.

Value	Corn 1	Corn 2	Corn 3	CCS 1
Year 5				
Real	$205.22	$203.50	$199.53	$584.37
Discounted	156.56	155.24	152.22	445.81

Value	CCS 2	CCS 3	Hog 1	Hog 2
(Trend Prices)				
Year 1				
Real	$ 34.60	$ 22.52	$ 627.25	--
Discounted	34.60	22.52	627.25	--
Year 2				
Real	34.60	22.52	627.25	$ 627.25
Discounted	32.33	21.04	584.21	584.21
Year 3				
Real	34.60	22.52	627.25	627.25
Discounted	30.22	19.-6	550.22	550.22
Year 4				
Real	34.60	22.52	627.25	627.25
Discounted	28.24	18.38	514.14	514.14
Year 5				
Real	375.88	363.80	689.75	689.75
Discounted	286.75	277.54	530.58	530.58
(1973 Prices)				
Year 1				
Real	82.48	70.40	970.41	--
Discounted	82.48	70.40	970.41	--
Year 2				
Real	82.48	70.40	970.41	970.41
Discounted	77.08	65.79	906.93	906.93

Table IV-3. Continued.

Value	CCS 2	CCS 3	Hog 1	Hog 2
Year 3				
Real	$ 82.48	$ 70.40	$ 970.41	$ 970.41
Discounted	72.04	61.49	847.55	847.55
Year 4				
Real	82.48	70.40	970.41	970.41
Discounted	67.32	57.46	792.15	792.15
Year 5				
Real	569.28	567.20	1055.33	1055.33
Discounted	441.92	432.71	805.11	805.11

Value	Hog 3	Hog 4	Sell Corn	Buy Corn
(Trend Prices)				
Year 1				
Real	$ 329.53	$ 777.00	$ 1.58	$ -1.73
Discounted	329.53	777.00	1.58	-1.73
Year 2				
Real	329.53	777.00	1.58	-1.73
Discounted	307.97	726.17	1.48	-1.61
Year 3				
Real	329.53	777.00	1.58	-1.73
Discounted	289.06	681.58	1.39	-1.52
Year 4				
Real	329.53	777.00	1.58	-1.73
Discounted	270.11	636.89	1.29	-1.42
Year 5				
Real	392.03	777.00	--	-1.73
Discounted	301.56	597.69	--	-1.33
(1973 Prices)				
Year 1				
Real	506.81	1180.71	2.30	-2.55
Discounted	506.81	1180.71	2.30	-2.55

Table IV-3. Continued.

Value	Hog 3	Hog 4	Sell Corn	Buy Corn
Year 2				
Real	$ 506.81	$1180.71	$ 2.30	$ -2.55
Discounted	473.65	1103.47	2.15	-2.38
Year 3				
Real	506.81	1180.71	2.30	-2.55
Discounted	442.65	1031.25	2.01	-2.23
Year 4				
Real	506.81	1180.71	2.30	-2.55
Discounted	413.71	963.81	1.87	-2.08
Year 5				
Real	591.73	1180.71	--	-2.55
Discounted	451.43	900.76	--	-1.94

Value	Buy Equip-ment 1	Buy Equip-ment 2	Buy Equip-ment 3	Rent Land
(Trend Prices)				
Year 1				
Real	--	--	--	$-60.00
Discounted	$22,872	$ 8,505	$30,023	-60.00
Year 2				
Real	--	--	--	-60.00
Discounted	28,100	8,837	33,243	-56.08
Year 3				
Treal	--	--	--	-60.00
Discounted	32,986	9,237	36,162	-52.63
Year 4				
Real	--	--	--	-60.00
Discounted	37,555	9,609	38,899	-49.18
Year 5				
Real	--	--	--	-60.00
Discounted	41.823	9,958	41,438	-46.16

Table IV-3. Continued.

Value	Buy Equipment 1	Buy Equipment 2	Buy Equipment 3	Rent Land
(1973 Prices)				
Year 1				
Real	--	--	--	$-60.00
Discounted	$30,058	$11,263	$39,398	-60.00
Year 2				
Real	--	--	--	-60.00
Discounted	36,014	11,752	42.981	-56.08
Year 3				
Real	--	--	--	-60.00
Discounted	41,581	12,209	46,329	-52.63
Year 4				
Real	--	--	--	-60.00
Discounted	46,784	12,636	49,458	-49.18
Year 5				
Real	--	--	--	-60.00
Discounted	51,646	13,035	52,383	-46.16

Value	Swine Expansion 1	Swine Expansion 2	Swine Expansion 3	Buy Gilts
(Trend Prices)				
Year 1				
Real	--	--	--	$-62.50
Discounted	--	$ -17.19	$ 19.83	-62.50
Year 2				
Real	--	--	--	-62.50
Discounted	$ 810.73	3.27	49.79	-58.41
Year 3				
Real	--	--	--	-62.50
Discounted	880.90	22.38	77.78	-54.82

Table IV-3. Continued.

Value	Swine Expansion 1	Swine Expansion 2	Swine Expansion 3	Buy Gilts
Year 4				
Real	--	--	--	$-62.50
Discounted	$ 946.49	$ 40.24	$ 103.94	-51.23
Year 5				
Real	--	--	--	-62.50
Discounted	1,007.77	56.92	128.39	-48.08
(1973 Prices)				
Year 1				
Real	--	--	--	-85.00
Discounted	--	-17.19	36.97	-85.00
Year 2				
Real	--	--	--	-85.00
Discounted	1,122.00	6.20	69.72	-79.44
Year 3				
Real	--	--	--	-85.00
Discounted	1,203.00	28.09	100.32	-74.24
Year 4				
Real	--	--	--	-85.00
Discounted	1,278.00	48.62	128.92	-69.39
Year 5				
Real	--	--	--	-85.00
Discounted	1,348.00	67.63	155.66	-64.85

Value	Hire Labor Period 2	Hire Labor Period 4	Short Term Credit	Inter. Term Credit
Year 1				
Real	$ -2.10	$ -2.10	$ -.056	--
Discounted	-2.10	-2.10	-.056	$ -.196
Year 2				
Real	-2.10	-2.10	-.056	--
Discounted	-1.96	-1.96	-.052	-.183

Table IV-3. Continued.

Value	Hired Labor Period 2	Hire Labor Period 4	Short Term Credit	Inter. Term Credit
Year 3				
Real	$ -2.10	$ -2.10	$ -.056	$ --
Discounted	-1.84	-1.84	-.049	-.337
Year 4				
Real	-2.10	-2.10	-.056	--
Discounted	-1.72	-1.72	-.045	-.482
Year 5				
Real	-2.10	-2.10	-.056	--
Discounted	-1.61	-1.61	-.042	-.617

	Savings Account	Rent Machinery for 189 acres	Rent Machinery for 1 acre
Year 1			
Real	$.05	$-2797.	$-14.80
Discounted	.05	-2797.	-14.80
Year 2			
Real	.05	-2797.	-14.80
Discounted	.047	-2614.	-13.83
Year 3			
Real	.05	-2797.	-14.80
Discounted	.044	-2443.	-12.92
Year 4			
Real	.05	-2797.	-14.80
Discounted	.041	-2283.	-12.08
Year 5			
Real	.05	-2797.	-14.80
Discounted	.038	-2133.	-11.29

in the objective function. Productive assets other than land which have lives greater than five years must also be compensated for in the objective function. Otherwise the investment would not be as profitable as it normally would be. In order to compensate for these assets, the cash inflows attributable to the asset after the fifth year are discounted and entered in the objective function in the year in which the investment is made. Although future use and income from them are unknown, I assume that depreciation is paid back in equal payments over the life of the asset with no salvage value. In addition, a rate of return on the cost of the investment is received in each year. Tables A-8-A-10 show the derivation of estimates for these values. Intermediate term borrowing activities that start after the second year are also compensated for in the objective function. The unpaid portion after the sixth year is discounted and included in the objective function in the year in which the credit is obtained.

Two sets of values are shown in Table IV-3. The two sets reflect the two different sets of farm prices to be used in the model Activities which do not involve farm prices have the same objective function values under either price set assumption. These activities which do not change are labor hiring, short and intermediate term credit, the savings account, renting machinery, and renting land.

Artificial and Disposal Activities

This model will require an artificial activity for each restraint that is specified as an equality. Such activities provide a basis for the computation of a solution and disappear early in the computation process

because a -M, a value of large magnitude, is entered in the objective function for them.

Disposal activities are required for all of the greater than or equal to restraints specified in the model. These activities have no objective function value, positive or negative. They allow for underutilization of resources.

CHAPTER V. ORGANIZATION OF PRODUCTION IN THE REPRESENTATIVE FARM FIRM

The organization of the firm's production activities varies with the different solutions to the model obtained with the trend price level, especially as the beginning equity level is varied. A general pattern of organization emerges when the various solutions are compared. To facilitate the discussion, the contracts and the beginning equity levels are listed and named in Table V-1. The contract terms were summarized in Table III-2.

Between 220 and 384 acres of crops are grown in each of the solutions to the model. Corn-Corn-Soybean rotations are used in all the solutions. Less than ten acres of continuous corn are grown in one year in several solutions. Labor during the harvest season is a limiting resource, and since the rotation uses less labor during that period, it is a more profitable activity. The acreage of crops grown generally declines as the beginning equity declines with a given set of contract terms. This is because the higher beginning equity allows the firm to invest in Equipment 3 which requires less labor to operate, and thus allows the firm to grow more crops. This pattern does not hold true for most of the cases that occur at the critical beginning equity level because in these cases few or no hog facilities can be acquired in the first years. This allows labor to be used for growing crops with leased machinery until the firm can finance the acquisition of hog facilities. The amount of crops grown in each solution is summarized in Table V-2.

Table V-1. Cases to be discussed

Case	Contract	Beginning Equity
1	1	$90,000
2	1	$87,110*
3	2	$90,000
4	2	$70,000
5	2	$61,970*
6	3	$90,000
7	3	$70,000
8	3	$47,158*
9	4	$80,000
10	4	$70,000
11	4	$66,448*
12	5	$80,000
13	5	$70,000
14	5	$48,178*
15	6	$80,000
16	6	$70,000
17	6	$46,938*
18	7	$80,000
19	7	$70,000
20	7	$63,888*
21	8	$60,000

*Critical level of beginning equity.

Table V-1. Continued.

Case	Contract	Beginning Equity
22	8	$50,000
23	8	$41.086*
24	9	$60,000
25	9	$50,000
26	9	$37,332*
27	10	$70,000
28	10	$60,000
29	10	$54,369*
30	11	$60,000
31	11	$50,000
32	11	$37,724*
33**	1	$60,000
34**	1	$50,000
35**	1	$46,938*
36**	7	$50,000
37**	7	$40,000
38**	7	$37,332*

**1973 price level used in these solutions.

Table V-2. Acres of crops grown

Case	Year 1	Year 2	Year 3	Year 4	Year 5
1	379	379	382	384	304
2	298	298	298	298	293
3	258	270	276	270	300
4	263	263	263	263	260
5	282	282	280	282	267
6	251	263	250	263	300
7	247	258	250	262	300
8	353	353	218	220	243
9	290	290	290	290	300
10	314	314	314	314	274
11	323	323	290	323	277
12	251	263	263	263	300
13	248	259	259	263	300
14	232	232	221	225	262
15	253	303	304	304	301
16	249	270	270	304	301
17	378	220	220	220	260
18	331	331	316	316	301
19	323	323	323	308	297
20	298	298	298	298	259
21	247	259	259	263	301

Table V-2. Continued.

Case	Year 1	Year 2	Year 3	Year 4	Year 5
22	233	240	240	240	270
23	221	221	221	221	262
24	248	263	263	263	301
25	234	245	245	245	301
26	378	263	220	220	262
27	263	263	263	263	301
28	287	287	287	287	281
29	300	300	300	300	272
30	243	258	258	263	301
31	234	245	245	245	301
32	333	333	221	221	262
33	413	304	304	304	301
34	378	276	304	304	301
35	378	259	304	304	301
36	413	304	304	304	301
37	376	289	304	304	301
38	378	261	304	304	301

Except for Cases 17 and 26, 22 litters of pigs were grown in the first year of all cases. Both of these cases had such a low beginning equity that finishing facilities could not be acquired as needed by the hog activities. In the second year, these two cases acquired the required finishing facilities to utilize the farrowing facilities that were on the farm. Starting in the second year, the model allowed investment in additional farrowing facilities, and all cases used this activity. The higher the beginning equity was over the critical level, the earlier was the investment in farrowing facilities. Most of the solutions for which the beginning equity level was critical were unable to invest in these facilities until the fifth year. The maximum amount of litters farrowed was approximately 160, with most solutions achieving this level. Both spring-fall and winter-summer farrowing activities were used, but in the final year the spring-fall activity, which uses less labor, was used more for reasons that will be discussed later. The amount of litters farrowed in each year of each solution is shown in Table V-3.

Feeder pigs were grown in the first year of each solution, except for Cases 17 and 26, which as previously noted, did not have sufficient beginning equity to invest in hog finishing facilities. These two cases were able to obtain finishing facilities in the second year. The solutions at the critical beginning equity levels depended most heavily on the feeder pig activity throughout the five years, whereas the solutions with a higher initial equity level either dropped or greatly reduced this activity once farrowing facilities were obtained. Since all cases were able to obtain

Table V-3. Litters of hogs farrowed

Case	Year 1	Year 2	Year 3	Year 4	Year 5
1	22	22	72	72	151
2	22	22	22	22	90
3	22	154	154	154	160
4	22	22	98	98	164
5	22	22	35	35	155
6	22	154	154	154	159
7	22	154	154	154	160
8	22	22	22	22	146
9	22	22	127	127	159
10	22	22	53	53	160
11	22	22	34	34	156
12	22	144	144	144	159
13	22	144	144	144	159
14	22	22	22	22	156
15	22	150	150	150	159
16	22	154	154	154	159
17	0	22	22	22	160
18	22	22	114	114	159
19	22	22	22	22	159
20	22	22	22	22	132
21	22	154	154	154	159
22	22	111	111	111	161

Table V-3. Continued.

Case	Year 1	Year 2	Year 3	Year 4	Year 5
23	22	22	22	22	157
24	22	154	154	154	159
25	22	156	156	156	159
26	0	22	22	22	156
27	22	22	154	154	159
28	22	22	61	61	160
29	22	22	22	22	156
30	22	154	154	154	159
31	22	156	156	156	159
32	22	22	22	22	156
33	22	150	150	150	159
34	22	150	150	150	159
35	0	140	150	150	159
36	22	150	150	150	159
37	22	150	150	150	159
38	0	150	150	150	159

farrowing facilities by the fifth year, this activity only appears in that year in Case 8 at a low level. This activity has the advantage of a low investment requirement for facilities, but as the firm accumulates capital for investment, it moves away from this activity because it uses more labor and operating capital than do the farrowing activities. Table V-4 shows the level of this activity for each of the years in each of the solutions.

Corn is bought and sold in each year of all the solutions. While buying corn is necessary in the first year because no inventory exists, it would not be necessary in later years in a real situation because the firm produces enough corn. Corn produced by the firm and held in inventory for feeding in the following year could be used as collateral for a loan to be repaid when the livestock are sold. The model does not allow this, and thus it sells enough corn in each year so that it can meet its financial requirements and carries the rest over to the next year for the hog activities. Corn is also sold to generate cash for investment purposes. The cases with the higher initial equities build up inventories of corn much more rapidly than the cases that are closer to or at the critical initial equity level. This reduces the cost of feeding hogs in these cases and reduces the amount of short term credit that must be obtained.

Land is rented in each year of each case as demonstrated in Table V-5. This activity ranges from 195 acres to 31 acres. In most cases, the solutions with beginning equities furthest from the critical level rent more land since they have more capital for investment in Equipment 3, the

Table V-4. Feeder pigs fed

Case	Year 1	Year 2	Year 3	Year 4	Year 5
1	562	562	--	--	--
2	627	627	627	627	--
3	1,479	--	--	--	--
4	1,350	1,350	552	570	--
5	1,176	1,176	1,030	1,030	--
6	1,488	--	--	--	--
7	1,494	5	43	--	--
8	66	66	1,665	1,665	114
9	1,094	1,094	--	18	--
10	876	876	530	562	--
11	798	798	660	678	--
12	1,488	--	--	--	--
13	1,493	5	5	--	--
14	1,521	1,521	1,660	1,660	--
15	1,444	--	--	--	--
16	1,479	--	--	--	--
17	--	1,666	1,666	1,666	--
18	755	755	--	--	--
19	906	906	906	1,094	--
20	666	666	666	666	--
21	1,493	5	5	--	--
22	1,556	554	554	554	--

Table V-4. Continued.

Case	Year 1	Year 2	Year 3	Year 4	Year 5
23	1,666	1,666	1,666	1,666	--
24	1,488	--	--	--	--
25	1,507	--	--	--	--
26	--	1,150	1,666	1,666	--
27	1,350	1,350	--	--	--
28	1,129	1,129	727	727	--
29	1,007	1,007	1,007	1,007	--
30	1,494	6	6	--	--
31	1,507	--	--	--	--
32	312	312	1,666	1,666	--
33	--	--	--	--	--
34	--	--	--	--	--
35	--	--	--	--	--
36	--	--	--	--	--
37	--	--	--	--	--
38	--	--	--	--	--

Table V-5. Acres of land rented

Case	Year 1	Year 2	Year 3	Year 4	Year 5
1	190	190	193	195	115
2	111	111	111	111	106
3	70	81	78	81	111
4	74	74	74	74	71
5	93	93	91	93	78
6	63	74	61	74	111
7	58	70	61	74	111
8	164	164	29	31	54
9	102	102	102	102	102
10	125	125	125	125	85
11	134	134	134	134	88
12	62	74	74	74	111
13	58	70	70	74	111
14	43	43	32	36	73
15	64	114	115	115	112
16	60	82	82	115	112
17	189	31	31	31	71
18	142	142	127	127	112
19	134	134	134	119	108
20	109	109	109	109	109
21	58	70	70	74	112
22	44	52	52	52	81

Table V-5. Continued.

Case	Year 1	Year 2	Year 3	Year 4	Year 5
23	32	32	32	32	73
24	59	74	74	74	112
25	45	56	56	56	112
26	189	74	32	32	73
27	74	74	74	74	112
28	98	98	98	98	91
29	111	111	111	111	83
30	54	69	69	74	112
31	45	56	56	56	112
32	144	144	31	31	73
33	224	115	115	115	112
34	189	87	115	115	112
35	189	70	115	115	112
36	224	115	115	115	112
37	187	100	115	115	112
38	189	73	115	115	112

labor-saving machinery. Exceptions to this pattern are the first four years of Cases 5, 11, and 29, the first two years of Cases 8 and 32, and the first year of Cases 17 and 26. Each of these cases is at a critical beginning equity level which prevents large investments in hog facilities. Because of this, these solutions rent large amounts of machinery services and land in order to grow crops in those years. The magnitude of the land renting activity in these solutions suggests that there is additional uncertainty for the firm in these cases.

Macinery is rented in nearly all the solutions, but is most important to the cases which are at or near the critical beginning equity level. This also represents an additional source of uncertainty for the firm. Labor is hired in the two periods in which this is allowed, the spring planting season and the fall harvest season. In all solutions, labor is hired to the maximum level allowed by the constraint set in the fall harvest season. In several cases, no labor is hired in the spring, but in most cases this activity enters at a level greater than zero, but less than the 250 hour maximum specified in the constraint set. Allowing the firm to hire additional labor for the fall harvest season would have a beneficial impact on net income in all solutions.

As would be expected, the greater the difference between the critical level of beginning equity and the actual level of beginning equity was, in general, the lower was the amount of short term credit obtained by the firm. The amount of short term credit also declined in amount in each case from the first to the fourth year. This occurs because of several

factors. First, most solutions to the model reduce the amount of feeder pigs with the passage of time. Since these require more operating capital than other activities, the reduction reduces the total amount of operating capital needed, and in turn, the amount of short term credit needed. Second, the firm is able to build up its operating capital with its savings. This is especially true as it builds up its holdings of corn over time which reduces the need for credit to buy corn. Finally, as the firm is better able to carry its own corn over to the next year for feeding, the cost of corn for feeding becomes less, and the amount of credit needed declines.

As Table V-6 shows, there are exceptions to the two relationships discussed in the previous paragraph. These show up in solutions that are at the critical level of beginning equity. All years of Case 2 use less short term credit than in Case 1 which has a higher initial equity. This is because much less land is rented in Case 2 and because machinery is owned in Case 2, while some machinery capacity is leased in Case 1. The pattern is also reversed in the first two years of Case 8 because the low initial equity does not allow investment in many hog facilities. The amount of litters farrowed and feeder pigs fed is low during these two years, reducing the amount of short term credit needed. This same pattern is repeated in the first two years of Cases 20 and 32 and in the first year of Cases 17 and 26. The significant amounts of short term credit used in all cases indicate its importance to the production organization of the firm. Although the use of short term credit does not appear in the statistics from the balance sheet that will be discussed later, its use does contribute to the financial risk faced by the firm.

Table V-6. Dollars of short term credit

Case	Year 1	Year 2	Year 3	Year 4	Year 5
1	43,566	42.531	40,681	38,951	60,000
2	40,156	39,469	38,285	35,983	39,825
3	40,246	40,958	35,202	31,186	57,392
4	52,716	51,431	49,098	47,509	59,810
5	58,829	57,565	52,945	51,774	59,942
6	36,447	47,198	28,589	23,798	52,009
7	54,291	48,892	41,311	38,319	59,761
8	32,462	31,097	65,729	64,108	60,353
9	39,912	38,659	37,254	34,634	60,608
10	47,524	46,298	41,728	40,103	61,123
11	50,227	49,011	44,269	42,335	60,821
12	46,447	41,419	31,870	19,640	55,493
13	54,275	50,431	41,998	31,598	59,761
14	66,425	65,061	62,218	55,745	60,478
15	43,735	43,486	30,562	22,823	57,931
16	54,126	48,286	34,722	30,716	57,926
17	26,185	69,311	61,224	51,827	61,157
18	28,898	27,705	26,718	20,570	59,462
19	45,991	44,821	35,903	33,417	63,494
20	42,212	41,282	39,807	35,476	50,921
21	54,669	52,212	42,992	33,407	58,821
22	60,915	59,753	52,091	43,752	59,490

Table V-6. Continued.

Case	Year 1	Year 2	Year 3	Year 4	Year 5
23	69,816	68,451	62,172	54,894	60,447
24	54,512	48,291	35,595	24,578	57,807
25	57,423	53,257	43,310	32,657	59,137
26	26,185	57,704	64,636	56,799	60,187
27	43,079	41,795	39,042	32,984	58,533
28	50,692	49,434	42,367	34,965	61,522
29	54,978	53,736	50,047	43,508	60,831
30	52,155	48,436	37,143	25,300	57,807
31	57,423	55,155	45,974	35,470	59,247
32	38,173	36,809	66,241	58,463	60,133
33	29,491	61,983	37,125	16,431	71,154
34	33,491	73,385	59,001	29,278	71,154
35	26,185	70,065	68,700	38,090	71,154
36	29,885	58,510	30,071	9,359	71,154
37	33,425	74,310	51,375	22,881	71,154
38	26,185	73,577	59,162	27,216	71,154

The greater the beginning equity with a given set of land contract terms, the greater was the amount of the intermediate term borrowing. This is shown in Table V-7. Only Case 16 does not conform to this pattern. In that case, the beginning equity for Case 15 is large enough to furnish the funds needed for investment without as much credit as is used by Case 16 which has a lower initial equity. There are two reasons for the general relationship between intermediate term credit and initial equity level. First, this borrowing activity requires a twenty-five percent equity in assets acquired on credit that must be met with cash at the time the credit is obtained. The higher initial equities can put more funds into meeting this requirement. Second, the cases with initial equities that are further away from the critical level can invest in more assets in the earlier years. This creates a greater repayment capacity for loans obtained in subsequent years. This is evidenced by the fact that the largest volume of loans is obtained in the later years in most cases.

In all solutions, a certain amount of the owner's labor is not used. This occurs mainly in the winter months. As hog facilities are acquired, especially farrowing facilities, the amount of unused labor is reduced. This is true for the summer period as well, where smaller amounts of labor are not used. There are several years in several solutions in which small amounts of labor are not used in the spring also. The largest amounts of unused labor occur in cases that are at or near the critical beginning equity level for the particular contract. This can be seen in Table V-8. The greatest non-use of labor is in the first year of Cases 17 and 26,

Table V-7. Dollars of intermediate term borrowing

Case	Year 1	Year 2	Year 3	Year 4	Year 5
1	--	--	6,768	--	15,494
2	--	--	--	--	9,396
3	--	15,959	--	--	77,544
4	--	--	10,436	33	34,220
5	--	--	1,744	23	20,813
6	--	--	--	--	100,460
7	--	17,905	64	1,518	55,576
8	542	--	2,767	--	16,898
9	--	--	14,413	33	52,651
10	--	--	4,158	55	33,646
11	--	--	1,601	21	25,655
12	--	17,905	--	--	88,793
13	--	17,905	--	1,503	60,042
14	3,059	--	240	1,812	30,708
15	--	33,492	377	--	50,767
16	--	22,232	--	12,441	57,993
17	--	3,309	--	--	39,851
18	--	--	12,879	--	63,756
19	--	--	--	324	45,506
20	--	--	--	--	15,951
21	--	17,905	--	1,503	52414
22	--	12,052	--	--	37,416

Table V-7. Continued.

Case	Year 1	Year 2	Year 3	Year 4	Year 5
23	896	--	--	--	32,184
24	--	19,432	--	--	73,082
25	279	16,525	--	--	51,314
26	--	2,417	892	--	29,376
27	--	--	18,104	--	58,479
28	--	--	5,412	--	41,216
29	--	--	--	--	25,851
30	--	19,355	--	1,847	73,072
31	279	18,136	--	--	49,064
32	967	--	2,341	--	28,798
33	22,629	19,865	--	--	25,982
34	8,539	22,297	11,659	--	39,607
35	--	18,716	23,779	--	46,077
36	22,629	19,865	--	--	16,084
37	7,432	28,696	6,366	--	30,366
38	--	25,086	17,408	--	35,107

Table V-8. Unused labor

Case	Year 1 Per. 1	Year 1 Per. 2	Year 1 Per. 3	Year 2 Per. 1	Year 2 Per. 2	Year 2 Per. 3	Per. 1
1	382	13	196	382	13	196	359
2	372	0	200	372	0	200	372
3	106	0	30	44	0	0	44
4	147	0	57	147	0	57	93
5	200	0	89	200	0	89	194
6	104	0	30	43	0	0	43
7	103	0	30	42	0	0	30
8	546	103	309	546	103	309	52
9	225	0	104	225	0	104	148
10	291	0	145	291	0	145	277
11	315	0	160	315	0	160	310
12	104	0	30	43	0	0	43
13	103	0	30	42	0	0	42
14	97	0	28	97	0	27	54
15	119	0	39	53	0	0	53
16	108	0	33	45	0	0	45
17	664	150	377	52	0	0	52
18	287	0	167	328	0	167	200
19	280	0	136	128	0	136	280
20	360	0	193	360	0	193	360
21	103	0	30	42	0	0	42

Year 3 Per. 2	Per. 3	Per. 1	Year 4 Per. 2	Per. 3	Per. 1	Year 5 Per. 2	Per. 3
6	186	359	5	185	59	0	0
0	200	372	0	200	299	0	160
0	0	44	0	0	104	0	0
0	30	87	0	24	96	0	0
0	90	190	0	84	52	0	0
0	0	43	0	0	104	0	0
0	0	43	0	0	104	0	0
0	3	52	0	0	40	0	0
0	65	142	0	59	104	0	0
0	142	267	0	132	84	0	0
0	161	306	0	155	63	0	0
0	0	43	0	0	104	0	0
0	0	43	0	0	104	0	0
0	0	53	0	0	59	0	0
0	0	53	0	0	99	0	0
0	0	54	0	0	99	0	0
0	0	52	0	0	74	0	0
0	93	200	0	93	99	0	0
0	136	222	0	100	98	0	0
0	193	360	0	193	131	0	57
0	0	43	0	0	99	0	0

Table V-8. Continued

Case	Year 1 Per. 1	Year 1 Per. 2	Year 1 Per. 3	Year 2 Per. 1	Year 2 Per. 2	Year 2 Per. 3	Year 2 Per. 1
22	85	0	20	44	0	0	44
23	52	0	0	52	0	0	52
24	105	0	31	43	0	0	43
25	101	0	31	39	0	0	39
26	664	150	377	211	0	100	52
27	148	0	57	148	0	57	44
28	214	0	98	214	0	98	183
29	252	0	121	252	0	121	252
30	104	0	31	42	0	0	42
31	101	0	31	39	0	0	39
32	470	71	261	470	71	261	52
33	558	91	308	52	0	0	52
34	563	104	316	57	0	7	52
35	664	150	377	101	0	38	52
36	558	91	308	52	0	0	52
37	564	105	317	55	0	4	52
38	664	150	377	59	0	11	52

Year 3 Per. 2	Per. 3	Per. 1	Year 4 Per. 2	Per. 3	Per. 1	Year 5 Per. 2	Per. 3
0	0	44	0	0	91	0	0
0	0	52	0	0	58	0	0
0	0	43	0	0	99	0	0
0	0	39	0	0	99	0	0
0	0	52	0	0	53	0	0
0	1	44	0	1	99	0	0
0	81	183	0	81	94	0	0
0	121	252	0	121	60	0	0
0	0	43	0	0	99	0	0
0	0	39	0	0	99	0	0
0	0	52	0	0	51	0	0
0	0	52	0	0	99	0	0
0	0	52	0	0	99	0	0
0	0	52	0	0	99	0	0
0	0	52	0	0	99	0	0
0	0	52	0	0	99	0	0
0	0	52	0	0	99	0	0

both of which have very low beginning equities and are at the critical level. Both cases are able to use more of the owner's labor in subsequent years as the firm invests its savings from the initial year in hog facilities.

Fractional units of crop machinery were specified in many cases. This was less apt to occur in those solutions which were at the critical beginning equity level because these cases relied more on leasing machinery than on buying it. Only in Case 2 was a complete unit of machinery bought in the initial year. This case was at the critical beginning equity level of the contract which imposed the greatest annual financial obligations on the firm. Several cases bought a complete unit of Equipment 3 by buying fractions of it in several years. The fact that labor restrictions precluded the complete use of the capacity provided by a complete unit of Equipment 3 influenced the investment pattern. Investment in farrowing facilities occurred at realistic levels. Although fractional units of it and the finishing facilities were specified, the effect of adjusting the level of investment to an integer level would not greatly affect the cash flows in the model.

The investment pattern of the final year of the model is distorted from what would occur in a real situation. The difficulty arises from the fact that the model specifies that assets such as machinery and hog facilities earn a rate of return for the remainder of their lives which is entered into the objective function in discounted form. Current assets such as corn and cash that exist after the end of the fifth year do not have a rate of return entered in the objective function. Because of this, the model

reduces the amount of current assets in the fifth year by converting them to hog facilities or machinery. In some cases, it accumulates more assets than it has labor to efficiently utilize. It may use some farrowing facilities only twice a year rather than four times. In addition to liquidating its corn inventory, many solutions also obtain large amounts of credit to finance the assets. It should be noted that the model requires payment of income taxes for the fifth year, the obligations for the land contract and for intermediate term borrowing that fall due at the beginning of the following year, the minimum consumption for the operator in the next year, and the fixed costs for the assets in the following year. This tendency to convert current assets to longer term assets is much more pronounced as the beginning equity level is increased above the critical point. Those solutions obtained at the critical level barely show this tendency since their borrowing ability is constrained. The ability of some cases to obtain and repay large loans by the time of the fifth year suggests that at that time, other enterprises such as feeding beef or finishing hogs in confinement might become feasible for the firm to adopt. This increased repayment capacity might also be applied toward more rapid retirement of the land contract principal obligation if possible, or even towards obtaining additional land by land contract.

In general, the solutions of the model under the different sets of conditions imposed by the various land contracts showed that the firm would grow corn and soybeans on its own land as well as on land that is rented. In addition, it would grow feeder pigs and farrow twenty-two

litters of pigs until it was able to invest in additional farrowing facilities. With the addition of new farrowing facilities, feeder pigs would no longer be grown. The solutions also show that the firm would utilize short term credit to meet most of its operating expenses. These general results show the necessity of non-equity resources to the land contract buyer if he is to be successful in meeting the annual obligations imposed by the land contract, taxes, and his own consumption. The results also clearly demonstrate that to be successful in meeting the contract terms, the business must obtain income from sources other than the land that was bought. Of the eleven critical beginning equity levels, only two did not have hog activities in the first year. All cases rented land in all years.

CHAPTER VI. IMPACT OF DIFFERENT LEVELS OF BEGINNING EQUITY

This chapter discusses the impact of varying the level of beginning equity with a given set of contract terms for the cases that were solved with trend prices. In all but one of the various sets of contract terms, three different levels of beginning equity have been summarized with the statistics that were discussed in Chapter III.[1] As with the production organization of the firm, a general pattern emerges, but exceptions will be noted and discussed. The combinations of contract terms were stated in Table III-2 and the combinations of contracts and initial equity levels were summarized in Table V-1.

As previously discussed, the current ratio gives an indication of the current liquidity of the firm. As might be expected, this ratio is higher with the higher beginning equities when a particular contract is imposed on the firm. With the initial equities that are at the crucial level, the ratio is close to one at the end of the first year, but grows larger over time. In half of such cases, it declines in both Year 4 and Year 5, while in Case 11 it declines in the final year. These declines are caused by the transformation of current assets to intermediate term assets. In making this transformation, inventories of corn are depleted in Year 4 which causes a large income tax liability which also decreases the ratio.

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[1]For Contract 1 the maximum level for beginning equity level was set at $90,000. Only two solutions were obtained because the constraint set allowed reduction to $87,110.

In those cases not at the crucial level of beginning equity, no general pattern of change during the first four years emerges for the current ratio. In some cases it drops after the first year due to large investments in farrowing facilities in the second year. Some of the cases with initial equities that are above the critical level also show an upward trend of this ratio in the first years. In all cases not at the critical equity level, only Case 1 does not have a pronounced drop in the current ratio in the final year. This is caused by the model's propensity to make large investments in the final year. Case 1 is not much greater in beginning equity than the critical level for the contract so that large investments in the final year are constrained.

The significance of the current ratio is that it gives an indication of the firm's susceptibility to income fluctuation arising from reduced yields or lower prices. The ratio shows that the cases which started at a higher initial equity would be better able to withstand such problems in a given year. This is especially true in the earlier years. For those cases at the critical level of beginning equity, the rise in this ratio over time indicates progress in the firm's ability to withstand problems caused by downward fluctuation of income. These ratios are listed in Table VI-1.

The coverage ratio indicates the degree to which the income flows produced in the current year can pay the obligations due in the beginning of the next year. These ratios are shown in Table VI-2. When the ratio is less than one, it indicates that cash assets are being used to meet the

Table VI-1. Current ratios

Case	Year 1	Year 2	Year 3	Year 4	Year 5
1	1.50	1.60	1.53	1.65	1.83
2	1.38	1.42	1.52	1.54	1.73
3	2.47	2.20	2.31	2.50	1.38
4	1.81	2.11	1.83	1.97	1.82
5	1.41	1.66	1.63	1.78	1.82
6	3.42	3.32	2.64	3.60	1.38
7	2.37	2.14	2.07	2.26	1.41
8	1.48	1.70	1.63	1.72	1.80
9	2.06	2.40	2.03	2.23	1.44
10	1.58	1.86	1.80	2.02	1.70
11	1.40	1.65	1.67	2.05	1.83
12	2.68	2.51	3.04	2.69	1.38
13	2.25	2.11	2.57	2.30	1.47
14	1.44	1.84	2.18	1.97	1.87
15	4.59	2.65	2.63	2.35	1.58
16	2.72	2.56	2.74	2.16	1.48
17	1.57	2.02	2.47	2.16	1.72
18	2.16	2.90	2.40	2.16	1.45
19	1.68	2.27	2.40	2.01	1.57
20	1.39	1.54	1.67	1.69	1.89
21	2.09	2.08	2.42	2.15	1.58
22	1.76	1.90	2.21	2.04	1.70

Table VI-1. Continued.

Case	Year 1	Year 2	Year 3	Year 4	Year 5
23	1.43	1.86	2.18	1.99	1.83
24	2.55	2.49	2.78	2.35	1.45
25	2.16	2.19	2.58	2.19	1.64
26	1.50	1.84	2.14	1.97	1.86
27	2.17	2.82	2.26	2.18	1.52
28	1.69	2.29	2.28	2.02	1.64
29	1.41	1.65	1.93	1.87	1.87
30	2.40	2.40	2.85	2.40	1.47
31	2.01	2.02	2.42	2.21	1.69
32	1.47	1.83	2.17	1.92	1.97
33	1.74	2.06	2.40	2.30	1.87
34	1.50	1.76	2.28	2.08	1.58
35	1.47	1.70	2.12	1.99	1.46
36	1.90	2.29	2.60	2.46	2.14
37	1.62	1.95	2.46	2.31	1.76
38	1.59	1.91	2.43	2.22	1.63

Table VI-2. Coverage ratios

Case	Year 1	Year 2	Year 3	Year 4	Year 5
1	1.03	1.01	1.09	1.07	1.09
2	1.01	1.00	1.00	1.12	1.06
3	1.10	1.13	1.14	1.11	.81
4	1.03	1.02	1.15	1.08	.94
5	1.03	1.00	1.18	1.09	1.04
6	1.09	1.14	1.65	1.20	.80
7	1.09	1.11	1.27	1.11	.77
8	1.04	1.02	1.15	1.06	1.01
9	1.03	1.03	1.17	1.11	.80
10	1.05	1.03	1.22	1.14	.96
11	1.18	1.13	1.38	1.31	1.23
12	1.08	1.11	.99	1.52	.79
13	1.02	1.05	.94	1.41	.80
14	1.04	1.00	1.00	1.43	1.05
15	1.11	.91	1.13	1.55	.88
16	1.10	.97	1.16	1.55	.83
17	1.05	1.04	1.00	1.56	.74
18	1.03	.74	1.07	1.41	.83
19	1.02	.72	1.00	1.53	.91
20	1.02	1.03	1.00	1.22	1.10
21	1.08	.99	1.00	1.50	.88
22	1.07	.99	.99	1.44	.93

Table VI-2. Continued.

Case	Year 1	Year 2	Year 3	Year 4	Year 5
23	1.04	.98	1.00	1.45	1.04
24	1.10	.99	1.09	1.61	.82
25	1.09	1.03	1.00	1.54	.89
26	1.03	1.07	1.00	1.41	1.05
27	1.04	.89	1.10	1.33	.85
28	1.04	.80	1.04	1.49	.93
29	1.04	1.02	1.00	1.36	1.06
30	1.09	1.00	1.00	1.64	.83
31	1.09	1.02	1.00	1.54	.92
32	1.04	1.08	1.00	1.43	1.10
33	1.08	1.12	1.29	1.67	1.36
34	1.23	1.21	1.04	1.66	1.19
35	1.19	1.33	1.00	1.60	1.11
36	1.10	1.57	1.42	1.76	1.51
37	1.31	1.18	1.18	1.75	1.29
38	1.27	1.30	1.09	1.74	1.22

obligations. In certain cases, this occurs in Years 2 or 3, but this is because corn inventories are being built up in these years. This occurs in the second year of Cases 15, 16, 18, 19, 21 through 24, 27, and 28, and in the third year of Cases 12, 13 and 22. The net result of this can be seen by referring to Table VI-1 which shows that the current ratio either increased, or decreased due to large investments in those years. These ratios also drop below one in the final year for many of the cases. The cases which involve a critical beginning equity level have coverage ratios greater than one in the final year with the exception of Case 17. Those cases with coverage ratios that drop below one in the final year use operating capital to meet the obligations at the beginning of the sixth year, while those which have coverage ratios above one generate sufficient net cash flows to meet the obligations. The reason for the ratio being below one is the model's propensity to convert current assets into intermediate assets in the final year.

The cases with critical beginning equities are less apt to have coverage ratios that are less than one in the first four years. Only in Case 23 does the ratio drop below one. This is because these cases have very little cash which is used as operating capital. Because of this, they must generate income to meet the obligations of the following year. In almost all of the cases with critical beginning equity levels, the coverage ratio is close to one in the first two or three years. Case 11 does not conform to this pattern. Its coverage ratio is higher because it does not build up large inventories of corn.

No general pattern of coverage ratios emerges for the cases with non-critical beginning equity levels other than what has been discussed. Some of them have a much higher coverage ratio in Year 4 when the inventories of corn are liquidated. The coverage ratios are high in years prior to when large investments are made. The important point that these ratios bring out is that the cases which are at the critical beginning equity level are much more dependent on their cash flows to meet financial obligations. In addition, the closeness of this ratio to one in many such cases indicates that a year of low income could create a situation in which the firm would be unable to pay its financial obligations. The combination of higher coverage ratios and higher current ratios that are generally found as beginning equity is increased suggest that these cases would have a greater chance of success under conditions of income stress.

The debt-equity ratios are shown in Table VI-3. In all cases they decline during the first four years. In the cases at the critical beginning equity level, the decline in the final year as well. Most of the other cases rise slightly in the final year. This ratio declines because of growth in net worth and/or declines in the amount of debt outstanding, both of which are indicative of financial progress by the firm. The highest beginning equity with a particular contract has the lowest debt-equity ratios in the first four years. The decline of this ratio caused by amortizing the land contract principal implies progress towards complete ownership of the land. However, the decline in this ratio caused by increased equity or reduced debt for non-land assets means that the firm would have

Table VI-3. Debt/equity ratios

Case	Year 1	Year 2	Year 3	Year 4	Year 5
1	1.67	1.42	1.25	1.03	.87
2	1.74	1.49	1.26	1.08	.93
3	1.70	1.59	1.31	1.08	1.38
4	2.14	1.81	1.65	1.37	1.36
5	2.40	2.00	1.74	1.47	1.27
6	1.64	1.36	1.22	1.04	1.59
7	2.11	1.96	1.66	1.38	1.53
8	3.20	2.72	2.39	2.03	1.83
9	1.89	1.60	1.49	1.23	1.38
10	2.12	1.78	1.57	1.32	1.29
11	2.23	1.87	1.61	1.32	1.25
12	1.85	1.74	1.41	1.22	1.69
13	2.11	1.97	1.59	1.38	1.62
14	3.15	2.59	2.14	1.91	1.76
15	1.83	1.85	1.53	1.34	1.46
16	2.08	1.94	1.59	1.50	1.69
17	3.26	2.75	2.28	2.04	2.03
18	2.00	1.65	1.49	1.28	1.57
19	2.27	1.84	1.53	1.37	1.49
20	2.49	2.12	1.82	1.59	1.35
21	2.63	2.34	1.86	1.61	1.74
22	3.18	2.72	2.17	1.87	1.82

Table VI-3. Continued.

Case	Year 1	Year 2	Year 3	Year 4	Year 5
23	3.83	3.09	2.53	2.24	2.02
24	2.56	2.30	1.85	1.63	1.99
25	3.13	2.64	2.10	1.84	1.97
26	4.36	3.61	3.00	2.65	2.27
27	2.37	1.97	1.81	1.53	1.69
28	2.75	2.22	1.89	1.67	1.70
29	3.03	2.54	2.11	1.84	1.65
30	2.60	2.35	1.87	1.64	2.01
31	3.15	2.77	2.18	1.87	1.95
32	4.22	3.52	2.95	2.71	2.24
33	2.09	1.46	.99	.83	.67
34	2.37	1.69	1.16	.84	.84
35	2.46	1.76	1.30	.93	.95
36	2.46	1.67	1.15	.90	.76
37	2.90	2.01	1.35	1.00	.94
38	3.06	2.11	1.47	1.08	1.04

greater collateral value from these assets if it needed to obtain credit. The reduction in this ratio also decreases the amount of financial charges that must be paid from the income produced by the firm's assets. This reduces the risk of not being able to pay the financial charges due each year.

The rate of return on equity fluctuates from year to year within the various cases because of the inventorying of corn in some years and the depletion of those inventories in other years. However, with all but one case, the rate of return increases as the beginning equity level is decreased. Case 1 has a slightly higher initial equity position than does Case 2 and a higher rate of return in four out of the five years. The small difference in beginning equity allows a slightly more efficient production organization. The more general result is what would be expected from economic theory. A firm is usually faced with a hierarchy of projects or enterprises in terms of their rate of return. It allocates its resources first to the project with the highest marginal rate of return until its marginal rate of return is equal to the marginal rate of return for the next highest project. It then allocates resources to both of these projects until the marginal rate of return is equated to the third highest project's highest marginal rate of return. The process is continued until the capital budget is exhausted. As this process is continued and the capital budget is expanded, the average rate of return on equity declines. The statistics in Table VI-4 show that this occurs in the solutions of the model as the initial equity is increased with a given set of contract terms.

Table VI-4. Rates of return

Case	Year 1	Year 2	Year 3	Year 4	Year 5
1	15.45	13.46	17.65	15.49	17.03
2	13.74	12.50	11.53	16.39	14.51
3	16.33	18.56	19.85	15.26	6.10
4	19.88	14.31	24.31	18.75	13.92
5	21.71	14.48	24.90	18.25	19.74
6	10.58	7.86	34.41	13.04	6.11
7	14.32	19.08	29.91	19.68	8.95
8	23.37	16.18	27.83	20.76	23.59
9	18.05	13.46	23.23	18.21	11.77
10	20.57	14.21	24.18	18.08	15.09
11	21.86	13.86	25.03	18.56	18.13
12	13.64	16.07	9.40	33.76	5.71
13	16.19	18.51	10.86	35.90	7.69
14	25.84	13.55	12.16	37.79	21.08
15	9.94	3.61	16.79	38.41	7.29
16	11.07	6.96	17.38	42.65	6.77
17	18.82	11.91	9.17	44.13	4.72
18	17.59	--	16.74	34.40	8.28
19	18.72	--	9.81	39.09	13.76
20	18.56	15.68	12.30	23.43	19.23
21	20.01	13.66	12.82	42.13	10.68
22	25.27	14.98	14.20	41.93	15.95

Table VI-4. Continued.

Case	Year 1	Year 2	Year 3	Year 4	Year 5
23	29.47	13.40	12.92	42.91	22.95
24	15.63	13.01	18.64	49.86	16.19
25	19.37	15.62	12.77	48.05	12.45
26	23.12	18.70	12.12	44.38	25.87
27	19.80	6.14	21.10	32.83	9.84
28	21.96	1.47	15.09	41.55	15.16
29	23.59	16.32	12.76	33.32	22.28
30	17.09	10.94	10.43	47.56	6.66
31	22.84	16.33	12.93	46.14	12.99
32	28.15	19.82	12.02	41.16	26.95
33	49.23	38.05	39.63	57.06	25.18
34	77.46	53.73	26.10	62.18	26.60
35	74.40	67.70	24.79	61.45	27.44
36	51.42	66.31	46.77	61.00	27.25
37	94.57	51.07	35.16	67.26	28.13
38	91.74	66.37	29.27	70.13	28.83

The average rate of return is also affected by the use of debt funds. A simple example will illustrate this. Project A requires $500 and yields a ten percent rate of return. Project B also requires $500, but only yields a five percent rate of return. These two projects are the only alternatives for the use of equity funds. Funds may be borrowed at an interest rate of four percent. Situation 1 has $1,000 of equity funds which it invests in both projects to yield an average rate of return on equity of 7.5 percent. Situation 2 has $500 of equity funds and $500 of borrowed funds and invests in both projects also. The rate of return on equity in this situation is eleven percent. This effect is financial leverage and involves the use of debt funds as long as their use provides a return greater than their cost and as long as sources of debt are willing to provide the funds. The greater use of short term debt as the initial equity is reduced with a given contract resembles this effect and is partially responsible for the higher rates of return that are obtained as the beginning equity level is decreased.

With the exception of Cases 1 and 19, decreasing the initial equity level increased the annual and overall rate of growth of net worth as shown in Table VI-5. This is tied to the average rate of return. The lower equity levels had higher rates of return, and thus were able to generate more savings relative to the size of their net worth which resulted in more growth on a relative basis. Case 1 had a lower rate of return, and thus a lower growth rate than did Case 2. The overall rates of growth for Cases 19 and 20 are about the same. In general, the result of

Table VI-5. Percentage change in net worth

Case	Year 1	Year 2	Year 3	Year 4	Year 5	Overall
1	8.9	9.8	9.9	9.8	20.6	74.3
2	8.4	8.3	8.7	7.3	15.0	57.5
3	7.0	14.3	12.7	11.3	15.9	77.6
4	9.6	13.1	12.1	12.1	17.9	84.1
5	10.4	14.5	10.8	11.5	26.2	97.2
6	10.8	18.4	8.3	12.6	10.7	77.1
7	11.2	18.2	11.9	13.4	16.8	95.1
8	9.3	14.9	12.8	12.8	23.0	96.6
9	8.6	12.1	12.4	11.9	15.8	77.5
10	10.5	13.2	12.3	11.2	21.6	87.6
11	10.5	13.8	10.6	15.0	19.8	91.7
12	10.6	16.6	16.6	9.4	11.1	83.1
13	11.1	17.5	17.7	9.8	13.7	91.7
14	10.5	18.0	17.2	9.4	27.7	113.7
15	12.1	19.7	13.9	7.3	13.2	85.8
16	12.9	21.8	16.6	8.2	13.0	96.2
17	7.4	19.7	18.2	9.0	25.2	107.6
18	8.7	15.7	14.1	7.7	12.9	74.6
19	10.0	17.1	13.7	5.2	17.7	81.6
20	9.6	11.5	10.1	8.7	23.8	81.0
21	10.7	21.8	19.3	10.6	17.4	109.0
22	9.9	22.9	19.7	10.8	22.5	119.5

Table VI-5. Continued.

Case	Year 1	Year 2	Year 3	Year 4	Year 5	Overall
23	11.4	20.8	18.6	9.6	31.0	129.2
24	13.7	23.8	19.0	8.1	14.2	107.0
25	11.9	29.3	20.8	9.3	18.6	126.0
26	7.3	21.3	18.7	10.7	35.2	131.0
27	6.4	15.8	16.4	10.8	18.1	87.8
28	7.0	19.0	16.7	7.8	20.1	92.1
29	7.2	14.7	15.4	9.5	26.8	97.1
30	11.8	22.2	20.3	10.2	14.0	106.7
31	11.2	24.8	21.8	11.4	20.5	127.0
32	10.5	17.7	18.3	6.5	40.8	130.7
33	50.6	45.7	29.3	16.5	12.8	273.2
34	46.5	48.2	39.6	19.6	13.2	310.3
35	42.1	46.9	42.9	22.0	14.1	315.2
36	62.3	51.8	30.8	13.5	16.8	327.1
37	57.5	60.4	40.3	20.4	14.0	386.7
38	53.0	60.3	46.4	21.9	14.3	400.3

increasing the beginning equity decreases both the average rate of return and the growth rate of net worth with a given set of contract terms.

In summary, with a given set of contract terms, changing the initial equity level results in a general pattern of change in financial indicators. The firm's exposure to financial risk, its rate of return on equity, and its rate of growth of net worth were increased as the initial equity was decreased.

CHAPTER VII. IMPACT OF VARYING CONTRACT TERMS

Eleven different sets of contract terms were imposed on the model. These are compared in this chapter by examining their impact on the crit ical beginning equity level and by comparing the different contracts at the same beginning equity level with the five financial indicators.

Critical Equity Levels

Table VII-1 shows the critical beginning equity levels for the eleven contracts. It is evident from these results that adjusting land contract terms can have a large impact on the level of beginning net worth needed by the contract buyer. Contracts 1, 2, and 3 specify a twenty percent down payment and amortization of principal for fourteen years. Contract 1 uses the Springfield Plan of amortization and has the highest critical beginning equity level. Since this set of contract terms requires the highest total payment and the highest principal payment in the initial years of any of the eleven contracts analyzed, it is logical that it would require a large equity base in order to create a sufficient repayment capacity. This set of contract terms is close to what an average land contract in Boone County would specify. The land contract buyer would need at least $87,110 to successfully meet the obligations imposed by these terms under the conditions assumed by the model.

Contract 2 uses the Standard Plan of amortization. The critical beginning equity level drops by $25,140 to $61,970 from the critical level

Table VII-1. Critical beginning equities

Contract	Critical Level
1	$87,110
2	$61,970
3	$47,158
4	$66,448
5	$48,178
6	$46,938
7	$63,888
8	$41,086
9	$37,332
10	$54,369
11	$37,724
12	$37,332

required for Contract 1. The only difference in the two contracts is the plan of amortization. In the initial years, this contract requires a lower total payment as well as lower before-tax profits to pay the principal portion.

The use of Contract 3 with an Increasing Plan of amortization reduces the critical beginning equity to $47,158 which is $14,812 below the level required by the Standard Plan and $39,952 below the level required by the Springfield Plan. This reduction is caused by a further reduction of the

total payment and by a decrease in the amount of before-tax profits that must be generated in order to have sufficient after-tax income to pay the principal on the land contract in the first years. Both this plan and the Standard Plan allow the firm to create the additional repayment capacity needed in subsequent years by investing excess income in earlier years. In the case of the Springfield Plan this strategy is not possible since the largest payment occurs in the first year and the size of the payment becomes smaller in each succeeding year.

Contracts 4, 5, and 6 also require a twenty percent down payment, but amortization is for twenty years. The Springfield Plan of amortization is used in Contract 4 which has a critical level of $66,448. This level is $20,662 below that of Contract 1 which differs only in the length of amortization. Contract 4 has lower principal payments which lowers the total payment due and decreases the amount of before-tax income that must be generated to pay the principal.

Changing to a Standard Plan of amortization decreases the critical beginning equity level to $48,178. This is $18,270 less than Contract 4 which uses the Springfield Plan and $12,792 less than Contract 2 which is amortized in fourteen years. In both cases, the reduction is caused by a decrease in the size of the total and principal payments due each year.

Contract 6 uses the Increasing Plan of amortization, but does not result in large reductions of the critical beginning equity from those needed by Contracts 5 or 3. Its critical level of $46,938 is only $1,140 less than that of Contract 5, and $220 less than that for Contract 3. The

reason that this change does not greatly reduce the critical initial equity level is that there is a floor of $46,938 under which it cannot go without reducing the size of the down payment. This floor consists of the contract down payment, the owner's minimum consumption requirement, and the fixed costs for assets.

The size of the down payment is reduced to fifteen percent in Contracts 7, 8, and 9 while the amortization period is kept at twenty years. This results in further reductions in the critical equity level for all three contracts. The result of this change is to reduce the floor under which the critical beginning equity cannot go while at the same time increasing the total annual payment and both its interest and principal components. The size of the payments for the different amortization plans follow the same pattern as in previous cases.

Contract 7 is amortized on the Springfield Plan and has a critical beginning equity level of $63,888. This is a reduction of $2,560 attributable to the reduction in the size of the down payment. For Contract 8 which uses the Standard Plan, this difference is $7,092. For Contract 9, with the increasing Plan, the difference is $9,606. The closer the contract was to the floor level of initial equity with a twenty percent down payment, the greater was the reduction in critical initial equity achieved by reducing the down payment to fifteen percent. While Contract 7 required a smaller down payment, it required more investment in the first year to create a repayment capacity sufficient to handle the higher annual contract payments. Reducing the down payment by five percent in Contracts

8 and 9 from that required by Contracts 5 and 6 caused a greater decline in the critical beginning equity because little or no additional investment was needed to create the needed repayment capacity in the first years.

Contracts 10 through 12 are amortized for twenty-five years, have a down payment of fifteen percent, and are amortized with the Springfield Plan, Standard Plan, and Increasing Payment Plan respectively. The beginning equity level for Contract 10 was reduced by $9,519 from that for Contract 7 which is amortized for five less years. In the case of Contract 11 this reduction is $3,362. The reduction is lower because the critical beginning equity level was close to the floor level with Contract 8. Contract 12 was not imposed on the model because the same set of terms with five less years of amortization in Contract 9 showed the beginning equity level to be at the floor level dictated by the down payment, fixed costs, and consumption in the first year.

These results are significant because they demonstrate that by changing the land contract terms from those typically found, the use of land contracts to acquire a farm can be made possible for farmers with much lower equities. This is evidenced by the fact that the lowest critical level of initial equity, that for Contract 9, is less than half the highest critical initial equity, that for Contract 1. Changing the plan of amortization has the greatest impact on the critical beginning equity. Also, by stretching out the period of amortization, significant reductions are achieved. Reducing the size of the down payment has a smaller impact since it results in higher annual payments.

Financial Indicators

The current ratios, which were shown in Table VI-1, conform to the same relationship that was found in the previous chapter. This relationship was that as the initial equity level was increased from the critical level, the current ratio increased also. If different contracts are compared at the same equity level, the case that it is furthest from the critical level for its contract will have the highest current ratios. The case closest to the critical level will have the lowest current ratios. For example, of the four cases at the $80,000 level of beginning equity, Case 15 has the highest current ratios. Its beginning equity level is $33,062 above the critical level for Contract 6. By adjusting the contract terms in the right direction, a land contract buyer with a given equity can improve his liquidity position and thus provide greater protection against forfeiture of the land contracts.

Of the cases that were at the critical level of beginning equity, those cases which required the lowest annual contract payments had higher current ratios than those which had higher annual payments. Thus, the critical level for Contract 6 had higher current ratios than did any of the other contracts at the critical level while Contract 1 had the lowest current ratios. This relation arises because the greater annual contract payments require a greater repayment capacity. Greater repayment capacity is achieved by investment in non-current assets. If the acquisition of these assets is financed with intermediate term credit, an additional current liability is added to the balance sheet which reduces the current

ratio even more. This relation implies that the gradual building of repayment capacity from the firm's savings that occurs when the amount of income needed to meet the land contract payments increases over time allows the firm to have a better liquidity position in the initial years. Use of the Springfield Plan, however, tends to reduce the current liquidity of the firm because it requires a greater investment in non-current assets.

A general pattern is less easy to find in the case of the coverage ratios which were shown in Table VI-2. With a given beginning equity level, the coverage ratios increase as the difference between the critical beginning equity level and the actual level increases. Contract 7 at the $80,000 and $70,000 beginning equity levels does not conform to this pattern. This is because of the higher annual payments required by this contract. In most cases, the contract buyer can improve his protection against not having enough income in a year to meet the contract and other obligations by changing contracts at a given equity level. This parallels the implications given by the current ratios.

The coverage ratios at the critical equity levels show no definite pattern. The highest ratios occur with Contract 4, followed by Contracts 11, 9, 5, 8, 10, 6, 7, 2, 3, and 1.

The debt-equity ratio is influenced by different sets of contract terms. Two factors affect it at a given level. The rate at which debt is retired has a direct affect on the level of this ratio. The Springfield Plan will lead to a faster reduction in it while the Increasing Payment Plan will keep the ratio much higher. Reducing the down payment also will

increase the ratio and prevent it from decreasing as quickly. The lowest debt-equity ratio achieved was with Contract 1 which used the Springfield Plan of amortization. The highest ratios were at the critical beginning equity levels for Contracts 8, 9, and 11. If the contract buyer wishes to achieve a lower debt-equity ratio, the land contract terms can be adjusted to accomplish this. At a given beginning equity level, attempts to reduce the debt-equity ratio by changing the land contract terms will also reduce the current ratio. These ratios were shown in Table VI-3.

The particular set of contract terms that is chosen at a given level of beginning equity will affect the average rate of return. First, the difference between the initial equity and the critical level for the contract will affect the rate of return by constraining the amount of funds available to the firm. Second, the rate at which the land contract principal is amortized will affect both the buyer's equity level and the amount of interest that he pays on the contract. For this study, a proper rate of return cannot be specified. This will vary for individuals depending on the alternatives open to them for investing their funds elsewhere and on the amount of compensation needed to adjust for the risk involved with the use of the funds.

With a given beginning equity, the land contract buyer may wish to choose the set of contract terms that allows him to earn the highest rate of return. For example, of the three cases that are at the $90,000 beginning equity level, Case 1 has the highest rates of return. It has a Springfield Plan of amortization which results in a quicker retirement of

debt and lower interest payments. The highest rates of return for the cases at the beginning equity levels of $80,000 and $70,000 are earned by cases with Contract 4 which also uses the Springfield Plan of amortization. The faster retirement of land contract debt appears to have a favorable impact on the rate of return. This conclusion does not consider the unfavorable impact of the contracts which retire debt faster on the current liquidity of the firm. Table VI-4 showed the rates of return.

The overall rate of growth for net worth also varies among contracts at a given beginning equity level. The buyer who wishes to maximize the growth of his equity can do so by changing his land contract terms. For example, of the six cases at the $70,000 level of beginning equity, Case 16 provides the greatest growth of net worth. It should be noted that maximization of the rate of growth of net worth does not conflict with the goal of high current liquidity in most cases. The highest growth rates also usually occur when the Increasing Plan of amortization is used. Because of this, these higher rates of growth indicate that more of the increase in net worth is in non-land assets.

The growth of net worth at the critical beginning equities also varies as can be seen in Table VI-5. In general, net worth grows the least when the Springfield Plan is used. There is little difference in growth between the other two amortization plans at the same down payment and period of amortization, but as the size of the down payment is decreased and the period of amortization is extended, the rate of growth rises.

The analysis demonstrates that different sets of contract terms have different impacts on the critical beginning equity level. It also shows

that different sets of land contract terms have an impact on the current ratio, coverage ratio, debt-equity ratio, average rate of return, and growth of net worth when the beginning equity level is held constant or when it is at the critical level. When the contract buyer can influence the terms of the land contract during the negotiations with the seller, he has an opportunity to improve the contract's impact on his farm business. Adjusting the contract terms in a particular direction, however, may have both favorable and unfavorable effects.

CHAPTER VIII. IMPACT OF ALTERNATIVE PRICE LEVEL

Cases 33 through 38 are solutions obtained by using the actual farm prices received in 1973 in the model. Contract 1 was imposed on the firm in Cases 33 through 35 and Contract 7 in Cases 36 through 38. With both contracts, the critical beginning equity level occurred at the floor level set by fixed costs and consumption for the first year and the contract down payment. This level is $46,938 for Contract 1 and $37,332 for Contract 7. Since these two contracts require the highest payments in the initial years of all the contracts considered in this study, the other contracts would all have a critical beginning equity level at the floor level with this set of prices.

The six cases that represent solutions with 1973 prices have a general pattern of production activities. The rotation of corn and soybeans using Equipment 2 and 3 are the only crop activities used and the two activities that farrow two litters of pigs each year are the only livestock activities used. The amount of crops grown ranges from 259 acres to 413 acres and is generally greater than the amount grown in those cases using the lower set of farm prices. There are two reasons for this. First, higher earnings allowed more and earlier investment in Equipment 3 which uses the least labor per acre in the harvest season when labor is a limiting resource. The second reason is that no feeder pigs are grown in these solutions which allows more labor to be used in crop activities. Since more crops are grown, more land is rented in these cases also. Between 70 and

224 acres of land are rented in these cases. This is shown in Table V-5. After the first year, all of these cases approach a level of crop activities of slightly over 300 acres. The lower initial equities do not achieve these levels until Year 3 when enough of Equipment 3 is acquired to grow this level of crops. The levels of crop activities are shown in Table V-2.

The only livestock activities used in the solutions at 1973 prices were those which farrowed two litters of pigs per year. In the first year of the solutions not at the critical beginning equity level, 22 litters were farrowed. The two solutions which occur at the critical beginning equity level did not have any litters farrowed in the first year because no funds were available for investing in hog finishing facilities. Starting in the second year, all solutions invested in farrowing and finishing facilities to provide capacity for 150 litters of pigs per year. In the fifth year, all solutions invested in additional farrowing facilities which were only used for farrowing two litters instead of four. This allowed the farrowing of 159 litters in the fifth year in all solutions. Table V-3 shows the amount of litters farrowed in each year.

Both short and intermediate credit activities were important in financing the firm's production activities in these solutions. The use of short term credit occurred over a wider range of levels in the six solutions than it did in the solutions at the trend price level. In the first year, use is generally lower because only 22 litters of pigs were grown which reduced the need for financing the purchase of corn. Most of

the solutions at the trend price level grew feeder pigs in the first year which required the purchase of corn, and in turn the use of short term credit. The level of credit use is much higher in both the second and fifth years since more litters of pigs were raised which required the purchase of corn. Because corn was more expensive with this set of prices, more credit was required. The solutions with initial equities not at the critical level were able to greatly reduce the amount of short term credit used in the third and fourth years as corn was inventoried and cash was accumulated. Use rises in the fifth year due to the conversion of short term assets to longer term assets. The levels for this activity are shown in Table V-6.

The use of intermediate term credit was at a larger level and was generally used earlier with the 1973 price level than with the trend price level. The higher prices created a much higher repayment capacity and thus allowed greater use of this activity in order to acquire productive assets. The amount of funds borrowed in the final year was generally less than with those solutions at the trend price level because more assets were accumulated in earlier years and more cash was available. Table V-7 shows the levels for this activity.

The amount of unused labor is shown in Table V-8. For the six cases in which 1973 farm prices were used, these amounts are greater for the first three periods in the first year than for cases using the trend prices. This is because feeder pigs were not grown in the former cases. Non-use of labor was nearly eliminated when farrowing facilities were acquired in the second year.

For Contract 1, the critical beginning equity level is in Case 2 for the trend price set and in Case 35 for the 1973 price set. Case 20 and Case 38 are at the critical initial equity level for Contract 7 with trend prices and 1973 prices respectively. The critical levels that occur with 1973 prices have higher current ratios, higher coverage ratios, higher rates of return, and much larger changes in net worth. The debt-equity ratios for Cases 35 and 38 are much higher in the first two years than for Cases 2 and 20 respectively, but decline to the same general level in the final year. This is caused by greater intermediate term borrowing in the first two years in Cases 35 and 38. The other four financial indicators are higher because of the higher net cash flows resulting from the higher farm prices.

The important implication of the discussion of this chapter is that the level of future prices would have a large impact on the success or failure of the contract buyer over a certain range of initial equities for certain contracts. In the two contracts that were tested with both levels of prices, large gaps exist between the critical initial equities for the two price levels. The gap for Contract 1 is $40,172 and for Contract 7 is $26,556. Over these ranges of beginning equities, a contract buyer would be successful if 1973 prices were realized, but would fail to meet his financial obligations if farm prices fell to the level of the historical trend. This gap is lower for the other contracts that have been considered in this study. This is because the critical beginning equities are closer to the floor level of beginning equity in the cases

using trend prices while all contracts would be at the floor level if 1973 prices were used. Contracts 6, 9, and 12 would be successful at either price level since the critical beginning equity level is at the floor level with either set of prices. Thus, the low-equity contract buyer can adjust for uncertainty regarding future prices by two methods that have been considered in this study. First, an initial equity can be accumulated which will guarantee success with either set of prices. This may required delaying the purchase of a farm for several years. A more attractive alternative may be to adjust the contract terms so that the land contract is flexible enough to allow success over a broad range of price levels. When the seller will permit such adjustment, this alternative does not require delaying the purchase of farm land.

CHAPTER IX. CONCLUSIONS

This chapter reviews and summarizes the results of this study in terms of the objectives that were stated in Chapter I and with respect to the hypotheses that were put forth in Chapter II.

Success and Failure Elements in Land Contract Use

The first objective was to examine the use of land contracts on an *ex ante* basis in order to discover success and failure elements in their use. Four hypotheses were advanced in order to guide the inquiry.

Hypothesis 1

This hypothesis investigated the ability of the firm to meet its financial obligations under two different sets of prices. Prices realized in 1973 were compared to those that would be realized if commodity prices returned to the level of their historic trend. It was found that the impact varied among contracts, but with those contracts which imposed large principal payments in the initial years, the impact was the greatest. There was no difference in the beginning equity level necessary for success in several contracts where the annual principal payment increased over the years from low levels in the first year. Land contract buyers who enter into contracts with certain sets of terms would be successful under one set of prices, but not under a lower set of prices over a certain range of initial equities. This points to a need for land contract buyers

to consider two points before entering into a land contract. First, the level of expected future prices that can reasonably be expected relative to the financial obligations imposed by the land contract should be investigated. Second, alternatives should be considered which provide flexibility when future incomes are lower than expected.

Hypothesis 2

This hypothesis asked what the beginning equity level for a land contract buyer would need to be in order for the farm business to generate sufficient income. This varied as the terms of the contract and the price levels were varied. The critical levels for the twelve contracts when prices based on the historical trend are used are shown in Table VII-1. The critical levels for the two contracts that were tested at 1973 price levels are stated in the text of Chapter IX. The critical equity levels occurred over a range of $49,778 for the twelve contracts that were tested at the trend price level. The range is $9,606 for the two contracts tested at the 1973 price level. Since both these contracts impose the greatest principal payments in the initial years at the two levels of contract down payment and are at the floor level of beginning equity, the other ten contracts would also have critical initial equities falling at one or the other extreme of this range. Especially at lower price levels, the terms of the land contract can be adjusted to make their successful use possible for farmers with lower beginning equities. This can make the goal of land ownership possible for low-equity farmers sooner than would otherwise be possible.

Hypothesis 3

The sensitivity of a land contract buyer's business to downward income fluctuation is examined by Hypothesis 3. Three financial indicators were generated in order to give an indication of this. In terms of the current ratio, three factors were found to increase this ratio, and thus the firm's ability to withstand income stress. First, with the same set of land contract terms, increasing the beginning equity level caused the current ratio to be higher. Second, when different contracts are compared at the same equity level, those cases which have beginning equity levels that are furthest from the critical level for the particular contract have the highest current ratios. Finally, the current ratios for cases at the critical initial equity level were higher for contracts with increasing annual principal payments than for contracts with constant annual principal payments. This relation was caused by the fact that with constant annual principal payments, a high debt repayment capacity was needed in the first years which was created by investment in intermediate terms assets at the start of the first year. Those contracts which required increasing annual principal payments gradually built debt repayment capacity out of retained earnings rather than from the initial equity. Retained earnings were current assets for at least one year prior to being invested, and thus had a positive impact onthe current ratio. While continued income stress in several years might interfere with the building of repayment capacity leading to default on the contract in these cases, the building of repayment capacity with retained earnings does allow more flexibility and more

protection if income stress occurs in a single year due to reduced crop yields or abnormally low prices.

The coverage ratios also showed a pattern of change as beginning equity and contract terms were varied. The coverage ratios were generally higher as the initial equity was increased above the minimum level required for success. The ratio was less than one in some years for the beginning equity levels that were not at the critical level, while at the critical level they tended to be at one or slightly above in most years. This illustrates the greater dependence of cases at the critical beginning equity level on the generation of sufficient cash flows, and thus the greater threat posed by income stress. Comparing different contracts at a given beginning equity level generally showed that the further a particular case was from the critical beginning equity level required by the given contract, the higher were its coverage ratios. The results for the coverage ratios are similar to those for the current ratios.

The debt-equity ratios reflected the impact of different beginning equity levels and different contract terms in the manner that would be expected. Increasing the level of beginning equity while hilding the contract terms constant caused lower debt-equity ratios. The rate at which the land contract's payment plan retired the debt also affected this ratio. The contract with the highest annual principal payments caused lower debt-equity ratios while the contracts with the lowest annual principal payments in the first years caused the ratio to be high and to decline more slowly. Decreasing the down payment for the land contract also caused the

ratio to be higher. While lowering the debt-equity ratio decreases the proportion of fixed financial charges that the firm must pay from the annual returns on its assets, it also causes the firm to have a lower current liquidity as reflected by the current ratio at a given beginning equity level. This indicates that there is a tradeoff between these two indicators of financial strength.

Hypothesis 4

The final hypothesis guided the inquiry into determining the impact of changing the down payment, the amortization plan, or the length of amortization for the land contract. Changing the contract terms affected both the required level of beginning equity and the rate at which the land contract buyer's net worth grew.

Of the twelve contracts that were considered in this study, two different down payments, three different lengths of amortization, and three different plans of amortization are represented. Starting with the contracts which have the higher down payment and the shortest length of amortization, substantial decreases in the critical initial equity level occurred as the plan of amortization was changed from Springfield to Standard to Increasing Plans. When the length of amortization was lengthened or the down payment decreased, changing from the Springfield Plan to the Standard Plan resulted in further decreases of the initial equity level crucial to success, but little change in it occurred by changing from the Standard to the Increasing Plan.

Holding the down payment and plan of amortization constant, lengthening the amortization period caused the critical initial equity level to decline significantly for the Springfield Plan contracts, somewhat less for the Standard Plan contracts, and slightly or not at all for the Increasing Plan contracts. This pattern is reversed when the down payment is decreased while holding the other factors constant. The decrease in critical beginning equity level is largest for the contract using the Increasing Plan and smallest for the contract using the Springfield Plan.

Of the cases that were not at the critical beginning equity level, the highest rates of growth of net worth were achieved using the Increasing Plan of amortization. For those cases at the critical beginning equity level, the rate of growth was smallest when the Springfield Plan of amortization was used, but did not greatly differ between the other two plans. Holding the plan of amortization constant and increasing the length of amortization or decreasing the size of the down payment also caused higher rates of growth. The rate of growth is influenced in two ways. First, the rate at which the land contract debt is required will affect it. Second, the rate of return on equity will influence it. The results indicated that cases with lower initial equities earned higher rates of return. The above relations conform to a pattern of higher rates of growth as the contracts are varied to require lower initial equities. This suggests that the higher rates of growth occur more because of the initial equity level than because of the rate of land contract debt retirement.

These conclusions indicate that changing contract terms and beginning equity levels can have a substantial impact on land contract use by low-equity farmers. These results will be applied in the next section.

Improving Land Contract Use

The findings of this study may be used to improve the use of land contracts by low-equity farmers in acquiring ownership of farm land. For a given set of contract terms, increasing the buyer's initial equity level will improve his chances of successfully completing the terms of the land contract and acquiring full ownership of the land. This alternative may be unappealing to potential buyers since it involves waiting while the higher equity level is acquired. In addition, the benefits of this strategy may be negated if land prices are on the increase as they have been in recent years. When the seller of land is willing to negotiate the terms of the land contract with the buyer, there is an opportunity for the low-equity buyer to either acquire land at an earlier date than he otherwise could, or to improve the tolerance of his business to income stress after entering into the contract without increasing his initial equity. When the sellers are inflexible in setting contract terms and require a contract such as Contract 1, which reflects the terms of the average land contract in Boone County, Iowa, the buyer will have no options in this area.

Most farm businesses grow over a period of years as earnings from the business are retained and reinvested. This will be especially true for

farmers who are getting started in business and who because of this, have not acquired ownership of large amounts of assets. For this group of potential land contract buyers, the Springfield Plan of amortization is poorly suited. Total payments decline over time, and thus the large payments must be made prior to the time when the firm can use its retained earnings to build up its debt repayment capacity. While this plan minimizes the amount of interest paid on the land contract, this may not be a relevant goal for low-equity land contract buyers unless funds can be obtained in the desired quantities elsewhere at a lower cost. When faced with a higher cost of funds and/or external capital rationing, it is desirable for the low-equity buyer to use either the Standard or Increasing Payment Plan. This will be especially so when the land contract allows prepayment of principal. The building of debt repayment capacity also causes the firm's current liquidity to be higher in the initial years which gives added protection against income stress.

Land contract buyers with low equities would be well advised to increase the period of amortization and to reduce the size of down payment. The benefits of either of these will depend upon the plan of amortization being used. If the seller insists on the Springfield Plan and a given length of amortization, there is little to be gained from a smaller down payment. In general, adjusting the contract terms to require smaller principal payments in the initial years will be to his benefit.

For the land contract buyer who is uncertain as to the level of future farm prices, there exists the possibility of obtaining a land contract which could be successfully completed under a wide range of prices.

Failure to carefully consider the level of future prices relative to the obligations imposed by the contract could create a situation where the buyer was forced to forfeit the land contract.

The fact that the objectives of buyers and sellers will often conflict as the terms of the land contract are negotiated suggests that there is a need for financial intermediation in the use of land contracts. If the land contract instrument can be adapted so that financial intermediaries can be involved in its use, the tax and income objectives of the seller need not conflict with the low-equity buyer's need for a low down payment and lower payments in the early years.

Performance of the Model

As indicated previously, there were some problems with the model due to its propensity to convert current assets to longer term assets in the final year. However, the need for large cash flows to pay the contract obligations forced the model to generate realistic results in the other years. Also, the solutions that were at the critical level of initial equity were less distorted in the final year. Two factors contributed to the problem in the fifth year. First, in many solutions, by the time of the fifth year the firm had acquired all the intermediate term assets that it could use, given its supply of labor. The assets accumulated would be used if more labor was available starting in the fifth year. The second, and more important influence was that cash that existed after the fifth year had no value in the objective function. Placing a value on it as to

what it would earn in the future, appropriately discounted, would help to eliminate the problem of the final year. Since the problem that was being investigated was concerned primarily with the generation of adequate cash flows, the unrealistic pattern of investment that occurred in the final year does not affect the conclusions of this study.

Certain steps could be taken to improve the accuracy of the model. The parameters for intermediate term credit may overly restrict its use. However, the amount of intermediate term credit was internally restricted in many solutions bv debt repayment capacity, and not be availability of cash for collateral. More information is needed concerning the parameters that determine the availability of credit from institutions such as Production Credit Associations, commercial banks, and the Farmers Home Administration.

Certain adjustments and additions could be made to the model which would increase its size and the cost of obtaining solutions. First, the corn inventory could be used as a source of collateral for obtaining credit. This would eliminate the buying of corn in Years 2 through 5 caused by selling of corn in the previous year to meet financial obligations. Second, additional activities could be made available, especially in the later years. Since labor is a limiting resource in the harvest season for each year, an activity that would allow the hiring of additional labor either on a full time or part time basis would expand the options of the firm in later years. Third, the cash flows are aggregated into one year periods in this model. Disaggregation into seasonal flows would give

a better indication of the seasonal needs for short term credit and would allow a more accurate calculation of the costs of short term credit. Finally, the use of a progressive income tax rate structure in the model would give more accurate income tax liabilities. However, as shown in Table A-11, the use of a single rate does not greatly distort the liability since the rates change very slowly.

Further Research

There are several areas in which further research into the use of land contracts by low-equity farmers might be useful. As mentioned in the previous section, more information concerning the factors that affect the decisions of lenders when they deal with low-equity land contract buyers would be useful to any further studies. Further studies might take the same approach as this study, but investigate land contract use in other economic regions of Iowa where physical parameters and land prices are different. The length of the model could also be extended and additional activities could be added. This would be especially useful for investigating the impact of a land contract that had a balloon payment.

The most important area for further research is to study the impact of changing land contract terms on the seller. This study has not considered the impact of changing the land contract terms on the seller. Not only will the level of total income from the land contract vary as the terms are changed, but the annual income tax liability will vary as well.

A contract that will provide a given level of income desired by the seller can be imposed on the model. If the income from the land contract was the only source of income to the seller, the income from interest and capital gains could be taxed within the linear programming model. The income tax liability would then be deducted from the seller's income. An equality constraint on annual after-tax income would mean that the seller would have the desired income he wished to have. This formulation would require two sets of additional activities in each year, additional rows to accumulate income from capital gains, interest, and non-taxable principal income, restraints to require the payment of income taxes in each year, and some flexibility in the length of amortization and the level of payments in the final years. A set of activities would allow a progressive tax rate on the seller's income subject to taxes.

In addition to requiring a minimum level of annual income for the seller from the land contract, the above formulation could also be adapted to include a prepayment privilege. The equality constraint on after-tax income would be changed to a minimum constraint and the amount of prepayment privilege would be a maximum constraint on the amount of principal repayment in each year. The length of amortization could be left open under this formulation. The size of down payment could also be endogenously determined by this type of formulation within constraints set by the seller. Such formulations of the linear programming model would allow contract payments that are best for the land contract buyer given the requirements imposed by the land contract seller.

This concludes this chapter and the study. The importance of land contract use in Iowa points to a need to know the impact of such use on both the buyer and the seller. It is the author's hope that this study has produced additional information concerning the use of land contracts by low-equity buyers both in prospect as well as in retrospect.

BIBLIOGRAPHY

1. Baker, C. B. "Financial Organization and Production Choices." American Journal of Agricultural Economics 50 (December, 1968): 1566-1577.

2. Beneke, Raymond R.; and Winterboer, Ronald D. Linear Programming Applications to Agriculture. Ames, Iowa: The Iowa State University Press, 1973.

3. Beuscher, Jacob H. Law and the Farmer. New York: Springer Publishing Company, Inc., 1953.

4. Boehlje, Michael. "Economic Considerations and Tax Issues in Real Estate Transfers." Iowa Cooperative Extension Service Law-Econ. 85, 1974.

5. Duncan, E. R.; and Shrader, W. D. "Ames Reservoir, Agronomic Data." Unpublished report, Iowa State University, 1972.

6. Eletson, R. Vern; and Raup, Philip M. "Financing Farm Transfers with Land Contract." Minnesota Agricultural Experiment Station Bulletin 454, 1961.

7. Fardi, M. A. "Iowa Farm Land Values Rise 13 Percent in 1966." Iowa Farm Science 21 (February, 1967): 3-4.

8. Gadsby, D. W. "Iowa Farm Land Values Creep up in 1962." Iowa Farm Science 17 (February, 1963): 3-4.

9. Harris, Marshall; and Hines, N. William. "Installment Land Contracts in Iowa." Monograph No. 5. Iowa City, Iowa: Agricultural Law Center, College of Law, The University of Iowa, 1965.

10. Herder, W. D. D. "Iowa Farm Land Values Reach All Time High." Iowa Farm Science 19 (February, 1965): 3-4.

11. Howell, H. B. "Comparing Iowa Farm Land and Common Stocks for Capital Growth and Earnings." Iowa Cooperative Extension Service FM 1668, 1973.

12. Howell, H. B.; and Stoneberg, E. G. "Suggested Farm Budgeting Costs and Returns." Iowa Cooperative Extension Service FM 1186, 1973.

13. Hull, Dale O.; and Hirning, Harvey J. "Estimating Farm Fuel Requirements for Crop Production and Livestock Operations." Iowa Cooperative Extension Service Pm-587, 1974.

14. Iowa Dept. of Agriculture. "Number and Size of Farms, Iowa State Farm Census." Des Moines, Iowa: Iowa Crop and Livestock Reporting Service, 1971.

15. Iowa Dept. of Agriculture. "Iowa Annual Farm Census, 1973 (Preliminary)." Des Moines, Iowa: Iowa Crop and Livestock Reporting Service, 1974.

16. Iowa Dept. of Agriculture. "Number of Farms and Land in Farms." Des Moines, Iowa: Iowa Crop and Livestock Reporting Service, 1974.

17. Iowa Dept. of Agriculture. "Farm Labor and Wage Rates." Des Moines, Iowa: Iowa Crop and Livestock Reporting Service, 1974.

18. Iowa Dept. of Revenue. "Iowa Income Tax Return for 1974." Des Moines, Iowa: Iowa Dept. of Revenue, 1974.

19. Iowa Dept. of Revenue. "Summary of Real Estate Assessment/Sales Ratio Study." Des Moines, Iowa: Iowa Dept. of Revenue, 1962 through 1973.

20. Irwin, George D. "A Comparative Review of Some Firm Growth Models." Agricultural Economics Research 20 (July, 1968): 82-100.

21. James, Sydney C., ed. Midwest Farm Planning Manual. Ames, Iowa: The Iowa State University Press, 1973.

22. Kay, Ronald Duane. "A Dynamic Linear Programming Model of Farm Firm Growth in North Central Iowa." Unpublished Ph.D. dissertation, Iowa State University, 1971.

23. "Land--A Hedge Against Inflation." Ames Daily Tribune (Dec. 14, 1974): 22.

24. Maas, W. "Iowa Farm Land Values Up." Iowa Farm Science 18 (February, 1964): 3-4.

25. Mann, Fred L. "A Comparative Study of Laws Relating to Low-Equity Transfers of Farm Real Estate in the North Central Region." North Central Regional Publication Number 136. Columbia, Missouri: University of Missouri, 1961.

26. Murrary, W. G.; and Fardi, M. A. "Iowa Farm Land Values Rise 10 Percent in '65." Iowa Farm Science 20 (February, 1966): 7-8.

27. Murray, W. G.; and Maas, W. "Iowa Farm Land Values Hold Steady in 1961." Iowa Farm Science 16 (February, 1962): 3-4.

28. Murray, W. G.; and Magill, W. M. "Land Values Rise 9 Percent in 1967." Iowa Farm Science 22 (February, 1968): 3-6.

29. Murray, W. G.; and Magill, W. M. "Land Values Rise 3½ Percent in 1968." Iowa Farm Science 23 (February, 1969): 3-6.

30. Murrary, W. G.; and Porter, D. E. "Rise in Land Values Slows to 2 Percent in 1969." Iowa Farm Science 24 (February, 1970): 7-9.

31. Murray, W. G.; and Porter, D. E. "Land Values Show Small Gains in 1970." Iowa Cooperative Extension Service Economic Information 168, 1971.

32. Murray, W.; Walker, L.; and Pritchard, R. "Land Price Increase Largest in Half Century." Iowa Cooperative Extension Service FM 1663, 1973.

33. Murray, W.; Walker, L.; Pritchard, R.; Futrell, G.; Howell, H.; and Stoneberg, E. "Land Values Double in 8 Years." Iowa Cooperative Extension Service FM 1681, 1974.

34. Reynolds, John E. "Financial Experiences with Land Contracts in Iowa." Unpublished M.S. thesis, Iowa State University, 1963.

35. Schwart, R. B. "Purchasing Used Machinery." Illinois Cooperative Extension Service, 1972.

36. Smith, Allen C.; and Baker, C. B. "The Effect of Real Estate Debt Commitments on Non-Real Estate Credit and Liquidity of the Firm." Illinois Agricultural Economics 9 (January, 1969): 1-6.

37. Standard Federal Tax Reporter. New York: Commerce Clearing House, Inc., 1975.

38. Stoneberg, E. G.; and Winterboer, R. "1973 Cash Rental Rates for Iowa Farmers." Iowa Cooperative Extension Service Pm 521 (Rev.), 1974.

40. Stoneberg, E. G. "Central Iowa Farm Record Summary, Area 3." Iowa Cooperative Extension Service FM 1122, 1951.

41. Stoneberg, E. G. "1960 Iowa Farm Business Summary, North Central Iowa." Iowa Cooperative Extension Service FM 1366, 1961.

42. Stoneberg, E. G. "1964 Farm Business Summary for North Central Iowa." Iowa Cooperative Extension Service FM 1474, 1965.

43. Stoneberg, E. G. "1973 Farm Business Summary for Central Iowa." Iowa Cooperative Extension Service FM 1686, 1974.

44. Trede, Larry Dean. "Swine Production Systems as Related to Business Management on North Central Iowa Farms." Unpublished M.S. thesis, Iowa State University, 1968.

45. U.S. Dept. of Agriculture. "Agricultural Finance Statistics." AFS-2. Washington, D.C.: Government Printing Office, 1974.

46. U.S. Dept. of Agriculture. "Agricultural Prices, Annual Summary, 1973." Washington, D.C.: Government Printing Office, 1974.

47. U.S. Dept. of Agriculture. "1973, Changes in Farm Production and Efficiency." Statistical Bulletin No. 233. Washington, D.C.: Government Printing Office, 1973.

48. U.S. Dept. of Agriculture. "Farm Cost Situation." FCS-43. Washington, D.C.: Government Printing Office, 1972.

49. U.S. Dept. of Agriculture. "Farm Real Estate Market Developments." CD-78, Supplement 1. Washington, D.C.: Government Printing Office, 1974.

50. U.S. Dept. of Treasury. "Farmer's Tax Guide." Washington, D.C.: Government Printing Office, 1975.

51. U.S. Dept. of Treasury. "1974 Instructions for Form 1040." Washington, D.C.: Government Printing Office, 1974.

52. U.S. Water Resources Council. "Agricultural Price Standards." Guideline 2. Washington, D.C.: Government Printing Office, 1974.

53. Van Horne, James C. Financial Management and Policy. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1974.

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APPENDIX: PARAMETERS OF THE MODEL

Table A-1. Coefficients for crop activities fertilizer and limestone use

	Cost Per Pound	Quantity[a]	
		Continuous Corn	CCS Rotation
Nitrogen	.055	130	250
Phosphorus	.105	40	110
Potassium	.054	80	160
Limestone	.003	272	510

Crop Yields[b]

Activity	Corn	Soybeans
Corn 1	108	--
Corn 2	108	--
Corn 3	108	--
CCS 1	216	36
CCS 2	216	36
CCS 3	216	36

[a](5).

[b](5).

Table A-1. Continued.

Variable costs

Cost[c]	Continuous Corn	CCS Rotation
Seed	$ 7.59	$22.20
Herbicide	4.97	16.24
Insecticide	.99	1.98
Drying	2.39	4.78
Fertilizer and Lime[d]		
N	7.15	13.75
P_2O_5	4.20	11.55
K_2O	4.32	8.64
Limestone	.82	1.53
Diesel Fuel[e]	1.71	5.03
Other	.86	2.25
Fertilizer Application[f]	1.44	2.88
Lubrication Costs[g]	.26	.75
Total	$36.70	$91.58

[c]Except where noted, all costs are from: (43).

[d](5).

[e](13).

[f](39).

[g](21, p. 125).

Table A-1. Continued.

Repair costs per acre

Equipment System	Repair Costs Per Acre[h]
1	$ 6.48
2	8.20
3	12.17

Total variable costs

Activity	Total Variable Costs
Corn 1	$ 43.18
Corn 2	44.90
Corn 3	48.87
CCS 1	110.43
CCS 2	115.52
CCS 3	127.60

Gross returns

Activity & Price Level	Years 1-4	Year 5
Corn 1,2,&3		
Trend Prices	--	$170.64
1973 Prices	--	248.40
CCS 1,2,&3		
Trend Prices	$150.12	491.40
1973 Prices	198.00	694.80

[h](35).

Table A-1. Continued.

Net revenue		
Activity & Price Level	Years 1-4	Year 5
Corn 1		
Trend Prices	$-43.18	$127.56
1973 Prices	-43.18	205.22
Corn 2		
Trend Prices	-44.90	125.74
1973 Prices	-44.90	203.50
Corn 3		
Trend Prices	-48.87	121.77
1973 Prices	-48.87	199.53
CCS 1		
Trend Prices	39.69	380.97
1973 Prices	87.57	584.37
CCS 2		
Trend Prices	34.60	375.88
1973 Prices	82.48	579.28
CCS 3		
Trend Prices	22.52	363.80
1973 Prices	70.40	567.20

Table A-2. Labor requirements

Activity	Period 1 Dec.-Mar.	Period 2 April-June	Period 3 July-Sept.	Period 4 Oct. & Nov.
Corn 1[a]	.21	1.63	.56	2.34
Corn 2	.21	1.45	.56	2.30
Corn 3	.21	1.25	.55	1.89
CCS 1	.55	4.81	2.09	5.87
CCS 2	.53	4.41	2.05	5.74
CCS 3	.52	3.83	1.82	4.72
Hog 1[b]	9.15	6.03	6.23	3.34
Hog 2	7.20	5.43	5.68	3.14
Hog 3	2.70	3.22	5.00	3.96
Hog 4	9.70	7.55	7.49	4.76

[a](21, p. 101).

[b](44, p. 107).

Table A-3. Variable costs, corn requirements, gross returns, and net returns for hog activites

Variable Costs[a]	Hog 1	Hog 2	Hog 3	Hog 4
Purchase cost	--	--	--	$ 690.36[b]
Supplements & Minerals	$ 235.00	$ 235.00	$ 117.50	238.95
Breeding Charge	6.00	6.00	3.00	--
Veterinary & Medical	31.00	31.00	15.50	51.90
Machinery Variable Costs	54.00	54.00	27.00	57.00
Miscellaneous	3.60	3.60	1.80	3.60
Total	$ 329.60	$ 329.60	$ 164.80	$1041.81
Corn Requirement (Bushels)	202	202	102	321
Yields				
Pigs weaned per unit	15	15	7.5	--
Feeder pigs bought	--	--	--	30
Market hogs sold	13.8	13.8	6.4	29.1
Cwt. of pork sold[c]	30.36	30.36	14.08	64.02
Cwt. of pork sold--sow[d]	4	4	4	--
Gross Revenue Trend Prices[e]	$ 956.85	$ 956.85	$ 494.33	$1818.81

[a](12).

[b]When 1973 output prices are used, this cost is $939.

[c]Market hogs are sold at 220 pounds each.

[d]Sow is sold after second farrowing at 400 pounds. The trend price is $23.58 per cwt. and the 1973 price is $32.03 per cwt.

[e]A gilt is retained from each of the activity units for Hog 1, 2, and 3.

Table A-3. Continued.

	Hog 1	Hog 2	Hog 3	Hog 4
Net Revenue Trend Prices	$ 627.25	$ 627.25	$ 329.53	$ 777.00
Gross Revenue 1973 Prices	1300.01	1300.01	671.61	2471.16
Net Revenue 1973 Prices	970.41	970.41	506.81	1180.71

Table A-4. Machinery investment

Equipment[a]	System 1 Type	System 1 Price	System 2 Type	System 2 Price	System 3 Type	System 3 Price
Disk	10 ft.	$ 850	14 ft.	$ 1,462	20 ft.	$ 2,759
					14 ft.	1,462
Plow	4 Bottom	1,420	5 Bottom	2,000	7 Bottom	2,274
Harrow	20 ft.	328	30 ft.	379	30 ft.	379
Planter	4 row	1,949	6 row	2.923	8 row	4,114
Cultivator	4 row	1,191	6 row	1,516	8 row	1,732
Rotary Hoe	4 row	758	6 row	1,083	8 row	1,299
Sprayer	8 row	812	8 row	812	8 row	812
Combine	4 row	12,722	4 row	12,722	large	24,500
Corn Head	4 row	5,630	3 row	4,233	8 row	8,745
Tractor	3-4 plow	6,900	5-6 plow	12,500	6-8 plow	13,859
					4-5 plow	8,283
Pickup Truck	3/4 ton	3,400	3/4 ton	3,400	3/4 ton	3,400
Wagon	200 bu.	1,083	200 bu.	1,083	200 bu.	1,083
Total		$37,043		$44,113		$75,780

[a](21, pp. 121-122).

Table A-4. Continued.

Personal Property Tax[b]	System 1	System 2	System 3
Year 1	$ 604	$ 703	$ 1,202
Year 2	$ 490	569	967
Year 3	432	498	840
Year 4	366	427	714
Year 5	304	356	588
Fixed Costs for Truck	$ 287 per year		

[b](21, pp. 225-228).

Table A-5. Hog facility investment activities

	Swine Expansion 1	Swine Expansion 2	Swine Expansion 3
Capacity	Farrow 4 litters per year	Finish 10 pigs--3 times per year	Farrow and Finish 1 litter
Useful Life (years)	20	5	10
Investment Cost	$720[a]	$69[b]	$274[b]
Annual Depreciation	$36	$13.80	$27.40
Assessed Value for Property Taxes[c]	$194.40	$18.63	$73.98
Annual Personal Property Tax[d]	$14.75	$1.41	$5.61
Annual Repairs Cost[e]	$25.20	$2.41	$9.59
Annual Insurance Premium[f]	$1.08	$.10	$.41
Total Annual Fixed Costs	$41.03	$3.92	$15.61

[a](44, p. 85).

[b](21, p. 94).

[c](21, pp. 225-229).

[d](21, pp. 225-229).

[e](21, p. 159).

[f](21, p. 159).

Table A-6. Fixed expenses

Expense	Cost
Real Estate Taxes[a]	$2,164
Insurance Costs	648
Building Maintenance and Repairs[b]	686
Contract Interest	varies
Intermediate Term Loan Interest	varies

[a](21, p. 225; 19, p. 10).

[b](21, p. 159).

Table A-7. Consumption, principal repayment and partial rent repayment

Expense	Cost
Minimum Consumption[a]	$5,014
Contract Principal	varies
Intermediate Term Principal Due	varies
Partial Rent ($30 x Acres Rented in previous year)	varies

[a](21, p. 254). The data was used to estimate a linear consumption function. The intercept estimate is used for minimum consumption, and the slope value is used for determining marginal consumption.

Table A-8. Estimation of the rate of return on machinery

Resource	Amount[a]	Cost[b]	Value
Labor	4.74 Hrs.	$5/Hr.	$ 23.70
Operating Capital	$43.18	.15	3.23
Land	1 acre	$60	60.00
Machinery			
Depreciation	--	--	16.00
Fixed Costs	--	--	2.41
Total			$105.34

Net Revenue from Corn 1 (Trend Price) = $127.46

Net Revenue - Total Resource Value = Residual = $22.12

Investment Cost = $160

Residual Divided by Investment Cost = $22.12/$160.00 = .138

Annual Rate of Return = 13.8%

[a]Amount of resources used is that for one unit of Corn 1.

[b]The following costs are assumed: required rate of return on operating capital is 15% per year and labor is valued at $5.00 per hour. Land cost is represented by the cost of renting land.

Table A-9. Estimate of the rate of return on Swine Expansion 1 and 2

Resource	Amount[a]	Cost[b]	Value
2 Gilts	$125.00	15%	$ 18.75
Operating Capital	329.60	15%	49.44
Labor	46.2 hrs.	$5.	231.00
Corn	404 bu.	$1.73	698.92
Depreciation	--	--	50.00
Fixed Costs	--	--	46.91
Total			$1095.02

Net Revenue from Hog 1 and 2 = $1254.50

Net Revenue - Total Resource Value = $159.48 = Residual

Investment Cost = $823.50

Residual Divided by Investment Cost = $159.48/$823.50 = .19

Annual Rate of Return on Investment = 19%

[a]The amount of resources used by both Hog 1 and 2 are included in the calculations since the farrowing facilities can be used by both. To complete the activities, 1.5 units of Swine Expansion 2 are required and these are included in the calculations.

[b]The following costs are assumed: required rate of return on operating capital and investment in gilts is 15% and labor is valued at $5/hour. The cost of buying corn is used to value the corn used.

Table A-10. Estimate of rate of return on Swine Expansion 3

Resource	Amount	Cost[a]	Value
1 Gilt	$62.50	.075%	$ 4.68
Operating Capital	$164.80	.075%	12.36
Labor	14.88 hrs.	$5/hr.	74.40
Corn	102 bush.	$1.73	176.46
Depreciation	--	--	27.40
Fixed Costs	--	--	15.61
Total			$310.91

Net Revenue from Hog 3 = $329.53

Net Revenue - Total Resource Value = $18.62 = Residual

Investment Cost = $274.00

Residual Divided by Investment Cost = $18.62/$274.00 = .06

Annual Rate of Return on Investment = 6%

[a]The following costs are assumed: required rate of return on investment in gilts and operating capital is 15% per annum and labor is valued at $5/hour. The cost of buying corn is used to value the corn used.

Table A-11. Combined income tax rates[a]

Taxable Income	Income Tax Rate	After Tax Income
$ 7,058- 9,410	24.29%	$ 5,343- 6,969
$ 9,411-11,763	25.93%	$ 6,970- 8,559
$11,764-13,999	27.23%	$ 8,560-10,059
$14,000-15,999	28.14%	$10,060-11,417
$16,000-17,999	28.63%	$11,418-12,756
$18,000-19,999	29.12%	$12,757-14,040
$20,000-21,999	29.79%	$14,041-15,305
$22,000-23,999	30.42%	$15,306-16,514

[a]Combined rate includes Federal and Iowa Income Taxes and Federal Self-Employment Tax. (50, pp. 54-55; 37, p. 11, 021; 18).

Table 12. Income tax rates used

Contract	Year 1	Year 2	Year 3	Year 4	Year 5
1	30.42%	30.42%	30.42%	30.42%	30.42%
2	28.63%	28.63%	29.12%	29.12%	29.12%
3	25.93%	27.23%	28.14%	28.63%	29.12%
4	28.63%	28.63%	28.63%	28.63%	28.63%
5	27.23%	27.23%	27.23%	27.23%	27.23%
6	24.29%	25.93%	25.93%	25.93%	27.23%
7	29.12%	29.12%	29.12%	29.12%	29.12%
8	27.23%	27.23%	27.23%	27.23%	28.14%
9	24.29%	25.93%	25.93%	27.23%	27.23%
10	28.63%	28.63%	28.63%	28.63%	28.63%
11	25.93%	25.93%	25.93%	25.93%	25.93%
12	24.29%	24.29%	25.93%	25.93%	25.93%

Table A-13. Contract payments

Contract	Year 2		Year 3	
	Principal	Interest	Principal	Interest
1	$10,979	$10,759	$10,979	$ 9,991
2	6,816	10,759	7,293	10,282
3	3,050	10,759	4,270	10,546
4	7,685	10,759	7,685	10,221
5	3,751	10,759	4,013	10,497
6	1,601	10,759	2,241	10,647
7	8,166	11,432	8,166	10,860
8	3,984	11,432	4,263	11,153
9	1,701	11,432	2,381	11,313
10	6,532	11,432	6,532	10,974
11	2,579	11,432	2,760	11,251
12	1,126	11,432	1,576	11,353

Table A-13. Continued.

Contract	Year 4		Year 5	
	Principal	Interest	Principal	Interest
1	$10,979	$ 9,212	$10,979	$ 8,454
2	7,803	9,772	8,350	9,225
3	5,490	10,246	6,710	9,863
4	7,685	9,583	7,685	9,145
5	4,294	10,216	4,595	9,915
6	2,882	10,490	3,522	10,289
7	8,166	10,288	8,166	9,717
8	4,562	10,854	4,881	10,535
9	3,062	11,146	3,742	10,931
10	6,532	10,517	6,532	10,060
11	2,953	11,058	3,160	10,851
12	2,027	11,242	2,477	11,101

Table A-14. Labor availability

Month	Period	Hrs. per day	Days	Total hrs. available	Overhead labor	Net labor
Dec.	1	8	26.6	212.8	25	187.8
Jan.	1	8	26.6	212.8	25	187.8
Feb.	1	8	24.0	192.0	25	167.0
March	1	8	26.6	212.8	25	187.8
Total	1	8	103.8	830.4	100	730.4
April	2	10	25.7	257	25	232
May	2	10	26.6	266	25	241
June	2	10	25.7	257	25	232
Total	2	10	78	780	75	705
July	3	9	26.6	239.4	25	214.4
August	3	9	26.6	239.4	25	214.4
Sept.	3	9	25.7	231.3	25	206.3
Total	3	9	78.9	710.1	75	635.1
October	4	10	26.6	266	25	241
November	4	10	25.7	257	25	232
Total	4	10	52.3	523	50	473