ENTRY INTO FARMING: THE EFFECTS OF LEASING AND LEVERAGE ON FIRM SURVIVAL

James W. Richardson, Catharine M. Lemieux and Clair J. Nixon

The 1979 Farm Finance Survey revealed that 42 percent of all farmers are over 55 years of age and these farmers control 48 percent of all farm assets. This implies that the ownership of about one-half of all farmland will be transferred in the next three decades. This turnover in ownership will intensify the capital requirements of agriculture. In 1970 the average capital requirement for a farm with \$40,000–\$60,000 gross sales was \$412,507 (Hottel and Barry). As in 1970, the question still remains, "How are aspiring young farmers going to gain control of enough resources to establish a viable operation?"

As debt-free farmers retire and low equity new entrants replace them, the financial structure of the farm sector will be greatly altered. Machinery accounted for 47 percent of the \$26.4 billion worth of assets acquired by the farm sector in 1981. The means by which this machinery is acquired will affect the future viability and growth potential of the farm sector. In the past, capital has largely been financed out of equity, but in 1981 nearly half of all machinery acquired was financed with debt (USDA). As the credit reserves of the agricultural sector are drawn down by declining net farm incomes, causing agricultural lenders to be more cautious in their lending practices, how are young farmers going to qualify for the necessary credit? Knutson, Penn, and Boehm identified this problem of entry into agriculture as "one of the major farm problems" (p. 269).

It is often repeated that the only way to enter agriculture is to "inherit it or marry it." However, 66.8 percent of all farmers (and 66.7 percent of all farmers under 25) reported they bought their farms from nonrelatives (*1979 Farm Finance Survey*). How new entrants gain control of the capital required to operate their farming enterprise then becomes an important issue when discussing the future structure of agriculture.

The overall objective of this study is to evaluate the effects of various equity structures on the survival and growth of new entrant cotton farmers on the Texas High Plains. A secondary objective is to compare the effects of leasing versus ownership of land and machinery on firm survival and growth.

Traditionally, machinery leasing has been evaluated in a partial budgeting or net present value framework (LaDue; Willet and Penland; Plaxico and Kletke). These methods do not consider the long-term effects of the lease versus borrow decision on potential survival of the farm operation. In this study we investigate the effects of various combinations of initial equity positions and debt financing versus leasing for tenant and part owners of a typical 640-acre cotton farm in the Texas High Plains. These results enable one to determine the implications of alternative capital structure on the survival/success of farms in the study area and on the future structure of agriculture.

Various studies, both surveys and simulations conducted during the 1960s, pointed to the availability of credit as one of the most limiting factors to young farmers trying to become established (Lu, Horne, and Tweeten; Epperson and Bell; Thomas and Jenson). Gaining control of a viable farming operation is an old problem. Kaldor and Jetton, in their 1966 survey of farmers in Iowa, found that 74 percent received some form of family assistance. In spite of this assistance, many farmers still worked in nonfarm jobs to accumulate necessary capital for entry. Available equity is a major factor in any loan decision. Patrick and Eisgruber found that capital rationing, either internally due to individual preferences or externally due to lack of sufficient resources, affected the rate of farm expansion. As a part of a 1969 simulation study on the process of firm growth, Boehlje and White examined the effects of two different beginning equity levels (40 and 75%) on firm growth. They concluded that equity ratios affected growth by changing net worth, thus influencing the operator's ability to borrow money for expansion. They found that higher net worth allowed faster expansion of capital-intensive operations with a resulting higher income and net worth at the end of 20 years.

Barry and Baker in their explanation of the life cycle theory of growth for an agricultural firm state that, "a blend of leasing and ownership provides financial diversification, stabilizes resource control, and builds equity" (p. 53). In conclusion, they pointed out a need for further research on the impact of various financial arrangements on farm firm growth.

MACHINERY LEASING

Leasing is becoming a prominent means of acquiring control of farm assets for several reasons: (1) The first year's lease payment is generally less than the down payment required under a financing operation.

James W. Richardson is an Associate Professor, Agricultural and Food Policy Center and Clair J. Nixon is an Assistant Professor, Accounting Department at Texas A&M University. Catharine M. Lemieux is an Agricultural Economist, Economic Research Service, U. S. Department of Agriculture.

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(2) Marginally profitable operations, particularly new entrants, cannot take full advantage of some of the tax consequences of ownership (for example, investment tax credit and first-year expensing). (3) A lease-purchase option for farm machinery can act as a hedge against rising machinery prices by fixing the purchase price at the end of the lease. (4) Lease payments are fixed for the term of the contract, while machinery loans are increasingly being written with variable interest rates, thus adding more uncertainty to the already uncertain world of weather and prices facing the farmer. (5) Leasing may be the only option available to gain control of the asset either because it is the only way the asset is available (such as land) or because of the low equity position of the operator. (6) Legally a lessor has a credit position superior to a lender. (7) The lease payment is generally a deductable expense for income tax purposes.

Tax implications of leasing arrangements are critical in any evaluation of a lease versus buy decision. The lessee (farm operator) in most leasing arrangements is allowed to deduct the annual lease cost of property as an ordinary business expense (Internal Revenue Code Sec. 162 [a] [3]).

Since farm operators usually take advantage of the cash method of accounting, they are allowed to deduct lease payments in the year they are paid. However, this deduction is allowed only for the amount allocable to the particular tax year. Since the lease payments for machinery are generally due at the beginning of the cropping season, this causes no problems. What the above position disallows is the advance payment of rent for future years to reduce current year's taxable income (Treasury Regulation 1.162–11).

There is the potential, however, to cloud the deductability of the lease payments when the lease contains an option to purchase. If the leasing arrangement is construed to be a purchase, the annual payments are treated as capital expenditures, and the only recovery cost for the farm operator is through depreciating the capitalized cost of the asset. The main condition for determining if lease payments are deductable as rent is whether the farm operator will acquire title or equity in the property as a result of the payments having been made. Merely having an option-to-purchase agreement in the lease will not necessarily void the rent deduction. In a strict lease/option arrangement, no title or equity in the property can be acquired up to the time that the lessee exercises the option.

Leasing has been recommended as an ''off balance sheet'' method of financing because of the importance of the leverage (debt/equity) ratio in loan eligibility determinations. However, as the frequency of leasing increases, lenders have come to realize that long-term lease payments have the same effect on cash flow as loan payments. Since it is cash flow that affects the repayment ability rather than just the quantity of debt for a given amount of equity, lenders rightfully should be concerned about leasing. In the past, leasing has been considered the more expensive option. However, it is possible for the lessor to pass some of the tax benefits of ownership back to the lessee in the form of lower interest rates, particularly with the lease provisions under the current tax law.

The principal disadvantage to leasing is that capital gains accrue to the owner of the asset. Another important consideration is that leased equipment does not contribute to the borrowing capacity or credit reserve of a farm operator. Such a reserve may be essential for the survival of the operation in times of fluctuating income.

SIMULATION MODEL AND TYPICAL FARM

The Firm Level Income Tax and Farm Policy Simulator (FLIPSIM V) was used for this analysis (Richardson and Nixon). The model is a firm level, recursive simulation model that simulates the annual production, farm policy, marketing, financial management, growth, and income tax aspects of a farm over a 10-year planning horizon (Figure 1). The model recursively simulates a typical farm by using the ending financial position for one year as the beginning position for the next year. The model is a Monte Carlo simulation model as opposed to a normative programming model. It does not include a normative objective function, but simulates a representative farm for a large number of replications in an uncertain environment. By changing the assumptions regarding beginning equity, debt structure, and machine leasing, the probable outcomes for alternative means of entry into farming can be simulated. An overview of how the model operates is presented below after a brief description of the typical farm used for the analysis.

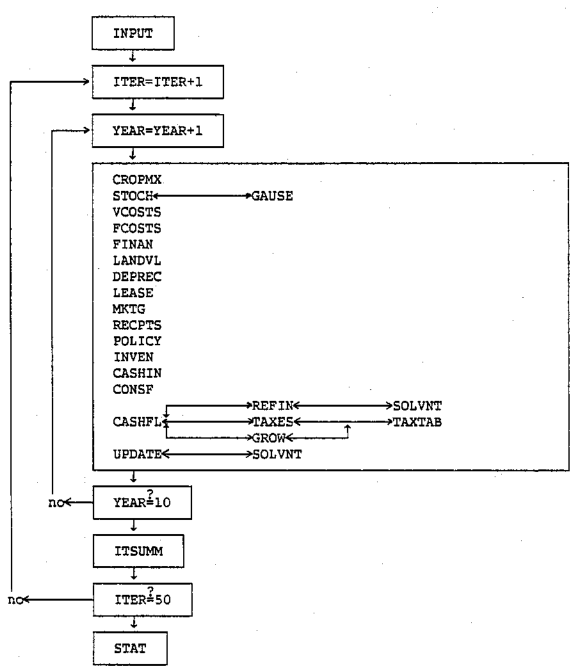

Figure 1. Diagram of the Subroutines in FLIPSIM V

Typical Farm

The typical farm used for this analysis is a 640-acre cotton farm in the Texas High Plains. Information to describe the farm was obtained from a stratified random sample of cotton farms in Lynn, Lubbock, and Gaines counties (Smith). Approximately 43 percent of the cropland on the farm was irrigated. Average yields for farmers in the area were 410 lbs./acre for irrigated cotton and 182 lbs./acre for dry-land cotton. Average lint and cottonseed yields were assumed to increase at the rate of 1 percent per year over the 1983–92 planning horizon.[1] The average price for cotton lint in 1983 was set at $0.50/lb. for the typical grade and staple of cotton produced in the High Plains. Annual average cotton lint and seed prices were increased an average of 7.9 percent per year, based on the average annual increases in cotton lint price forecast by Chase Econometrics for 1983–92.

Production costs for irrigated and dry-land cotton in the study area were obtained from enterprise budgets developed by the Texas Agricultural Extension Service.[2] These 1982 costs were inflated annually in the model based on projected inflation rates provided by Chase Econometrics. Annual inflation rates for labor, seed, fertilizer, chemicals, fuel, and harvesting costs were, respectively, 6.4, 7.4, 10.9, 5.0, 10.3, and 4.6 percent. Land values were inflated an average of 5.7 percent per year, based on the Chase forecast. Also based on the Chase Econometrics forecast, the purchase price of new replacement equipment was increased an average of 6.2 percent per year. The nominal market value of the used machinery was assumed to increase 1 percent per year over the period.[3] Interest rates assumed for the typical farm analysis were based on the Chase Econometrics forecast.[4]

Chase Econometric's projected loan rates and target prices for cotton lint were adjusted for the typical grade and staple of cotton produced in the study area. The projected loan rate and target price for cotton increased 49.8 percent and 51.3 percent respectively, over the 10 years from their 1983 announced levels over the planning horizon. The 1983 acreage reduction program (20 percent set aside) was assumed to be only 10 percent effective in reducing cotton production. It was assumed that the farm operator participated in all farm program provisions (except Payment in Kind), and the acreage reduction program was discontinued after 1983. The typical farm did not participate in FCIC all-risk crop insurance.

For the analysis reported here, the crop mix for the typical farm was held constant with 43 percent of the cropland planted to irrigated cotton and 57 percent planted to skip-row, dry-land cotton (CROPMX in Figure 1). The initial crop mix was allowed to change (decrease the proportion of irrigated cotton) as the farm grew, based on typical crop mixes for larger farms in the study area (Smith). The per acre cost of production and machinery requirements were also adjusted at discrete intervals (960, 1280, 1800, 2800, and 3800 acres) as the farm grew, based on the results of a farm survey by Smith.

Simulation Model

The model generated random values for annual crop prices and yields (STOCH in Figure 1). For this study, annual prices and yields for dry-land and irrigated cotton lint and cotton seed were drawn at random from a multivariate normal probability distribution.[5] The 10-year planning horizon was replicated 50 times, selecting a different set of random prices and yields each year. Since a pseudo-random number generator was used to generate the random values, the same set of random yields and prices was used for each equity option analyzed.

Variable costs of production (VCOSTS in Figure 1) for the farm were calculated for each crop enterprise and summed to obtain total input costs. Harvest costs were calculated by multiplying production times updated harvesting costs per yield unit. Production and harvesting costs were decreased for landlord participation in fertilizer and ginning costs (25%) associated with rented cropland. Labor cost was the sum of full-time employee salaries plus wages paid to part-time employees. The amount of part-time labor hired was the residual labor required each month after fully utilizing full-time employees and unpaid family labor. Labor costs and per acre production costs were identical for all beginning entry options analyzed.

Property taxes were calculated as the product of a constant property tax rate for the study area and the agricultural-use value of owned land in the previous year (FCOSTS in Figure 1). Other fixed costs for the farm were calculated by inflating their initial values by an average annual inflation rate of 4.6 percent.

Interest cost for operating capital was calculated based on the farm's total variable cost of production, the annual interest rate for operating capital, and the fraction of the year the operating money was used (6 months). Existing and new long- and intermediate-term loans were amortized based on their life, principal owed, and annual interest rate (FINAN in Figure 1). Long-term loans were 30-year loans, and intermedi-

[1] Average annual cotton lint yields were increased 1 percent per year to account for improved managerial ability and technological changes.

[2] Production costs for irrigated and dry-land and cotton in 1982 were, respectively, $139.13 and $59.76 per acre. These variable per acre expenses include seed, fertilizer, chemicals, fuel, lube, repairs, harvesting, and other miscellaneous cash costs. Labor and operating interest costs are calculated separately for the farm as a whole.

[3] The annual inflation rate in the nominal value of used machinery is not forecasted by Chase Econometrics since this value is specific to each local market. Over the 1975–80 period, the nominal value of used machinery on the typical cotton farm in the southern Texas High Plains increased an average of 1 percent per year. These calculations were based on annual quotas for a complement of equipment purchased new in 1974.

[4] The interest rates for initial long- and intermediate-term loans were 10 and 14 percent respectively. Annual interest rates for all new loans were allowed to change over time, based on Chase Econometrics' forecast of the annual prime commercial interest rate for 1983–92. The long-term interest rate was set at 0.5 percentage points over the prime; intermediate-term interest rates were set at 1.5 percentage points over the prime; the interest rate charged on operating loans was set at 3.0 percentage points over the prime; and interest rates received for cash reserves were set at 3.0 percentage points under the projected prime. The forecasted prime rate for 1983–92 is: 0.142, 0.137, 0.122, 0.188, 0.109, 0.106, 0.105, 0.105, 0.105, 0.103.

[5] Prices for cotton lint and actual lint yields for producers in the Lubbock area over the 1971–81 period were used to estimate the covariance for the multivariate normal distribution. The covariance matrix was estimated using deviations from trends for these variables. Mean yields were obtained by inflating current average yields 1 percent per year, while mean prices were developed from price forecasts provided by Chase Econometrics. The procedure for drawing random values from a multivariate normal distribution described by Anderson (pp. 11–19) and demonstrated by Clements, Mapp, and Eidman was used in the model.

ate-term were 5-year loans. All loans were amortized using the remaining balance method (Penson and Lins, pp. 178–79). Variable interest rates were used for new loans based on annual interest rates developed from the Chase Econometrics forecast. Regardless of the combination of rented land and owned land, the operator paid the same interest rates.

The market value of land and farm machinery was updated annually (LANDVL in Figure 1). The simulation model calculated depreciation for each item of machinery owned by the operator (DEPREC in Figure 1). For equipment purchased prior to 1981, the model calculated depreciation using the double declining balance method, assuming a 7-year life. Equipment put into service after 1980 was cost recovered using the 5-year accelerated method. For equipment purchased after 1982, the model assumed a 5-year cost-recovery period and that the operator elected not to take first-year expensing. Equipment that had reached the end of its economic life (8 years for tractors and pickups and 10 years for other machinery items) was traded in on a new replacement. The farm operator was permitted to replace an old piece of equipment if sufficient cash was available (including the market value of the old piece of equipment) to meet the 30 percent down payment requirement, and if the additional debt did not cause the intermediate-equity ratio to fall below its minimum, 30 percent. If sufficient funds were not available, the operator continued to use the piece of machinery until capital became available for its replacement. Investment tax credit was calculated for new purchases of machinery.

The machinery-leasing section of the model (LEASE in Figure 1) permitted the operator to lease any piece of equipment in the machinery complement, for a variable length of time, at a fixed annual lease rate. When the leasing option was used, it was assumed that the operator would begin the planning horizon leasing all tractors, cotton strippers, and large implements on a 5-year lease with a 9.7 percent rate (average annual percentage rate).[6] At the end of the 5-year lease, it was assumed that the operator would buy the piece of equipment for its predetermined salvage value (25 percent of the original market value). Depreciation and investment tax credit were taken on the purchase. Although the farm operator for the typical farm was a new entrant, he started farming with a mixture of new and used equipment. For the scenarios involving leasing of machinery, it was assumed that the operator had 100 percent equity in machinery not under a lease agreement.

Annual cash receipts were computed based on acres harvested (a fixed fraction of planted acreage), stochastic yield, and stochastic annual average price (adjusted by a seasonal price index for the marketing month). Cash receipts were adjusted to reflect the landlord's share of the cotton crop (25 percent) on rented cropland (MKTG and RECPTS in Figure 1). Since cotton in the study area was marketed across tax years (60 to 80 percent is marketed before January 1), the model calculated annual cash receipts as the sum of receipts for cotton produced in year $t-1$ and marketed in March of year t, and cotton produced and marketed in year t. It was assumed that 60 percent of the cotton lint was sold in the year it was produced, regardless of the operator's beginning equity position or tenure arrangement.

Whenever the season average price cotton lint was less than the target price for cotton, a deficiency payment was made (POLICY in Figure 1). The payment was the payment rate times farm program yield (average annual yields for 1971–80) times farm program acreage (planted acres) times the national allocation fraction (0.90). The payment rate was the lesser of the target price minus the season average lint price or the target price minus the loan rate. The landlord's share of deficiency payments were deducted for cropland rented on a cropshare.

Family cash withdrawals from the new entrant were held constant in real 1982 dollars by inflating a minimum cash withdrawal of $10,000/year by Chase's projected change in the Consumer Price Index, 6.1 percent per year (CONSF in Figure 1). Family living expenses were held at this minimum for all options since the operator was assumed to be a beginning entrant with low equity. Once family withdrawals were calculated, the final cash flow position for the farming operation was determined by the model. Cash flow surpluses were invested in short-term money market funds, while deficits were covered immediately (CASHFL in Figure 1).

Cash flow deficits were covered by (1) obtaining a loan secured by crops being held for sale in the next tax year, (2) obtaining a second mortgage on equity in farmland and/or machinery, or (3) selling farmland (REFIN in Figure 1). It was assumed the operator could obtain a mortgage on up to 70 percent of the equity in farmland and machinery and that he would sell off the most recently purchased farmland first if forced to dispose of farmland. If an operator availed himself of these options and still could not remove the deficit, the farm was declared insolvent. Cropland sold due to cash flow deficits was assumed to be leased back on a cropshare basis the following year. Since cropland could be sold to avoid insolvency, operators who owned land initially could withstand greater cash flow deficits than operators who leased both land and machinery.

Personal income taxes and social security taxes were calculated for the farm operator assuming that the operator was married, filing a joint income tax return, and itemizing personal deductions (TAXES in Figure 1). The regular income tax liability was computed using two methods: (1) income averaging (if qualified) and (2) the standard tax tables. The model selected the tax strategy that resulted in the lower income tax liability. All investment tax credit allowances were deducted from the regular tax liability, and the result was compared to the income tax liability under the alternative minimum tax. The operator paid the excess of the alternative minimum tax over the sum of the regular in-

[6] The machinery lease gives the machinery company the depreciation and investment-credit benefits. The effective annual lease rate is 19.7 percent.

come tax liability and the regular minimum tax. Income tax rate schedules for 1983 and 1984 were included in the model, as well as a procedure to develop tax rate schedules for 1985–92 on the basis of changes in the Consumer Price Index.

The farm was permitted to grow by purchase of cropland if the operator had sufficient cash to cover the down payment for the cropland (30%), plus additional machinery necessary, without borrowing against his equity in land to meet either of these down payment requirements (GROW in Figure 1). The farm operation could grow by leasing land if the operator could meet the down payment requirements for purchasing additional machinery needed by the proposed larger size farm. If machinery was purchased due to growth, the machinery was depreciated, and the operator's income taxes were recalculated.

RESULTS

The alternative debt structures and leasing options analyzed in this study are summarized in Table 1. Option 1 is the average equity position for individual farmers 25 and under, as reported in the *1979 Farm Finance Survey*. Option 2 represents an individual with a low level of equity in land and 80 percent equity in machinery. (The *1979 Farm Finance Survey* reported that 51.6 percent of all Texas farmers have no debt on their machinery. This figure was 31.3 percent for farmers 25 and under.) Option 3 represents an individual with minimum equity in both land and machinery. Options 4 and 6 had the same equity levels for machinery as options 2 and 3, but zero equity in land; that is, these farm operators are tenants. Options 7 and 8 represent individuals who had the same equity in land as options 1 and 3, but leased most of their machinery.

Table 1. Alternative Beginning Equity Options for a 640-Acre Cotton Farmer in the Texas High Plains

Option	Total Beginning Equity[a]	Beginning Equity in Cropland		Beginning Equity in Owned Machinery	
	($)	($)	(%)	($)	(%)
	Own Both Land and Machinery				
1	137,000	120,000	60	17,000[b]	20
2	122,000	60,000	30	62,000	80
3	84,000	60,000	30	24,000	30
	Lease Land and Own Machinery				
4	62,000	0	0	62,000	80
5	39,000	0	0	39,000	50
6	24,000	0	0	24,000	30
	Own Land and Lease Majority of Machinery[c]				
7	144,000	120,000	60	24,000	100
8	84,000	60,000	30	24,000	100
9	64,000	40,000	20	24,000	100
	Lease Both Land and Majority of Machinery[c]				
10	24,000	0	0	24,000	100

[a] The capital requirement reported here does not include the operating loan needed for the first year.
[b] The *1979 Farm Finance Survey* reported this equity position as typical for individuals 25 years old and under.
[c] In all options involving leased machinery, it was assumed the producer had 100 percent equity in 25 percent of the machinery complement (about $24,000 worth of equipment) and leased the remainder of the equipment on a 5-year lease.

Option 10 represent a farmer who rents both land and the majority of his equipment. The beginning equity levels for these 10 scenarios ranged from $264,000 for option 7 to only $24,000 for options 10 and 6 (Table 2).

The results of simulating the 10 scenarios stochastically for 50 iterations (replications) are summarized in Table 2.[7] These results show that option 1, representing the typical capital structure for young farmers

Table 2. Results for Simulating a 640-Acre High Plains Cotton Farm Assuming Alternative Levels of Equity and Combinations of Owned and Leased Farm Machinery

Variables	Beginning Equity Options[a] 1	2	3	4	5	6	7	8	9	10
Prob. of Survival[b]	86	74	44	64	54	38	86	76	46	66
After-Tax Net Present Value ($1000)[c]										
mean	1650.6	2099.5	1113.4	1967.1	1218.8	1094.7	1784.8	1370.8	925.1	1098.9
std. deviat.	2132.4	2798.9	2236.8	3130.3	2184.0	2322.0	1982.9	2279.0	2042.0	1661.7
coef. var.(%)	129.2	133.3	200.9	159.1	179.1	212.1	111.1	166.2	220.7	159.2
Acres Farmed Last Year										
mean	2806.4	3091.2	1984.0	2854.4	2179.2	1884.8	2969.6	2355.2	1779.2	2316.8
std. deviat.	1240.7	1480.4	1688.9	1426.8	1257.3	1510.7	1127.3	1343.3	1512.6	1187.8
coef. var.(%)	44.2	47.9	85.1	49.9	57.7	80.2	37.9	57.0	85.0	51.3
Ending Leverage Ratios										
mean	0.91	1.07	1.67	1.25	1.57	1.82	0.67	1.07	1.91	1.06
std. deviat.	0.91	1.09	1.15	1.19	1.22	1.15	0.80	1.00	1.34	0.98
coef. var.(%)	100.00	101.86	68.86	95.20	77.71	63.19	119.40	93.46	70.15	92.45

[a] The beginning equity options are defined in Table 1.
[b] Probability of survival is the probability the farm will remain solvent for 10 years. A farm was declared insolvent when its leverage ratio exceeds 2.34. The probability of survival is computed as the number of solvent iterations divided by the total number of iterations, 50.
[c] After-tax net present value is the present value of the net annual family withdrawals plus the present value of change in net worth over the 10-year planning horizon. A nominal, after-tax discount rate of 4 percent was used for the calculations.

[7] All input data to describe the typical farm were held constant across all options analyzed. In addition, no changes were made in the model from one option to the next. Thus, the differences in Table 2 are due only to the differences in beginning equity in land and machinery and to the proportion of land and machinery leased.

in the U.S., offered one of the greatest chances of survival of those tested. The only other capital structure option that approached it for probability of survival was option 7, which had 60 percent equity in real estate and leasing machinery. Because of the built-in initial credit reserve, the magnitude of the probabilities of survival fairly closely followed the initial capital outlays required for each option, except for options 3, 9, and 10. Option 3 is the most likely capital structure for an individual starting business without family assistance. This capital structure had one of the lowest probabilities of success of all options tested, although it required almost 350 percent more initial capital than option 10 (a full tenant leasing machinery).

Option 9 was another case where a redistribution of the initial capital outlay brought about a substantial improvement in the firm's probability of survival. If the money invested in land had been invested in machinery, the probability of survival would have increased nearly 40 percent over option 4. Option 10, the all-leasing option, was one of the least expensive options in terms of initial capital outlay, but had a probability of success which exceeded option 4 (leased land and 80 percent equity in machinery), even though option 4 required a 250 percent greater capital outlay. The full tenant who leased machinery (option 10) had a higher probability of surviving 10 years than a tenant who debt-financed all machinery (option 6). Options 3, 5, 6, and 9 all required high loan payments in proportion to beginning equity and had the lowest chance of survival of all options simulated.

Average after-tax net present value was greatest for option 2 (30 percent equity in land and 80 percent equity in machinery). Option 4 (80 percent equity in machinery only) had the second highest average after-tax net present value. These two options were third and fourth, respectively, in required initial capital, so it would appear that the initial capital structure (both options had invested only minimal amounts in land) enabled these firms to grow at a faster rate. For the most part, the average number of acres farmed the last year of operation had the same ordering as average after-tax net present value. The options with the lowest probability of success (9, 3, and 6) had the highest coefficients of variation for the variables in Table 2. The all-leasing option (option 10) had one of the lowest standard deviations for after-tax net present value and acres farmed in the last year, indicating a tighter distribution for the reported variables. As expected, the higher the ending leverage ratio for all options, the lower the probability of survival.

Each year of the planning horizon the leverage ratio for the firm is compared to the maximum allowable leverage ratio (2.34) to determine solvency. If the firm is insolvent, the iteration is stopped and the year the firm went bankrupt recorded. The probability the firm will remain solvent for a given number of years (that is, its cummulative probability of survival) can be calculated from these data. The probability of survival decreases over time, due to the lumpiness of machinery replacement, farm growth, and accumulation of debt from these activities.

Table 3. Probability of a 640-Acre High Plains Cotton Farm Remaining Solvent for a Given Number of Years, Assuming Alternative Beginning Equity and Machinery Leasing Situations

	Beginning Equity Options[a]									
YEAR	1	2	3	4	5	6	7	8	9	10
1	1.00	1.00	0.68	1.00	0.98	0.74	1.00	0.84	0.56	0.90
2	1.00	1.00	0.56	0.94	0.86	0.68	1.00	0.84	0.54	0.90
3	1.00	0.98	0.52	0.92	0.78	0.58	1.00	0.84	0.54	0.90
4	1.00	0.96	0.52	0.84	0.68	0.56	1.00	0.84	0.54	0.88
5	1.00	0.90	0.50	0.80	0.68	0.54	1.00	0.84	0.52	0.88
6	0.98	0.84	0.50	0.72	0.68	0.54	0.98	0.82	0.50	0.86
7	0.92	0.80	0.50	0.66	0.60	0.48	0.96	0.82	0.48	0.84
8	0.90	0.76	0.50	0.66	0.54	0.42	0.96	0.82	0.48	0.76
9	0.88	0.74	0.46	0.64	0.54	0.40	0.90	0.78	0.48	0.68
10	0.86	0.74	0.44	0.64	0.54	0.38	0.86	0.76	0.46	0.66

[a] The alternative beginning equity options are defined in Table 1.

Table 3 indicates the cummulative probability of survival for the typical farm under the different beginning equity options for each year of the planning horizon. The cummulative probabilities of survival do not change significantly, but it is interesting to compare the chances of survival at the halfway point, five years. As a group, the probabilities of survival changed the least for the options with leased machinery. This would indicate that leasing payments provided needed flexibility in the first few years of operation.

CONCLUSIONS

A whole-farm simulation model was used to analyze the effects of various beginning equity structures on the survival and growth of a typical Texas High Plains cotton farm. The farm was simulated recursively over a 10-year planning horizon using stochastic prices and yields to develop probability distributions for selected output variables. The farm selected for the analysis was a typical 640-acre family-farm operation in the area. It was assumed that this question would be representative of a new entrant. Four types of scenarios were simulated: (1) debt-financing both land and machinery, (2) leasing land and debt-financing machinery, (3) debt-financing both land and leasing machinery, and (4) leasing both land and machinery. Different equity levels were included under each debt-financing option.

One of the primary conclusions to be drawn from this study is that anyone attempting to enter farming in the Texas High Plains by maximizing leverage for land and machinery (option 3) is unlikely to survive for 10 years. Leasing both land and machinery (option 10) increased the chances of survival for the operation and required less than one-third the initial capital outlay for option 3. Investing limited capital in land did not increase the chances of survival of the operation because the principal and interest payments exceeded the returns available from agricultural production, while the rental payments did not. (This result was expected because the purchase price of land included capital gains expectations not included in determining the rental price of land.) Using limited capital as a downpayment toward financing machinery (options 5 and 6) instead of leasing major pieces of equipment (option 10) also lowered the probability of survival of the operation. Even with 80 percent equity in financed machinery (option 4) the probability of survival was less than the total leasing (option 10). The same result was evident when options 3 and 8 were compared. Both require the same initial capital outlay, but the probability of success increased 75 percent when machinery was leased rather than debt-financed.

The effects of initial capital structure were still evident at the end of the planning horizon. Leasing enabled the operation to grow more quickly. Average acreage farmed after 10 years was greater, for both a tenant or a land owner, if initially acquired machinery was leased rather than debt-financed.

These results indicate that leasing machinery with a purchase option can increase the chance of survival for new entrants in farming. The impact of the initial capital structure affected the growth potential for the farm and was still evident at the end of a 10-year planning horizon. Greater use of machinery leasing could increase the viability of the farm sector and tend to increase the size of farms over time. These results are specific to the Texas High Plains, and care must be taken when extrapolating these results to other areas of the country. However, the general conclusions of this study should be transferrable to other agricultural areas.

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