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## Estimating Productivity and Financing Limits for Resources ${ }^{1}$

TWO AREAS of Ilinois were chosen as the site of the study explained in this chapter. One is a cash-grain area in east central Illinois; the other is a livestock area in the west central part of the state. ${ }^{2}$ The areas are outlined in the map shown in Figure 25.1. They are remarkably similar in agricultural production conditions. Thus, the large difference in the proportion of farms reported as cashgrain or livestock operations must be ascribed to factors other than production. Homogeneity between areas is important to some interarea comparisons which will be made.

In 1958, 400 farmers in the cash-grain area cooperated with the University of Illinois in an account-keeping project. In the livestock area, 299 farmers cooperated in the same project. The distribution of account keepers, based on returns to capital and management for each area, is given in Table 25.1. Studies at the University of Illinois suggest that voluntary account-keeping cooperators tend to be selective among the entire population of commercial farms so as to exclude extremes at both ends of most distributions. In other respects they represent fairly well the population of commercial farms defined in similar terms.

Among all farmers characterized in Table 25.1, it was thought that borrowers would more likely be found among those at the relatively low levels of income than among those at relatively high levels of income. Furthermore, the financial condition of the low-income farmer makes the situation more sensitive to lender decisions at reasonably low loan levels. Accordingly, all subsequent analyses and estimates relate to farmers in each area who earned $\$ 5,000$ or less as returns to capital and management in 1958. This includes about one-third of the account keepers in each area.

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Fig. 25.1. Location of lending institutions (Illinois).

Table 25.1. Distribution of Cooperating Account-Keeping Farmers by Level of Income, East-Central (Cash-Grain Area) and West-Central (Livestock Area) Illinois, 1958

|  | Cash-grain area |  |  | Livestock area |  |
| :--- | :---: | :---: | :---: | :---: | ---: |
| Returns to capital <br> and management | Number | Percent <br> of total |  | Number | Percent <br> of total |
| Under \$0 | 22 | 5.5 |  | 8 | 2.7 |
| $0-2,500$ | 45 | 11.2 |  | 33 | 11.0 |
| $2,501-5,000$ | 73 | 18.3 |  | 45 | 15.1 |
| $5,001-7,500$ | 72 | 18.0 | 57 | 19.1 |  |
| $7,501-10,000$ | 74 | 18.5 |  | 42 | 14.0 |
| $10,001-15,000$ | 67 | 16.8 |  | 62 | 20.7 |
| $15,01-20,000$ | 29 | 7.2 | 29 | 9.7 |  |
| Over 20,000 | 18 | 4.5 | 23 | 7.7 |  |
| Total | 400 | 100.0 | 299 | 100.0 |  |

## PRODUCTIVITY ESTIMATES

From records of the 140 farmers in the cash-grain area and from those of the 86 farmers in the livestock area, tabulations were made of the value of farm output and various categories of outlays resulting from their 1957 farming operations. Cobb-Douglas functions were fitted to these data. The result is a set of coefficients, each of which is an estimate for its respective factor, of the percent by which the value output would be increased by a 1 percent increase in the factor. ${ }^{3}$

Resource categories relevant to the research are listed in the row stubs of Tables 25.2 and 25.3. ${ }^{4}$ All are expressed as annual outlays

Table 25.2. Productivity Estimates for Selected Classes of Resources on Farms With Returns Less Than $\$ 5,000$ to Capital and Management,

East-Central Illinois (Grain Area), 1957

| Class of resource | Percent increase in output from onepercent increase of resource input ( $\mathrm{b}_{\mathrm{i}}$ ) | Error estimate for rate of percentage increase ( $\mathrm{Sb}_{\mathrm{i}}$ ) | Increase in value of output from onedollar increase of resource (MVP ${ }_{i}$ ) ${ }^{\text {d }}$ |
| :---: | :---: | :---: | :---: |
| Building expense (annual) | $0.0657^{\text {a }}$ | 0.03887 | 0.93 |
| Soil fertility inputs (annual) | 0.0704 | 0.02688 | 1.82 |
| Livestock and feed (annual) ${ }^{\text {b }}$ | 0.0701 | 0.01032 | 0.44 |
| Operating expense (annual) | 0.1884 | 0.06860 | 2.98 |
| Machinery investment (inventory) | 0.1608 | 0.04697 | $0.63{ }^{\text {c }}$ |
| Machinery expense (annual) | 0.2750 | 0.07142 | 2.53 |

[^1][^2]Table 25.3. Productivity Estimates for Selected Classes of Resources on Farms With Returns Less Than $\$ 5,000$ to Capital and Management, West-Central Illinois (Livestock Area), 1957

|  | Percent increase in <br> output from one- <br> percent increase of <br> resource input $\left(b_{i}\right)$ | Error estimate for <br> rate of percentage <br> (ncrease $\left(\mathrm{Sb}_{\mathrm{i}}\right)$ | Increase in value of <br> output from one- <br> dollar increase of <br> resource $\left(\mathrm{MVP}_{\mathrm{i}}\right)^{\mathrm{d}}$ |
| :--- | :---: | :---: | :---: |
| Building expense (annual) | $0.0159^{\mathrm{a}}$ | 0.02860 | 0.31 |
| Soil fertility inputs (annual) | $0.0147^{\mathrm{a}}$ | 0.01003 | 1.35 |
| Livestock and feed (annual) $^{\mathrm{b}}$ | 0.4438 | 0.02576 | 0.94 |
| Operating expense (annual) | 0.0748 | 0.05959 | 1.58 |
| Machinery investment (inventory) | 0.0622 | 0.03390 | $0.3 \mathrm{c}^{\mathrm{c}}$ |
| Machinery expense (annual) | 0.0693 | 0.05995 | 0.99 |

${ }^{\text {a }}$ Not significantly different from 0 at five-percent level.
${ }^{\mathrm{b}}$ Beginning livestock inventory plus purchased livestock and feed.
${ }^{c}$ Should not equal $\$ 1$ at optimum with unlimited capital available to acquire resources. Must be multiplied by reciprocal of annual rate of depreciation to transform to annual cost in order to make such a comparison.
${ }^{\mathrm{d}}$ Evaluated at geometric means of the variables.
except for machinery investment, which is expressed as a capital or inventory item. Thus its coefficient and derivatives therefrom cannot be interpreted in the same manner as can the coefficients for other resource categories. (See footnote c in the two tables.)

The regression coefficients are given in the first column. The statistical significance of each coefficient is judged by comparing its size with the size of its error estimate given in the second column. All coefficients differ significantly from zero except for building expense in both areas and for soil fertility inputs in the livestock area.

## Optimal Inputs

Estimates can be obtained from the regression coefficients for the income value of one-dollar increments in the various resource categories. These estimates are given in column 3. An exception to this interpretation already has been noted for machinery investment. In order to make its value productivity comparable, it is necessary that the number indicated be multiplied by the reciprocal of the annual rate of depreciation.

The average quantity of resources used on grain and livestock farms is given in columns 2 and 5 in Table 25.4. As would be expected, the greatest difference between the two groups of farms is found in livestock and feed and in soil fertility inputs. The lower outlays for soil fertility inputs in the livestock area reflect the complementary relation between the livestock and crop systems of farms in the area. With substantially less livestock, farms in the cash-grain area are shown to spend more on soil fertility.

Columns 1 and 4 of Table 25.4 show the resource quantities that would, according to the functions, be used to maximize profits. Comparisons of the differences between actual and optimum use in columns 3 and 6 are of interest. In the grain area the difference between optimal

Table 25.4. Actual and Optimal Use Rates for Resources Cash-Grain and Livestock Farms, Illinois, 1957

| Class of resource | Grain area |  |  | Livestock area |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Optimum quantity ${ }^{\text {a }}$ | Actual quantity ${ }^{b}$ | Optimum minus actual | Optimum quantity ${ }^{\text {a }}$ | Actual quantity ${ }^{\text {b }}$ | Optimum minus actual |
|  | (dollars) |  |  |  |  |  |
| Building expense | 1,355 | 1,436 | -81 | 455 | 1,473 | -1,018 |
| Soil fertility | 1,525 | 801 | 724 | 430 | 318 | 112 |
| Livestock and feed ${ }^{\text {c }}$ | 1,332 | 3,317 | -1,985 | 12,329 | 13,719 | -1,390 |
| Operating expense | 5,022 | 1,311 | 3,711 | 2,264 | 1,379 | 885 |
| Machinery investment | 3,042k ${ }^{\text {d }}$ | 5,326 | - | 1,692k | 5,071 | - |
| Machinery expense | 8,093 | 2,251 | 5,842 | 1,970 | 2,048 | -78 |

${ }^{\text {a }}$ Rate at which $\$ 1$ additional expense returns $\$ 1$, assuming other resources used at level of geometric means.
${ }^{\mathrm{b}}$ Geometric mean of values for farm records used.
${ }^{c}$ Beginning livestock inventory plus purchased livestock and feed.
${ }^{\text {d The investment optimum must be adjusted to annual basis by a factor " } k \text { " which accounts for }}$ the depreciation rate.
and actual building expense is so slight that it could be due simply to chance. ${ }^{5}$ In the case of livestock and feed (operating expense) and machinery expense, on the other hand, the difference is significant. For soil fertility inputs, one cannot be so certain.

Comparing optimum with actual use rates, the livestock farms appear to have been closer to an optimal organization than was true for the grain farms. For livestock and feed, the livestock farms also exhibit a relative "overuse" of resources. Size of observational error leads indicates the need to be cautious in ascribing much significance to the extent of overuse in the livestock area. Outlays on buildings likewise are relatively too high for profit maximization in both areas, though not greatly so in the grain area and perhaps not significantly so in the livestock area.' The pattern of differences between optimum and actual rates of resource use suggests the possibility of some basic difference between these outlays and those for which the differences between optimum and actual are consistently positive. One hypothesis lies in the possibility that it is easier to finance outlays that entail the creation of assets (buildings, livestock, machinery) than it is to finance outlays that do not entail asset creation (fertilizers, operating expense, and machinery expense).

## LOAN LIMITS

Limits in use of loans may be imposed internally (by farmers) as well as externally (by lenders). Borrowing is a means to modify restraints on profit maximization. However, it also reduces the farmer's financial flexibility and increases the consequences of error in management or in expectation.

[^3]Before 1940 Professor Kalecki developed the principle of increasing risk to show logically the plausibility of a restriction on firm size from exposure of equity as a result of using borrowed funds. ${ }^{6}$ Consider two farmers equal in equity but different in indebtedness. For a given variation in asset prices, the percentage variation in equity is higher for the indebted farmer than for the debt-free farmer. Even though homogeneous in all other respects, including expectations on uncertain outcomes, it seems likely they still would differ in selection of a course of action. If it is assumed that the indebted farmer is not so deeply in debt as to make his asset ownership nominal, one would expect him to be more cautious if only to protect the equity he has that is relatively more exposed.

The cautious behavior might be reflected in several ways. One way might be through adopting alternatives that yield outcomes in short time periods. Another way might be to adopt alternatives with relatively small variance of probable outcomes. Another way might be to use decision criteria that include some notion of loss control in place of, or in addition to, profit maximization. ${ }^{7}$ In any case, the result is a resource organization different from that yielded by perfect knowledge and a profit-maximizing motivation.

## Lender Limits

The use and allocation of resources may be affected by lender decisions as well as these "internal" factors. A borrower may abandon a project on recommendation of a lender that he do so. Or a lender may refuse to finance assets required for project A but agree to finance assets for project B. It is apparent that any loan adds generally to the sum of assets available to the farmer. Thus, to expand project $B$ with borrowed funds may make possible an expansion also of project $A$ with the use of resources not required to be financed. The fact that this possibility exists has led to the fallacious conclusion that credit available to farmers is completely fluid or nonspecialized. What difference does it make that a farmer finances feeder cattle more easily than fertilizer purchases if he simply uses his borrowing power to finance cattle and his other resources to buy fertilizer? It makes no difference as long as the attainment of a profit maximum is unaffected by the total capital plus borrowing power available to the farmer. However, if profit maximizing is restricted by ability to borrow, it does make a difference. Financing assets that create new borrowing power lifts substantially the restriction on profit maximizing. Financing assets that do not have this

[^4]effect "absorbs" the farmer's equity at a rapid rate. Financing feeder cattle for a farmer in good financial condition with an adequate feed supply may absorb but little of the farmer's equity. On the other hand, financing a fertilizer purchase which creates no increase in pledgeable assets might result in a heavy absorption of the equity the farmer had prior to the loan.

Whether or not these results materialize depends on lender response to loan applications to finance these various activities. A survey of lenders was conducted to test the above ideas. The reason for studying two areas lies in the hypothesis that there may be a difference in lender response related to the type of farming dominant in the area. Thus, a farmer in the cash-grain area might experience a lower limit to finance livestock than he might if he were in a livestock area.

## Estimating Lending Limits

From available records a farm was synthesized for each area described in terms of assets and liabilities (Table 25.5). The farms were so constructed that they were identical in the three equity measures indicated at the bottom of the table. However, they differed in detail. Three additional criteria guided the synthesis. The various categories

Table 25.5. Financial Summaries for Farms Used To Base Loan Requests in Selected Farming Areas of Illinois

| Item | Area |  |
| :---: | :---: | :---: |
|  | East-central (cash-grain) | West-central (livestock) |
|  | (dollars) |  |
| Cash | 1,431 | 250 |
| Cash value of life insurance | 910 | 279 |
| Farm feeds | 1,571 | 1,935 |
| Market livestock | 6,784 | 8,688 |
| Current assets | 10,696 | 11,152 |
| Other livestock | 398 | 1,040 |
| Machinery and equipment | 8,492 | 7,394 |
| Working assets | 8,890 | 8,434 |
| Real estate | 38,125 | 38,125 |
| Total assets | 57,711 | 57,711 |
| Open account (grain elevator) | 620 | 1,152 |
| Note on cattle .. | 5,500 | 5,500 |
| Fertilizer loan | 282 | 206 |
| Current liabilities | 6,402 | 6,858 |
| Machinery purchase contract | 3,125 | 2,669 |
| Real estate mortgage | 19,684 | 19,684 |
| Total liabilities | 29,211 | 29,211 |
| Net worth | 28,500 | 28,500 |
| Current worth | 4,294 | 4,294 |
| Intermediate worth | 10,059 | 10,059 |

of assets needed to be roughly consistent with the means of resource categories for which the productivity estimates were made (Table 25.4). The farms needed to be so synthesized that they would appear familiar to lending officers in each of the two areas. Finally, the farm descriptions needed to be consistent with a plausibly constructed lending situation described by the interviewer. Indeed, the lending situation involved the personal characteristics of the interviewer himself!

Lending officers were interviewed in 21 lending institutions in each area, distributed by type of lender as shown in Table 25.6. Locations of the institutions are shown within the areas outlined in Figure 25.1. Interviews were started in September and completed in October. Timing the interviews was a critical problem. Much of the methodological value of the observational technique rested on preserving the context of an actual lending situation. Yet, at any given time of the year, loan applications would be more appropriate for some purposes than for others. Financing feeder cattle reaches a peak of activity in the fall of the year, which was the observational period. Machinery financing might be expected to be at a seasonal low. To take into account the ef fects of seasonal variations on lender response would have required considerably more time and resources than were available for this research undertaking.

In obtaining loan estimates, the interviewer identified himself to the farm lending officer, enlisted his cooperation in the project, and suggested the following lending situation: A potential customer purchased 80 acres with assurance of being able to rent an additional adjoining 160 acres from the same landowner on a crop-share lease. Location was approximately specified in the lender's community to control the mental picture of land type in all interviews. It was suggested that this man's father had rented the 160 acres for many years before retiring, but did business in another community. Hence, the interviewee would not be personally acquainted with the family. The young man was 31 years old, married, had two children, and was reared on a rented farm. The young man and his wife had worked in a factory for four years to acquire capital, and had begun farming on 160 acres in a neighboring county without any parental financial aid. Livestock experience had included feeding 25 head of steers the past two years and raising ten litters of hogs each of the last four years. Income had been supplemented with off-farm labor as much as possible. This background and the financial statement

Table 25.6. Schedules Taken From Lenders in Two Illinois Farming Areas, by Type of Lender, 1959

|  | Small banks $^{\text {a }}$ | Large banks $^{\mathrm{b}}$ | PCA | Total |
| :--- | :---: | :---: | :---: | :---: |
| Grain area | 9 | 8 | 4 | 21 |
| Livestock area | 9 | 8 | 4 | 21 |

[^5]suggested that the young man was a capable and industrious operator, making good financial progress.

Upon presentation of this situation, the lender was asked to assume that the farmer described desired to become a customer. It was suggested that the farmer felt the present financial structure would permit a minimum operation without borrowing, but that faster financial progress could be made with the use of borrowed funds. Hence, it was proposed that five alternative loan requests be considered in turn (randomly ordered between interviews) assuming the remaining needs could be met with available funds. Maximum available loans and the terms for the first loan purpose were determined and recorded. Then the interview reverted to the pre-loan situation and a second loan purpose was considered. The process was repeated for each request.

The proposed use of funds for each purpose was plausibly "spelled out." For example, the machinery purchase request was for the larger equipment needed in going from 160 - to 240 -acre operations and for replacement of old machines (as specified in the detailed machinery inventory worked out prior to the interview). Thus, the loan amounts obtainable tend to group at levels representing combinations of specific requests. Similar justification was made for other requests. In each case the initial loan request was for an amount greater than believed obtainable. This was done as a "shock" treatment in the hope of obtaining less "interviewer-conditioned" responses than might be obtained by successively increasing requests until a cutoff was obtained. It was hoped that this approach might suggest naïveté of the interviewer and thus allow the lender to use his correct judgment in "teaching" a realistic evaluation. It was feared the increasing-amounts request method might produce overly large "interviewer-pleasing" responses.

## Loan Limits Obtained

Loan limits established by interview procedures already outlined were tabulated for each type of lending institution in each area. The arithmetic means are presented in Table 25.7. The original intention was also to observe any differences between types of loan in terms of loan, i.e., interest rate, use of chattel mortgage, length of loan, and the like. The purpose was to determine whether changes in such terms with respect to loan amount might differ by type of loan. However, this attempt was unsuccessful. The response generally implied that for a given borrower and purpose the central question was approval of the loan, and that the terms of loan were subsidiary considerations which were set by general policy of the institution in question. That is, for purpose A a loan was possible to a limit of $\$ \mathbf{x}$, and within this limit the terms of loan were not observed to vary in any way.

Variation in interest rate and terms between borrowers with different amounts of assets was an observed fact, however, as was variation in interest rate by bankers in the livestock area to favor feeder-cattle

Table 25.7. Mean Maximum Borrowing Limits, by Type of Lender and Proposed Use of Loan Proceeds, Two Areas of Illinois, $1959^{\text {a }}$

| Area and agency | General operating expense | Machinery purchase | Feedercattle purchase | Buildings and buildings repair | Fertilizer purchase | All purposes |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | (mean dollar loan amounts) |  |  |  |  |  |
| Livestock area |  |  |  |  |  |  |
| Small banks | 1,478 | 1,167 | 6,128 | 322 | 624 | 1,944 ${ }^{\text {b }}$ |
| Large banks | 2,212 | 1,725 | 7,581 | 1,100 | 875 | 2,699 ${ }^{\text {b }}$ |
| PCA | 2,500 | 3,700 | 6,000 | 1,550 | 972 | 2,944 ${ }^{\text {b }}$ |
| All agencies | 1,952 | 1,861 | 6,657 | 852 | 786 | 2,422 ${ }^{\text {c }}$ |
| Grain area |  |  |  |  |  |  |
| Small banks | 2,167 | 844 | 5,944 | 867 | 934 | 2,151 ${ }^{\text {b }}$ |
| Large banks | 1,837 | 487 | 4,975 | 1,075 | 1,591 | 1,993 ${ }^{\text {b }}$ |
| PCA | 1,775 | 1,500 | 7,000 | 1,850 | 1,375 | 2,700 ${ }^{\text {b }}$ |
| All agencies | 1,966 | 833 | 5,776 | 1,133 | 1,268 | 2,195 ${ }^{\text {c }}$ |

a Except as stated in the following footnotes, differences between areas and lending agencies for given loan types have not been tested for statistical significance.
${ }^{\mathrm{b}}$ The loan limit for all purposes, averaged for all Production Credit Associations, exceeds the average for all banks with a difference significant at a five-percent probability level.
${ }^{c}$ The loan limit for all purposes, averaged for all agencies, does not differ between areas at an acceptable probability level.
loans. These facts apparently reflected policies set by farmercontrolled boards of directors. No such variation in chattel commitments was noted among purposes, and the security required varied from only a signature to notes on all available chattels.

If the aggregate response of all institutions is considered, no difference in loan limit to finance general operating expense was observed between the two areas. Otherwise, there appeared to be a tendency for the limit to be higher in the livestock area for feeder-cattle purchase (expected) and for purchase of machinery (somewhat unexpected). Finally, the limits tended to be higher in the grain area for fertilizer purchase (expected), but also higher for buildings and building repair (somewhat unexpected).

In the livestock area, the Production Credit Associations fixed loan. limits somewhat higher than did either small or large banks for all loan types except for purchase of feeder cattle. In the grain area, the Production Credit Associations fixed higher loan limits than did banks on feeder cattle and buildings and machinery purchases, but their limits on general operating expense were lower. PCA loan limits on fertilizer purchases were higher than those of small banks and lower than those of large banks.

Small banks were more conservative than large banks for all types of loans in the livestock area. In the grain area they were more conservative in financing outlays for building and fertilizer but less conservative for feeder cattle, machinery purchase, or general operating expense. Thus, it is difficult to conclude with certainty that competition among lending institutions, as found in the large bank category, generally has the effect of reducing conservatism in appraising loan
applications. ${ }^{8}$ Any such effect may be offset by the fact that those banks without a competitor in the same town were in the smaller farming communities and tended to be more familiar with farming.

## Classification and Analysis

When loan proceeds are used to finance general operating expenses, no specific assets are created in the process. The same is true, though with some modification, in the case of fertilizer purchases. In the case of machinery or feeder cattle, assets are created that are specific and tangible. Though less so, the same tends to be true of building outlays. Therefore, loans are grouped without regard to type of lender in categories distinguished as indicated in parts A through $D$ of Table 25.8. Differences between areas for given loan classes are shown in the third column. The average maxima for given loan classes are shown in the last column. The fact that the difference between areas was not significant at acceptable probability levels suggests that it is entirely appropriate to so aggregate responses over both areas.

Table 25.8. Mean Maximum Loan Limits, by Class of Loan, Two Areas of Illinois, $1959^{1}$

| Class of loan | Mean loan limit |  | Difference between areas | Mean loan limit for both areas |
| :---: | :---: | :---: | :---: | :---: |
|  | Livestock area | Grain area |  |  |
|  | (dollars) |  |  |  |
| A. Asset creating ${ }^{\text {a }}$ | 3,124 | 2,581 | 543 | 2,852 |
| Not asset creating ${ }^{\text {b }}$ | 1,369 | 1,618 | -249 | 1,493 ${ }_{\text {h }}$ |
| Difference | 1,755 | 963 |  | $1,359^{\text {h }}$ |
| Difference between differences | $792^{\text {f }}$ |  |  |  |
| B. Feeder cattle ${ }^{\text {c }}$ | 6,657 | 5,776 | 881 | 6,217 |
| Machinery or buildings ${ }^{\text {d }}$ | 1,356 | 963 | 393 | 1,160 |
| Difference | 5,301 | 4,813 |  | 5,057 ${ }^{\text {h }}$ |
| Difference between differences | 488 ${ }^{\text {e }}$ |  |  |  |
| C. Machinery | 1,861 | 833 | 1,028 | 1,348 |
| Buildings | 852 | 1,133 | -281 | $9^{993}{ }_{\text {h }}$ |
| Difference | 1,009 | -300 |  | $355{ }^{\text {h }}$ |
| Difference between differences | 1,309 ${ }^{\text {e }}$ |  |  |  |
| D. General operating expense | 1,952 | 1,966 | -14 |  |
| Fertilizer purchase | 786 | 1,288 | -502 |  |
| Difference | 1,166 | 678 |  |  |
| Difference between differences | 4888 |  |  |  |

${ }^{\text {a }}$ Machinery, feeder cattle, or buildings.
${ }^{\mathrm{b}}$ General operating expense or fertilizer purchase.
${ }^{\text {c Illustrative of asset creation at a rate high with respect to loan level. }}$
${ }^{\mathrm{d}}$ Illustrative of asset creation at a rate low with respect to loan level.
${ }^{e}$ Not significant at acceptable probability level.
${ }^{\mathrm{f}}$ Significant at 10 percent probability level.
${ }^{8}$ Significant at 5 percent probability level.
${ }^{h}$ Significant at 2.5 percent probability level.
${ }^{i}$ A split-split plot analysis of variance model was used, with areas, type of lending agency, and purpose as factors.

[^6]All three loan types that create assets are aggregated in part A. Analysis of variance yields a conclusion that loans in this class are granted to a limit significantly higher than is the limit for loans of the nonasset-creating class, and that this distinction was stronger in livestock than in the grain area. In part $B$, the asset-creating class was disaggregated in order to compare the component which was thought to create added loan value at a relatively more rapid rate (feeder cattle) with the rest of the aggregate. Again, the difference is highly significant. The remaining two components of the asset-creating class of loans are compared in part C. The difference here, too, is significant. The difference might be ascribed to institutional policies that restrict lending on real property. But there may also be an economic reason related to the relatively slower rate of turnover of building capital, as compared with machinery capital. Thus, the asset-creating class in decreasing order is feeder cattle, machinery, and buildings. The apparent reverse order of machinery and buildings in the grain area is not statistically significant. In the grain area, PCA loans for each purpose were larger than bank loans by about the same percentage. But in the livestock area, the difference between PCA and bank limits was much larger for machinery than for buildings. It has been suggested that this difference is due to variations in relative willingness to make machinery loans of longer than one-year terms.

In part $D$, the two components of loans that do not create assets are compared. It may be difficult to find a reasonable hypothesis for the observed difference. Actually, the difference is slight in the grain area where heavy rates of fertilizer applications are much more common than in the livestock area. One might suspect from comments made in interviews that lenders may ascribe to the need for financing general operating expense some meaning as regards the ability of the applicant to manage his financial organization. Yet they recognized also that meeting the general operating expenses was a condition necessary to successful pursuit of any plan of operation. Many respondents in the livestock area commented that fertilizer lending was a practice of recent origin and that they were being conservative because they lacked the knowledge of responses needed to appraise the request.

## IMPLICATIONS

Having established that differences in loan limits exist among types of loans, there remains the question of whether the differences are in accord with resource quantities optimal in the two farm organizations. Estimates given in Table 25.9 and 25.10 are derived from preceding tables as indicated by the footnotes. In the first column are the resource quantities in each category listed for the synthesized farms. In the second column are loan limits established at averages of lender response. By adding these two estimates, we get an estimate of the maximum quantity the applicant could command by using his whole borrowing power, alternatively, for each of the five purposes.

Table 25.9. Comparison of Optimal Resource Quantities and Quantities Owned and Capable of Being Financed, Livestock Area, 1959

| Class of resource | Quantity <br> on hand $^{\text {a }}$ | Mean loan <br> limit $^{\mathrm{b}}$ | Maximum <br> quantity | Optimum <br> quantity | Optimum less <br> maximum |
| :--- | ---: | :---: | :---: | :---: | :---: |
|  |  | (dollars) |  |  |  |
|  |  |  |  |  |  |
| Livestock and feed | 10,623 | 6,657 | 17,280 | 9,233 | $-8,047$ |
| Machinery | 7,294 | 1,861 | 8,255 | 3,915 | $-4,340$ |
| Buildings | 19 | 852 | 871 | 455 | -416 |
| Fertilizer | 18 | 786 | 782 | 430 | -352 |
| Operating expense | 213 | 1,952 | 2,165 | 2,264 | 99 |

${ }^{\text {a }}$ From column 2, Table 25.5: livestock and feed excludes other livestock; buildings include (all) real estate; cash on hand is allocated among buildings, fertilizer, and operating expense in the proportion shown optimal.
${ }^{\mathrm{b}}$ From Table 25.7, row 4.
${ }^{\text {C }}$ The sum, column 1 plus column 2.
${ }^{\mathrm{d}}$ From Table 25.3 for buildings, fertilizer, operating expense; for livestock and feed and for machinery: column 1 less deviation from optimum given in Table 25.4.
${ }^{\mathrm{e}}$ The difference, column 4 less column 3.
In column 4 are listed the resource quantities optimal according to productivity estimates established from the farm records described previously. These estimates reflect optima for the average levels of inputs on the farms, while the maximum quantities in columns 1 and 3 are for the synthesized farm used in the lending situation. These may be reconciled by recalling that the synthesized farm was based on the average farm of the productivity estimates. Structural similarities are evidenced by the comparisons of factors made in Table 25.11. Hence the comparison of the two sets of estimates provides an approximation of the possible effects of loan limits on the attainment of optimum farm

Table 25.10. Comparison of Optimal Resource Quantities and Quantities Owned and Capable of Being Financed, Cash-Grain Area, 1959

| Class of resource | Quantity <br> on hand $^{\mathrm{a}}$ | Mean loan <br> limit $^{\mathrm{b}}$ | Maximum <br> quantity $^{\mathrm{c}}$ | Optimum <br> quantity $^{\mathrm{d}}$ | Optimum less <br> maximum $^{\mathrm{e}}$ |
| :--- | :---: | :---: | :---: | :---: | :---: |
|  |  | (dollars) |  |  |  |
| Livestock and feed | 8,355 | 5,776 | 14,131 | 6,370 | $-7,761$ |
| Machinery | 8,492 | 833 | 9,325 | 6,280 | $-3,045$ |
| Buildings | 243 | 1,133 | 1,376 | 1,355 | -21 |
| Fertilizer | 272 | 1,268 | 1,540 | 1,525 | -15 |
| Operating expense | 916 | 1,966 | 2,882 | 5,022 | 2,140 |

${ }^{\text {a }}$ From column 2, Table 25.5: livestock and feed excludes other livestock; buildings include (all) real estate; cash on hand is allocated among buildings, fertilizer, and operating expense in the proportion shown optimal.
${ }^{\mathrm{b}}$ From Table 25.7 , last row.
${ }^{\mathrm{c}}$ The sum, column 1 plus column 2.
${ }^{\mathrm{d}}$ From Table 25.2 for buildings, fertilizer, operating expense; for livestock and feed and for machinery: column 1 less deviation from optimum given in Table 25.4.
${ }^{\mathbf{e}}$ The difference, column 4 less column 3.

Table 25.11. Comparison of Structural Features of the Farms Used in Productivity Estimates and in the Lending Situation

| Feature | Grain area |  | Livestock area |  |
| :---: | :---: | :---: | :---: | :---: |
|  | Productivity | Lending | Productivity | Lending |
| Total acres | 257.7 | 240 | 227.4 | 240 |
| Soil productivity rating | 81.5 | - - | 76.4 | - - |
|  | (dollars) |  |  |  |
| Beginning livestock inventory | 4,535 | 5,282 | 9,067 | 9,945 |
| Livestock purchase | 1,924 | 3,148 | 5,280 | 3,218 |
| Labor input | 3,327 | 3,200 | 3,558 | 2,796 |
| Annual machinery expense ${ }^{\text {a }}$ | 4,374 | 4,529 | 4,085 | 4,149 |
| Returns to capital and management | 2,192 | 2,504 | 2,457 | 2,246 |

[^7]organization. Exact comparisons will be made when the estimates for the synthesized farm are completed.

In the last column of Tables 25.9 and 25.10 , the maxima available to the applicant have been subtracted from the optimum resource quantities. These figures must be interpreted carefully. They do not represent an attainable distortion of farm organization when taken together. Each figure must be considered by itself. Each estimate of optimum assumes other resources are fixed at existing levels. Each estimate of maximum assumes the financing of no other assets. A negative number means more of the resource is available than would be optimal. A positive figure means less of the resource is available than would be optimal.

It is apparent that it would be rather easy for the operator in either area to obtain a relative oversupply of livestock, feed, or machinery. In fact, his controlled assets in these categories are already excessive. He would not seem particularly limited in access to financing for buildings and fertilizer in the livestock area. In the grain area he nears his limit with respect to these resources. In both areas, the farm operator finds it difficult to finance the general operating expenses at levels found optimum in the areas. This may reflect a belief on the part of lenders that operators should finance operating expenses out of their own cash and current income.

If this is so, it may be, as has long been suggested, that seasonal demands for cash comprise a determinant of farm organization. How strong it is would depend on the extent to which the farmer relies on his credit to finance his operation. Our cases have been synthesized to insure that loan limits would be reached at levels that might affect the organizations. Many farmers are not so vulnerable to loan decisions. On the other hand, many farmers are just as fully exposed-some even more so.

The estimates given in Tables 25.9 and 25.10 do no more than
suggest the possibility that there may be a connection between loan limits that differ by use of loan proceeds and the resource organization of farms. This project is in its final phase. A model will be developed to indicate the conditions in which the above situation might logically be expected to occur. It may well be that the difficulty in financing operating expenses affects the farmer's distribution of cash and credit among the other resource categories. This problem will be studied in the above research project.

## Discussion

## EDWARD M. NORMAN*

From an approach utilizing economic theory, we have an opportunity to look at a practical study in the Baker-Irwin presentation. A comparison is made between a cash-grain area and a livestock area, each apparently having the same productive resources and capabilities. Probably the study of farms of $\$ 5,000$ or less per year would give a better insight into the basic problems.

Much use is made of the optimum input based on past production records of an area. An optimum level based on past records is excellent, but it must be realized that the relationship between input and output does not assume definite arithmetical or geometrical proportions. These levels are well used as a basis for comparison and do not necessarily indicate that a particular investment loses money.

The approach was made to lenders utilizing identical financial statements modified only to present minor differences in the assets of a farmer typical of each area. The attitudes of lenders of each area may be summarized as follows: (1) lenders in the grain area were more liberal toward soil fertility; (2) similarly, lenders in the livestock area were more liberal on feeder cattle; (3) all lenders looked with more favor on asset-creating loans; and (4) loan levels, with few exceptions, increase from small banks to larger banks to PCA's. This brief summary of the findings is similar to our own personal observations gained through experience in agricultural credit.

It seems that both farmers and lenders alike in a given area tend to follow similar patterns in enterprises and apply capital accordingly. Each of us would have predicted that lenders in the cash-grain area would have favored soil fertility more than lenders in the livestock area, and similarly, that lenders in the livestock area would favor livestock enterprises more than farmers in the cash-grain area. Since other resources are vitally important in both areas, attitudes are

[^8]almost the same. By this proposition we feel that farmers do not farm for maximum profit but are inclined to meet certain goals in income, and do not abandon practices until forced to do so. They are motivated by competition and the standards of the community in the application of capital.


[^0]:    ${ }^{1}$ This research is conducted cooperatively by the University of Illinois and the Tennessee Valley Authority.
    ${ }^{2}$ A more complete description of the areas may be found in C. B. Baker, "Estimating the effects of loan decisions on farmers' use of fertilizer," Proceedings, Conference for Cooperators in the TVA Agricultural Economics Research Activities, Knoxville, Tenn., Mar. 24-26, 1959.

[^1]:    ${ }_{b}$ Not significantly different from 0 at five-percent level.
    ${ }^{\mathrm{b}}$ Beginning livestock inventory plus purchase livestock and feed.
    ${ }^{\text {c }}$ Should not equal $\$ 1$ at optimum with unlimited capital available to acquire resources. Must be multiplied by reciprocal of annual rate of depreciation to transform to annual cost in order to make such a domparison.
    ${ }^{\text {d }}$ Evaluated at geometric means of the variables.

[^2]:    ${ }^{3}$ For a more detailed discussion of fitting Cobb-Douglas functions with farm records data, see Gerhard Tintner and O. H. Brownlee, "Production functions derived from farm records," Jour. Farm Econ., Vol. 26, Aug., 1944, pp. 566-71.
    ${ }^{4}$ Two other variables were included in the analysis. They were land capital inventory and labor input. Output included sales, ending livestock inventory, and change in inventory' of grain, feed, and seed.

[^3]:    ${ }^{5}$ Details in making this test are given in C. B. Baker, "Resource productivity in dryland farming," Proceedings, Western Farm Economics Association, 1952, pp. 36-40.

[^4]:    ${ }^{6}$ Michael Kalecki, "The principle of increasing risk," Essays in the Theory of Income Fluctuations, Irwin, Ltd., London, 1939, pp. 95-106.
    ${ }^{7}$ C. B. Baker, Decision-Making and Financing Farm Assets, J. S. McLean Memorial Lecture, Ontario Agricultural College, Guelph, Ontario, Feb. 11, 1960.

[^5]:    ${ }^{\text {a }}$ Banks in towns where there is no other bank or PCA office.
    ${ }^{\mathrm{b}}$ Banks in towns which have a competing lending agency (bank or PCA) in the same town.

[^6]:    ${ }^{8}$ All statements in these last three paragraphs must be tempered by reference to footnotes in Table 25.7 wherein probability levels are reported for differences found to be significant. Tests to establish the significance of difference take account of variations in response as well as the mean levels of responses reported in the body of the table.

[^7]:    ${ }^{\text {a }}$ Includes depreciation, machinery repairs, machine hire, fuel, and farm share of automobile expense.

[^8]:    *President, First National Bank, Clarksville, Tennessee.

