

FARM SIZE AND RURAL COMMUNITIES: SOME ECONOMIC RELATIONSHIPS

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Although American agriculture has been adopting new technology for more than 100 years, the rate of adoption has greatly accelerated in recent decades. This technological revolution has resulted in important changes in rural America. Mesthene [12] points out the impact of technological change on society; Donaldson and McInerney [6] examine the impact of machinery technology on agricultural adjustment.

When farms increase in size and decrease in number, employment opportunities in agriculture are reduced [1]. This change, in turn, affects the viability of towns in farming areas, as shown by Heady and Sonka [8] and by Hamilton, Peterson, and Reid [7]. Changes in agricultural technology, in farm size, and in farm-oriented towns have major economic and social effects on rural communities. Beale [2] documents recent demographic changes and Brinkman [3] discusses the impact on the rural sector of transition to an urban society.

The author describes a study of the economic impact of farm size alternatives on a rural community in Idaho. The basic assumption is the economic interdependence of the farm and non-farm sectors in the rural community. The study had two objectives: (1) to derive empirical measures of the relative economic importance of small farms and large farms and (2) to estimate the income, output, and employment effects of farm size alternatives on the rural community.

STUDY AREA AND METHOD

The community studied was chosen because of its similarity to many rural communities in America. Farming is the basic and long-established

industry. Crop and livestock production is diversified; farms differ in size and structure, including part-time, single family, and partnership arrangements. The towns within the area include a crossroads village and the seat of county government which is also the site of a recently built plastic-ware fabrication plant. A regional trade center is adjacent to the study area.¹ Major cities are 120 and 220 miles from the study area, in nearly opposite directions.

Examination of census and other statistical data showed that the community has recently undergone changes in farm size structure, agricultural employment opportunities, and population movements.² These shifts are consistent with changes that have occurred generally in rural America and have been described and documented by Ball and Heady [1], Heady and Sonka [8], Beale [2], and Brinkman [3].

Input-output analysis was used to measure the economic interrelationships among the industries in the study area. The assumptions and procedures associated with regional input-output models that were adhered to in this study have been described by several authors including Chenery and Clark [4], Leontief [11], Isard and Langford [10], and Richardson [14]. Income multipliers were derived as described by Miernyk [13] and Richardson [14]. Methods developed by Doeksen and Schreiner [5] and Hirsch [9] were used for computing employment multipliers. These plus output multipliers were the bases for consistent forecasting of final demands to reflect alternative structural changes over a five-year period. Richardson [14] discusses the application of consistent forecasting.

The community economy was divided into 22 endogenous and four exogenous sectors, with

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¹Estimated 1975 populations are: study community, approximately 10,500; crossroads village, 1,492; county seat, 5,865; regional trade center, 23,709; two counties of which study community is a part, 24,500. The regional trade center is 23 miles from the crossroads village and 15 miles from the county seat.

²The total number of farms in the study area declined 14 percent from 1964 to 1969, the latest date for which data were available when the study was made. However, the number of Census Class I and II farms (\$20,000 and up annual gross sales) increased 41 percent. There was a 24 percent decrease in the number of farms with less than \$20,000 gross sales. Total population in the two-county area dropped 8 percent during the 1950 decade and 11 percent during the 1960s; from 1970 to 1975 population increased 30 percent.

households included as an endogenous sector. Agriculture was subdivided into two sectors: small farms, defined as those having less than \$25,000 in gross sales of farm products in 1974 (the base year) and large farms, those with \$25,000 or more gross farm sales. This division approximates the boundary between the contracting and the expanding sectors of agriculture in the study area in 1974.

Other endogenous sectors were based on the two- or three-digit U.S. Department of Commerce Standard Industrial Classification (SIC), after the elimination of industries not present in the study area and the combination of those of less importance. This procedure, plus the necessity of grouping related firms to maintain confidentiality, resulted in a higher level of aggregation than is optimal in an input-output model. However, because the purpose of the study was to determine the economic impact of structural change in the agricultural sector on the total economy of the community, the sectoring scheme did not detract from achieving the objectives. The model included four nonfarm agricultural sectors and 15 nonagricultural sectors.

The exogenous sectors were (1) state and local government, (2) federal government, (3) net inventory change/depreciation allowance, and (4) exports/imports.

SAMPLING AND DATA COLLECTION

Nearly all data were obtained by personal interview. A randomized block design was used to sample 84 farms (49 small farms and 35 large farms) and 70 nonfarm rural households. These numbers were 14 percent of the estimated population of each group in the study area. Information not available from interview questionnaires was derived from published data, expert observers, and average values; however, missing information was not a major difficulty.

Telephone directory and observation were used to compile the population of 294 business firms operating in the study area. All agriculturally related industries were interviewed. Nonagricultural industries were stratified by size according to employment and business volume. The overall sample included 60 percent of the business firms in the study area. This proportion exceeded sampling criteria used by Isard and Langford [10] in their regional input-output study. Income tax return (IRS)

data were used both as a supplement to and a benchmark for assessing the reliability of business and household income and expenses.

The 16 government agencies in the study area were surveyed by a combination of mail, telephone, and personal interviews. Complete expenditure data were collected, but it was necessary to use Census data on state and county finances to assign tax revenue by industry.

ECONOMIC STRUCTURE

The economic structure of the agricultural sector is summarized in the following points.

1. Small farms were a relatively small economic sector.³ They provided 12 percent of total employment, 7 percent of consumer spending, and 4 percent of household income. Large farms provided 15 percent of total employment within the study area, 7 percent of consumer spending, and 25 percent of household income.
2. Small farms represented a relatively small market for the output of local businesses. They purchased about 1 percent of the output of other farms, 3 percent of the output of nonfarm agricultural industries, and 2 percent of the output of nonagricultural industries. Large farms purchased 8 percent of the output of other large farms, 12 percent of the output of small farms, 10 percent of the output of nonfarm agricultural industries, and 4 percent of the output of nonagricultural industries.
3. Small farms spent a relatively larger portion of their production expenditures locally than large farms (59 percent versus 55 percent). Large farms spent more than small farms in total dollars with local merchants in 1974, \$20.4 million compared with \$4.0 million.
4. Small farms required fewer man-years of labor per farm and as a sector, and had a higher labor-output ratio than large farms.
5. Small-farm households had more off-farm employment than large-farm households; small-farm household members worked an average of 228 person-days off the farm compared with 124 for large-farm households.
6. Twenty-two percent of the small-farm operators sampled expected to cease farming within five years, whereas all large-farm operators expected to stay in production.
7. Small- and large-farm households each

³The percentage distribution by acreage of small farms (less than \$25,000 annual gross sales) and large farms (\$25,000 or more annual gross sales) was:

Acres	Small Farms	Large Farms
120 or less	74%	24%
121-180	11%	17%
181-240	6%	15%
over 240	9%	44%

spent \$1.3 million locally. Small-farm households provided a 10 percent smaller aggregate market than large-farm households, but showed a higher propensity to spend locally.

ECONOMIC INTERDEPENDENCE

Two factors determine the degree of economic interdependence of an industry with the rest of the regional economy: (1) the magnitude of its direct requirements coefficients and (2) the size of its multiplier or total requirements coefficient.

Large direct coefficients from endogenous industries indicate that a large portion of each input dollar is spent within the local economy. Small farms spent proportionally more locally than did large farms, with the exceptions of intrafarm transactions, purchases of professional services, and payments to households. Both farm sectors had higher direct requirements coefficients than did retail and service sectors.

Multiplier coefficients measure the total impact on the regional economy of a change in the level of economic activity of an industry, including direct and indirect effects on other industries and induced effects on household consumption. Output, income, and employment multipliers were derived for each of the endogenous industries in the study area (Table 1).

TABLE 1. OUTPUT, INCOME AND EMPLOYMENT MULTIPLIERS, IDAHO FARM SIZE ALTERNATIVES STUDY, 1974

Industry	Output Multiplier	Income Multiplier	Employment Multiplier
Large Farms	1.8729	1.3423	1.6157
Small Farms	1.8694	1.4464	1.1546
Agricultural Services	1.3234	1.1821	1.2077
Construction Trades	1.6457	1.6131	1.2185
Farm Product Raw			
Materials	1.8337	3.9758	3.0553
Printing and Publishing	1.2701	1.1554	1.0631
Miscellaneous			
Manufacturing	1.3175	1.1083	1.0457
Utilities	1.1342	1.3208	1.1525
Farm Equipment Dealers	1.2349	1.1793	1.1691
Agricultural Chemicals	1.1461	1.1910	1.2364
Hardware	1.2964	1.1500	1.1144
Clothing Stores	1.1542	1.1398	1.1147
Food Stores	1.1775	1.1534	1.1291
Petroleum Products	1.2909	1.2465	1.3210
Automotive and			
Transportation	1.4852	1.2655	1.2377
Furniture	1.3659	1.1580	1.1486
Restaurants	1.6370	1.1735	1.1261
Miscellaneous Retail	1.6988	1.1403	1.1455
Finance, Insurance,			
Real Estate	1.3874	1.1467	1.1963
Professional Services	2.0050	1.1267	1.1418
Other Services	1.8495	1.1775	1.1241
Households	1.6610	undefined*	undefined*

*The direct income and employment coefficients for households are effectively zero although mathematically undefined.

The reason for the reversal in the relative sizes of the income and employment multipliers is found in the method for calculating multipliers. Employment multipliers equal the sum of direct, indirect, and induced employment effects divided by direct employment effects. In the case of small farms the large direct effects, in relation to indirect and induced effects, result in a low ratio of total effects to direct effects, i.e., a small employment multiplier. Small and large farm direct employment effects are contrasted in the labor productivity values for the two farm sizes: \$13,157 gross output per man-year of labor for small farms, \$55,578 for large farms.

The following paragraphs summarize farm multipliers.

Output Multipliers. The output multiplier for both large and small farms was 1.87. Only one other industry had an output multiplier higher than large and small farms: the professional services output multiplier was 2.00.

Income Multipliers. The income multiplier for small farms in the region (1.45) exceeded that for large farms (1.34). Both, however, were exceeded by the income multipliers for farm product raw materials (3.98) and construction trades (1.61).

Employment Multipliers. The employment multiplier for small farms (1.15) was smaller than that for large farms (1.62).⁴ Farm product raw materials had the highest employment multiplier (3.06); large farms were second but small farms ranked tenth among the 22 endogenous industries.

GROWTH PROJECTIONS

Consistent forecasting makes use of multipliers to project the cumulative effects of changes throughout the economy. Five sets of consistent forecasts were made, incorporating various growth assumptions over a five-year period (Table 2).

TABLE 2. PROJECTED OUTPUT, INCOME AND EMPLOYMENT, IDAHO FARM SIZE ALTERNATIVES STUDY

Consistent Forecast	Output	Income	Employment
	(Thousands of Dollars)		(Man-Years)
Base Year Levels (1974)	195,066.0	37,041.7	4,022
1. Minimal Growth Set			
Run A: Small Farms Expand	197,363.2	37,379.2	4,197
Run B: Small Farms Decline	192,662.4	36,679.1	3,807
2. Moderate Growth Set			
Run A: Small Farms Expand	226,173.6	42,941.0	4,662
Run B: Small Farms Constant	224,872.9	42,747.2	4,460
Run C: Small Farms Decline	223,767.5	42,582.6	4,549
3. High Growth Set			
Run A: Small Farms Expand	248,178.5	47,114.4	5,104
Run B: Small Farms Constant	245,922.0	46,778.3	4,998
Run C: Small Farms Decline	244,153.9	46,515.0	4,915
4. Total Displacement Set			
Run A: Agriculture Grows 3%	203,614.9	38,844.5	3,906
Run B: All Industries Grow 3%	226,145.0	43,239.2	4,378
Run C: Agriculture Grows 5%	209,881.9	39,978.6	4,006
Run D: All Industries Grow 5%	248,147.3	47,442.7	4,782
5. Structural Reverse Set			
Run A: Agriculture Grows 3%	203,729.5	37,599.8	5,123
Run B: All Industries Grow 3%	226,260.1	41,994.4	5,587
Run C: Agriculture Grows 5%	209,935.0	38,535.8	5,417
Run D: All Industries Grow 5%	248,280.5	45,999.9	6,193

1. Minimal growth set: economy maintains 1974 demand level while small farm output

- increases or decreases 5 percent per year.
2. Moderate growth set: economy grows 3 percent per year while small farm output increases 3 percent per year, remains constant, or decreases 3 percent per year.
 3. High growth set: economy grows 5 percent per year while small farm output increases 5 percent per year, remains constant, or decreases 5 percent per year.
 4. Total displacement set: small farm sales to export fall to zero at end of five years while the agricultural sector grows 3 or 5 percent per year, or all industries grow 3 or 5 percent per year (small farm production continues to satisfy intermediate demand for large farms).
 5. Structural reverse set: large farm output declines to 50 percent of 1974 level at end of five years and small farms take up the slack while the agricultural sector grows 3 or 5 percent per year, or all industries grow 3 or 5 percent per year.

Output Impacts. Only in the minimal growth set when small farms contracted 5 percent per year for five years did total output decline from the 1974 level of \$195.1 million to a projected level of \$192.7 million. In all other cases total output increased; the highest level, \$248.3 million, was projected in the structural reverse set with all industries growing at 5 percent.

Income Impacts. The only instance in which total income was less than the 1974 level of \$37.0 million also occurred in the minimal growth set with small farms declining (\$36.7 million). The highest level of total income, \$47.4 million, was projected in the total displacement set with agriculture growing 5 percent annually.

Employment Impacts. In three projections employment declined below the 1974 level of 4,022 man-years: the minimal growth set with small farms declining (3,807 man-years), the total displacement set with agriculture growing 3 percent (3,906 man-years) and with agriculture growing 5 percent (4,006 man-years). Thus, only when all industries, including agriculture, grew 3 or 5 percent per year were the negative employment effects of total small farm displacement offset.

The highest employment level, 6,193 man-years, was projected in the structural reverse set with all industries growing at 5 percent. However, at all projected growth levels in the structural reverse set employment exceeded that of other alternatives.

CONCLUSIONS

In terms of dollar transactions, employment opportunities, and economic output, small

farms represented a relatively small sector in the economy of the area studied. However, because small-farm operators had a higher propensity than large-farm operators to purchase both factors of production and consumption goods locally, they were important to local suppliers and merchants.

Survey results indicated that the number of small farms in the study area would decline in the next five-year period, whereas large farms would continue in production or become larger. This finding suggests that past changes in the structure of the farm sector will continue in the short-term future.

The impact on the local economy of continued decline of small farms can be stated empirically by using the multipliers derived in this study. With other factors unchanged, each \$1 decrease in small farm output will result in a \$1.87 decrease in total output in the regional economy; each \$1 decrease in the direct income derived from small farms will cause a \$1.45 decline in total regional income; and each man-year decrease in employment on small farms will reduce total regional employment by 1.15 man-years.

The impact on the regional economy is, of course, determined by activity in the large farm and nonfarm sectors as well as in the small farm sector. Only under the assumption that small farms decline while all other industries maintain 1974 levels of final demand will regional output, income, and employment drop below base-year levels over a five-year projection period. When large farms are assumed to capture the entire agricultural final demand market, regional output and income exceed 1974 levels, but total employment increases only with a moderate or high growth rate in nonfarm industries. If large farms decline as an industry while small farms expand to offset the large farm decline and to meet the demands of a growing market, study area income, output, and employment will increase over 1974 levels.

It is unlikely that the nonfarm sectors of the study area economy would continue to operate at 1974 levels of output for five years. Therefore, succeeding forecasts assume moderate (3 percent) or high (5 percent) growth rates in other economic sectors. These growth rates are consistent with the expectations of local businessmen for the future of the community. The five-year projections then indicate that regional income, output, and employment will be higher than base-year levels despite negative multiplier effects of small farm displacement. The impacts of continued small farm decline are reductions in employment, income, and output, but the net effects depend on the rates of growth in other sectors of the economy.

SOME POLICY INDICATIONS

This study demonstrates the impact of farm size structure on three economic indicators: income, output, and employment. The economic tradeoff brought into focus is essentially between income and employment. Displacement of small farms by large farms results in greater regional income whereas increasing the number of small farms yields greater regional employment. Agricultural output is comparable for the two farm size structures.

In the broader context of rural development, the economic dependence of small rural towns on an agricultural sector including small farms is related to trading patterns, proximity to regional growth centers, opportunities for non-agricultural development, demographic patterns, and other factors. Although each community is unique, there are many similarities. The analysis presented provides a framework for understanding economic interdependencies in rural communities and indicates areas where public policies and private economic endeavors (e.g., technological develop-

ment and innovation) affect rural communities most severely.

A wide range of policy alternatives is suggested by these findings. At one extreme, the process of economic change which results in fewer and larger farms, rural-to-urban outmigration, and declining rural towns can be accepted as socially desirable. The benefits to society are assumed to exceed the costs of change to the individuals affected. Public policy would center on alleviating the economic and human costs incurred by small farmers and dependent rural communities.

At the other extreme, the continued existence of viable small farms and rural communities can be accepted as a worthy goal. Policies would ensure the continued survival of small farms and small towns, regardless of economic efficiencies foregone by society.

The relative merits of these extreme positions and various alternatives between them cannot be assessed by economic analysis alone. Each has a set of costs and benefits (economic and noneconomic) for individual farmers, rural communities, and society as a whole.

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