MARKETING EFFICIENCY AND EQUITY: A CASE STUDY OF AN AREA'S COTTON GINNING INDUSTRY

Stephen Fuller, Clyde Eastman and Joe Dewbre

Applied economists are becoming increasingly aware of the need to document the social rates of return to investment in research and to analyze how the benefits and costs brought about by the adoption of a research product are distributed among affected groups.[1] Relatively little empirical work has been done on these interrelated topics. Griliches [3] made an early contribution to the subject of social rates of return in his essay dealing with the hybridization of corn. Peterson [4] estimated the rate of return from investment in poultry research. Recently, several journal articles have examined not only the social rate of return to investments in agricultural research but also the distribution of benefits and costs associated with implementation of the research output. Schmitz and Seckler [6] computed the returns to investment in research directed toward development of the mechanical tomato harvester and the wage costs that its adoption brought to displaced tomato pickers. Ayer and Schuh [1] calculated the returns to investment in seed cotton research in Brazil and the division of benefits between producers and consumers.

A recent study at New Mexico State University [2] applied a marketing efficiency model to an eastern New Mexico area to find the least-cost organization for the area's cotton ginning industry. Because the least-cost organization offers sizable savings and profitability, its adoption appears imminent; that is, the research product will take on the characteristics of an innovation because of commercial applicability. In terms of Schumpeter's innovation classification scheme, the marketing innovation might be typed a combination of new marketing processes and new marketing methods. In essence, the total variable resource commitment required to process the area's cotton production is reduced. This paper examines the rate of return to research investment and the benefits and losses to directly affected groups.

BACKGROUND

The cotton ginning industry in the study area consisted of five single-plant proprietorships and one single-plant cooperative organization. Decreasing yields and reduction in planting acreage, had reduced total production in the area over the last decade. The number of operating gins however, had remained nearly constant. Low volumes per firm made it difficult to use gin employees efficiently and, in part, explained the high operation costs of each firm.

The marketing efficiency model was designed to include the cost functions of existing gin plants and seed cotton assembly and storage costs. The least-cost solution involved nominal investment in additional seed cotton storage facilities and operation of a single gin plant over an extended processing season. Through sensitivity analysis, it was determined that operation of either the cooperative or the most centrally located proprietorship firm yielded similar total systems cost. The locational and processing cost advantage of the proprietorship firm slightly outweighed the storage cost advantage associated with operation of the cooperative.

Since the research had limited applicability to

Stephen Fuller is assistant professor and Clyde Eastman is associate professor and Joe Dewbre is former graduate student of Agricultural Economics and Agricultural Business at New Mexico State University.

[1] Recently, publications such as *Hard Tomatoes, Hard Times* have focused additional attention on the subject.

ginning industries in other areas, the marketing innovation was assumed to have no effect on price because of the insignificant influence on aggregate supply.

Even though the study was not intended to be prescriptive, it seems reasonable to assume that the potential profitability of the cost-minimizing system would provide incentive for its adoption. The total variable resource commitment associated with the cost-minimizing assembly, storage and processing system was approximately 31 percent less ($8.00/bale saving) than with the conventional system. Given the area's existing production level, the additional investment required to implement the new system could be recovered in approximately 1.5 to 2.0 years. This would appear to provide a substantial incentive for adoption. If these changes evolve as a result of the distribution of research findings, several unanswered questions become relevant. Which groups will stand to gain and lose from the innovation, and what will be the magnitude of these gains and losses?

POTENTIAL DISTRIBUTION OF GAINS AND LOSSES

Identifiable direct losers are the employees and owners of the ginning firms which will be forced out of business. Reducing the number of operating gins through the use of additional seed cotton storage facilities will extend the processing season and consequently, the employment of some gin workers. However, the gains in labor productivity and the reduction in employees required for ginning the cotton in the area would substantially reduce total expenditure for this resource. Most gin employees there operate marginal farms and use the seasonal employment to supplement their farm incomes. Losses to gin employees are assumed to occur since few alternative employment opportunities would exist for this group; a reasonable assumption because: (1) gin employees have no transferable skill; (2) gin employees are immobile because most are area farmers who do not wish to relocate, and (3) gin employees are unorganized and are, therefore, not expected to act as a group to delay innovation.

The cotton processing firm adopting the marketing technology would be expected to force competing firms out of the industry through its cost advantage.[2] The owners of these firms would incur losses in the form of depreciation in the value of their gin plant assets and through the cancellation of income derived from firm ownership and management. The potentially displaced gin owners are elderly and very unlikely to relocate to find employment. Because of immobility and limited employment opportunities in the area, the presently experienced low profit levels have not stimulated liquidation of the proprietorship firms.

To identify gainers, it was necessary to make assumptions regarding ownership form of the evolved firm.[3] If the farmers collectively decide to use the cooperative organization, the benefits of cost reduction would be realized by cotton producers. The outcome associated with the proprietorship is more difficult to predict. In the short-run, the proprietorship may lower processing fees sufficiently to force competitors to exit the industry, while increasing fees at a later time to enjoy excess profits. Because of state and federal regulatory agencies and the proprietorship's recognition that cotton producers may establish a cooperative if they fail to share in benefits, the gains would likely be shared with farmers. Therefore, with the cooperative organization, cotton producers would expect to gain the benefits; whereas, with the proprietorship, the farmers may be forced to share the gains with the private entrepreneur. Either legal form of business enterprise will create losses for displaced gin employees and gin owners.

Producing agriculture's adoption of technology has substantially, if indirectly, affected the structure of rural communities and trade centers. In the case of the cotton gin, the gainers probably have less propensity to consume than the losers. However, the size of new income flows and the redistributed income flows and the number of unemployed who migrate would be negligible to the area's total economy. Most of the displaced gin owners would retire in their present community since most are approaching eligibility for receipt of social security benefits. Seasonal gin laborers would likely not leave

[2] An alternative procedure to achieve the same end would have the innovating firm purchasing competing firms. This would necessitate a capital outlay that would not be required with the above procedure. In most cases, the market value of gin plants in the study area was near the "scrap" value. Because owners of competing firms have limited employment opportunities, it is doubtful that they would be willing to offer their firms at this value. Therefore, instead of incurring a loss on purchased gin firms, it would seem rational for the innovating firm to force competing firms to exit through the use of its cost advantage.

[3] It was assumed that either the cooperative or the proprietorship would evolve; however, it is conceivable that both firms may operate. If this were the case, the potential savings would be reduced. The cooperative would be expected to force the proprietorship to charge processing fees that were near its costs of processing.

the community because they would have to sell their farms. Only several younger, full-time gin employees would be expected to leave the trade area. Consequently, the marketing innovation would be expected to have an insignificant effect on the community's expenditure pattern. If farmers were to receive the anticipated gains, one might expect an increase in area cotton production, which would add new income inflows. However, the expected gains per bale represent only about 0.05 percent of their value. So, there would be no incentive to increase production substantially. Because there is no local gin input supply industry, the displaced gins would not foster a closing of a local service industry. The adoption of the marketing technology would seem to have a significant indirect effect on some areas whose economy was more directly related to the cotton producing sector, but in the study area under consideration, indirect effect appears to be insignificant.

The following question logically evolves from the analysis within this section: is a particular market arrangement "preferable," "more desirable," or "better" in some overall sense than the present arrangement? An appeal to welfare economics is a rational course of action since its purpose is to examine the discipline of applied ethics.

WELFARE ECONOMICS

The "new" welfare economics has descended primarily from Pareto's work and is an attempt to determine how much can be said about general welfare without resorting to interpersonal comparisons. Pareto's criterion states that a change from arrangement B to arrangement A is desirable if such a change makes someone better off while no one is made worse off. By recommending only those changes which make at least one individual better off while making no one worse off, the economist avoids making value judgments about income redistribution effects of a given policy. However, several problems arise in the application of this criterion. First, the criterion favors the status quo, since in application the initial distribution of resources or goods is necessarily preserved. Its second inadequacy revolves about the fact that most policies require some groups to sacrifice.

To avoid this impasse, Hicks and Kaldor have proposed modifications to the Pareto criterion. The modifications involve the use of the compensation principle. This principle implies that a policy is desirable if the gainers could compensate the losers and still retain some gains. This modification permits the existence of losers and at the same time supposedly precludes the necessity of value judgments. There is currently controversy regarding the issue of whether compensation actually need be paid. Schmitz and Seckler [6] indicate that it is *not* sufficient that compensation could be paid – it must actually be paid if a change from the status quo is to be recommended. That is, to state that one arrangement is preferable to another on the basis that the increase in real income to gainers is greater than the decrease in real income to losers, is to assume that a unit of income yields equal utility to both groups. Therefore, to recommend such an arrangement without actual payment of compensation is to make an interpersonal comparison of utility. Others argue, however, that only the potential for compensation must exist, since in most cases compensation is not feasible. They assume that over time gains and losses will be distributed evenly among all members of society. Schultz [7] maintains, however, that gains and losses from economic progress are in no way evenly distributed. He argues further that not only are the gains and losses unevenly distributed but are accumulative; that is, they continue to burden particular classes, occupations, industries, and areas, over long periods of time. The issue of whether or not compensation is actually paid depends eventually upon the point of view accepted. Even if compensation were paid, at least two kinds of value judgments are involved: (1) individuals not directly affected will not dislike seeing another person becoming relatively richer, and (2) society does not judge the idea of compensation or the specific compensation device as bad in itself.

Even though welfare economics may not explicitly answer all our questions, it does provide a framework for our inquiry. Its application allows the researcher to examine the consequences of his research product, and at the same time permits an examination of judgments which may have been implicitly made. In the case under consideration, the predicted market arrangement would not meet the Pareto criterion since losses to affected groups have been recognized. To determine whether compensation is feasible, it is necessary to compute the magnitude of gains and losses to affected groups.

GAINS, LOSSES AND RETURNS

To measure the costs of labor displacement created by the mechanical tomato harvester, Schmitz and Seckler [6] treated these costs as annual flows. An analogous treatment, in this case, would mean that losers as a group would suffer continual annual

losses as a result of the new marketing procedure. This may appear to be an untenable assumption, but without any reliable predictor of the potential employment possibilities of the displaced group, the assumption was retained.[4] However, as Robinson [5] points out, "At any moment it is hard to foresee how those workers, for whose services in their former occupation there is likely to be less demand, will ultimately be absorbed." Gross returns to research investment represent the potential total savings to the study area available through the marketing innovation (Table 1). To calculate net returns to research investment, we subtracted the costs to affected groups from gross returns. It was assumed that adoption would not take place at a piece-meal rate over a period of time, but rather would be completed in one time period. We calculated first-year rate of return to research investment by dividing the return, assumed to be a perpetual flow, by the once-incurred research and extension cost. By assuming stability of conditions in the study area, we discounted the flow of returns back to a present value in order to estimate a long-run benefit-cost ratio.[5]

The following calculations of first-year return on research investment, long-run benefit-cost ratio, and distribution of benefits and losses are computed for a closed economic area, since the applicability of the research finding was assumed to be limited to the ginning industry in the study area. Research and extension costs totaled $18,100. First-year gross returns to research and extension investment with either the cooperative or the proprietorship organization were calculated at 579 or 640 percent, respectively. As shown by the information in Table 1,

Table 1. GROSS RETURNS, NET RETURNS AND PREDICTED LOSSES TO SELECTED STUDY AREA GROUPS AS A RESULT OF THE MARKETING INNOVATION, 1972[a]

Ownership Form	Gross Returns or Savings[b]	Costs to Selected Groups: Gin Employees	Costs to Selected Groups: Gin Owners	Costs to Selected Groups: Total	Net Returns
	dollars				
Cooperative	104,803	29,260[c]	29,500[e]	58,760	46,043
Proprietorship	116,130	23,940[d]	33,900[f]	57,840	58,290

[a]Estimates are based on gin employment records and financial statements.

[b]Total gains or savings available through adoption of marketing technology.

[c]Computed from estimated man-hour requirements under present system of 2.5 man hours per bale less estimated man-hour requirements under cooperative owned system of 1.4 man hours per bale. Displaced hours were costed at $1.90 per hour. Those gin employees who were also farmers would gain from adoption of the marketing technology since their returns from producing cotton would increase; however, this value was unknown and was not subtracted from wage losses.

[d]Computed from estimated man-hour requirements under present system of 2.5 man hours per bale less estimated man-hour requirements under proprietorship owned system of 1.6 man hours per bale. Displaced hours were costed at $1.90 per hour. Those gin employees who were also farmers would gain from adoption of the marketing technology since their returns from producing cotton would increase; however, this value was unknown and was not subtracted from wage losses.

[e]Represents the expected decrease in value of displaced proprietorship gin assets due to forced obsolescence and the cancellation of flow derived from gin ownership.

[f]Represents the expected decrease in value of the displaced gin assets due to forced obsolescence and the cancellation of income flow derived from gin ownership. Estimate includes value of displaced cooperative gin manager's salary.

[4] More realistic treatment of losses to labor would involve a comparison of the possible effects both with and without gin reorganization. This would require information on (1) the future of the cotton industry in the study area, (2) future alternative employment opportunities for displaced workers, and (3) knowledge of future technological changes in the ginning industry. Such information was not currently available.

[5] The long-run benefit-cost ratio of research investment was calculated with the following formulation: $\frac{R}{(i)\ (C)}$ where

R = returns or saving from innovation,
i = rate at which return or savings were discounted, and
C = cost of research and extension.

full compensation could be paid. If full compensation were paid, the net rate of return to research cost with the cooperative organization would be 254 percent. If the proprietorship organization prevailed, the net rate of return to research investment in the first year would be 322 percent after full compensation was paid. The net rate of return to research investment is conservative, to the extent that the displaced group finds comparable paying employment.

To calculate a present value of the annual net return flow, we discounted the annual net benefit flow at eight percent. We divided the present value of the annual net return or net benefit flow by the once-incurred research investment to get a long-run estimate of a benefit-cost ratio. We computed the long-run benefit-cost ratio for the cooperative and proprietorship, with compensation, to be 31.79 and 40.25, respectively.

The desirability of change hinges upon the value judgment regarding the need to pay compensation. Actual payment of compensation is unlikely to occur. In this case, the displaced individuals are unorganized and are not expected to organize to demand compensation. Clearly, not everyone benefits from the adoption of the new marketing technology. Displaced gin employees and gin owners stand to lose. Even the intended beneficiaries – the cotton producer -- may not benefit if the proprietorship prevails and captures the economic surplus from innovation for himself.

CONCLUDING REMARKS

Economists who employ efficiency models have contended that the models' outcomes did not necessarily define desirable social choices. The model was thought to be a diagnostic tool to locate inefficiencies and its outcome not a prescription of what should be done. This point of view would seem to relieve the researcher of a possible judgment regarding income distributional effects. However, in some cases, this may be a naive contention. Randall[6] argues that the provision of information, no matter how objective, automatically influences power relationships. For example, in the case examined, the publication of the research finding may increase the power of cotton producers and diminish the power of gin employees and most gin owners. Therefore, a publication whose intent was not prescriptive may in essence become a blueprint for change – a change that will alter income flows. Economists debate the value judgment regarding the need for actual compensatory payment when a policy is implemented which makes someone worse off while the net social gain is positive. In some cases, through the publication of our research, we are unconsciously making value judgments about income distribution. An applied welfare analysis of our research product would aid us in identifying these judgments.

Agricultural economists have in the past looked to research products of physical scientists to find cases that lend themselves to analysis of "who gains" and "who loses." This paper implies that agricultural economists may find it a valuable experience to extend their research findings to determine implied income distributional effects. Applied welfare economic analysis of our efficiency oriented research would aid the researcher in identifying the potential social consequences of an adopted research product. How many, if any, of our research products would give rise to negative net returns to research investment, i.e., are there any cases where the total losses to affected groups are greater than the total gains? What is the probability that the intended beneficiaries of our research in application do receive the benefit?

[6] The authors are indebted to their colleague Alan Randall for his thoughts on this subject.

REFERENCES

[1] Ayer, H. W. and G. E. Schuh, "Social Rates of Return and Other Aspects of Agricultural Research: The Case of Cotton Research in Sao Paulo, Brazil," *American Journal of Agricultural Economics,* 54:557-569, Nov. 1972.

[2] Fuller, S. W., et. al., "A Study of Assembly, Storage and Processing Costs as Affected by Altering the Number of Operating Gins," New Mexico Agri. Exp. Stat. Research Report No. 247, 1973.

[3] Griliches, Zvi, "Research Costs and Social Returns: Hybrid Corn and Related Innovations," *Journal of Political Economy,* 66:419-431, Oct. 1958.

[4] Peterson, W. L., "Return to Poultry Research in the United States," *Journal of Farm Economics,* 49:656-669, Aug. 1967.

[5] Robinson, E. A. G., *The Structure of Competitive Industry,* University of Chicago Press, 1958.

[6] Schmitz, A., and D. Seckler, "Mechanized Agriculture and Social Welfare: The Case of the Tomato Harvester," *American Journal of Agricultural Economics,* 52:509-577, Nov. 1970.

[7] Schultz, T. W., "A Policy to Redistribute Losses from Economic Progress," *Journal of Farm Economics,* 43:554-565, Aug. 1961.