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RESEARCH REVIEW

IN THIS ISSUE

"An excessive study of mathematics absolutely incapacitates the mind," according to Sir William Hamilton, the 18th century Scottish philosopher. "In mathematics, dullness is elevated to a talent," added Hamilton, "and talent degraded into incapacity." The three articles in this issue of *Agricultural Economics Research* depend heavily on mathematics, statistics, and computers. Whether these articles are evidence of dullness in ERS elevated to a talent, talent degraded into an incapacity, or neither of the above, we leave for the reader to determine.

An overview of comprehensive models used to support ERS forecasts and longrun projections of commercial agriculture forms the subject of the first article. This overview opens a series of articles planned for AER that will describe and explain ERS modeling efforts. In this issue, we focus on commercial agriculture. Other articles or series of articles are planned to appear later on rural growth, natural resource development, and progress in underdeveloped nations.

The authors of the second article use an econometric model to evaluate two decades of farm programs. The programs helped support farmers' income during the early part of the period, but they also provided economic incentives which stimulated output. As a result, farm prices during the latter part of the period were lower than they would otherwise have been.

An interesting problem raised in the third article is: "What is a random sample?" The authors take the position that observations randomly sampled from aerial photos warrant the same statistical treatment as if they had been randomly sampled from the ground. Reviewers of the article cautioned that the procedure was not valid; some points on the air photos had twice the probability of other points of entering the sample because of planned overlaps in the photo segments. The authors countered that all points on the ground had an equal probability of appearing twice as often in the photos. But the reviewers were also concerned that air photo coverage was not randomized before the photos were taken. The fine point of the argument appeared to turn on whether a sample must be purposively randomized or be simply unpredictable *a priori*. The issue was not resolved before we went to press, and the article appears as is so that you can make up your own mind.

Both this journal issue and the last one represent a new focus for AER involving changes in its essential components: content, style, and format. We intend a broader perspective, one that reflects the total ERS effort, that shows the work of ERS as an *Agency* in agricultural economics. The major articles will reflect this shift. The former Book Review section will too. Renamed Research Review, it carries important brief commentaries that do not fit into the article format.

Content is significant but it cannot be conveyed without language. The words, the style one chooses, must be clear and concise, freed of ambiguities, pared of padding. In an age of considerable division into specialized fields that require technical language, AER will continue to treat subjects technically. But we will avoid the use of "jargon" words as much as possible. Similarly, we will use only charts and tables that function with the text, not that detract from or duplicate it. Considerable time and care remain imperative in both the selecting and editing of Journal material.

Format, how the Journal "looks" to the eye, completes the essential set of components. We have made certain changes to facilitate the information flow from page to brain. For example, the abstract now flows spatially with the article. The tables and figures are shaded for clarity and ready separation from the text. We are treating the cover differently to capture both the realism and abstraction of agricultural economics. The journal that makes a statement by its content, style, and format will attract and sustain more reader interest.

We are also attempting to make AER more noticeable to a wider audience. Its circulation, at around 3,000, is small. Yet it carries articles whose content is both timely and timeless, whose subjects are important, and whose techniques can be both additive within the agricultural economics discipline and also perhaps applicable beyond it.

Finally, *Agricultural Economics Research* currently represents the sole quarterly research journal of the U.S. Department of Agriculture. Its continued usefulness depends on our efforts and on yours. We need and invite your support.

Clark Edwards
Judith Armstrong

FROM THE ST. CROIX TO THE POTOMAC

by Sherman E. Johnson. Big Sky Books, Montana State University, Bozeman, Montana 59715. 289 pages. 1974. $4.95 (paperback).

In times past when it was not déclassé to read the poems of Longfellow and Lowell, pupils recited how "lives of great men" promise that we too can leave footprints. Thereupon a dutiful scholar such as this reviewer read the autobiography of the swashbuckling Theodore Roosevelt and that of the "up-from-slavery" Booker T. Washington. There followed the works of the muckraking Lincoln Steffens, the "never-educated" Henry Adams, and the Plains pioneer Alvin Johnson.

And now we have the footprints of Sherman Johnson, sometime college professor and drought years' land planner and purchaser for the Resettlement Administration. Principally a career agricultural economist in the U.S. Department of Agriculture, Johnson rose to receive the President's Award for Distinguished Federal Civilian Service. If Johnson's footprints are not giant they are nonetheless sharply graved.

And graved with a purpose. In his autobiography, Sherman Johnson declares his message unabashedly. Primarily, he intends to exalt the role of the Government bureaucrat; secondarily, to advise him on deportment. With the unembellished directness that is his signature, Johnson upholds the worth of public service and testifies to his own pride in it. Far from being annoyed by "the invidious connotation of the word *bureaucrat*," he is "proud of the appellation."

Johnson advocates dedication. For "success, and happiness in professional public employment, first one needs a spirit of service to fellowmen, second, one must place the opportunity for service above greater financial rewards." The theme is echoed in the book's closing line: "If young people become convinced they are truly serving the public welfare they will find professional public service a rewarding experience."

On careful reading, the autobiographical narrative divides three ways. First Johnson describes life in the Swedish lumbering and farming community of the St. Croix Valley of Minnesota, where he was born in 1896. He recounts the hardship and financial insecurity of farming in that territory, also the diversity of personalities who inhabited the place.

Second, we see traced the remarkable career of a man who as a youth scarcely could leave farmwork to attend school and who interrupted his schooling after the eighth grade. Although he lived only 27 miles from Minneapolis and St. Paul, he first visited those cities when his father, who admired Theodore Roosevelt, took his 16-year old son to hear the Bull Moose candidate for the Presidency. The one trip "whetted my appetite," Johnson writes. Thereupon, he enrolled in an agricultural academy in St. Paul and eventually in the university. He received his B.S. degree at age 28 and continued with graduate studies.

Once embarked on a professional career, Johnson moved among the landgrant institutions of Minnesota, Louisiana, Montana, and South Dakota. After study of the new farm programs from the vantage point of the Brookings Institution, he worked as land planner and purchaser in the Northern Plains. In 1936 Johnson moved permanently to Washington. He rose quickly to head the Division of Farm Management and Costs in USDA's Bureau of Agricultural Economics. Without disparaging his later War Food and international achievements, many of us who watched from near at hand believe that Johnson distinguished himself the most as a leader in farm management research. Later assignments include agricultural counseling in India and elsewhere, and election as President of the International Association of Agricultural Economists.

A third division of the autobiography contributes to agricultural history. Sherman Johnson was so involved in production policy for U.S. agriculture for 30 years that the story of his life is the story of that policy.

Each part of the Johnson saga will appeal to a separate readership. The account of life in the country will attract some readers out of nostalgia; others, from curiosity. Johnson's associates and friends, of whom there are many, will savor the personal story with deep appreciation. Absence of literary grace notes and of soul-in-torment drama will reduce its appeal to strangers. Stylistically, the book is written almost without inflection: crossing a stream by guiding a Model T Ford on two planks ranks equally with a conference with Nehru about India's food problem.

Modest man that he is, Sherman Johnson will not be dismayed if his most lasting message proves to be his insights into the history of agricultural programs. His career spanned exciting, yeasty years. Government and farm leadership pulled agriculture out of depression, encouraged it to produce full-blast during wartime, applied technology in postwar years while trying to mitigate income-depressing consequences, and finally taught a technological lesson worldwide.

A few evaluative reflections shine through. Johnson regrets the favoritism shown in farm programs toward the larger commercial farmers. He laments the disregard of smaller farmers, tenants, and especially hired farmworkers. "Society cannot afford to maintain a caste system in agriculture," he warns.

It is indeed some distance from the St. Croix to the Potomac. Johnson's footprints in spanning that distance and his testimony of gratification are worth heeding. As his autobiography reveals, Johnson wielded influence and won laurels not only without engaging in strategic maneuver, but without being capable of it. We can suspect that in governmental infighting his greatest resource was not technical skill but his known absolute candor. It was disarming. If intellectual display appears now to be in vogue, it may be refreshing to know that a competent economist attained the highest civilian recognition in the U.S. Government without imposture or pedantry.

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UNCLE SAM'S FARMERS: THE NEW DEAL COMMUNITIES IN THE LOWER MISSISSIPPI VALLEY

By Donald Holley. University of Illinois Press, Urbana, Illinois. 312 pages. 1975. $14.50.

The depression years of the early 1930's seem long ago. Cotton in the deep South sold for 6 cents a pound when a buyer could be found, working capital or "furnish" for family living and crop production was nearly impossible to obtain; tax and mortgage payments were in arrears; and jobs were almost nonexistent. Because of its rurality, the rural Mid-South perhaps did not have as high a jobless rate as did the more industrial East and Midwest. But poverty was more severe; it was the sharecroppers, the tenant farmers, and the sawmill workers who were dispossessed. These people were disadvantaged before the Great Depression; with it, their plight became almost hopeless.

But the period was also a time of experimentation in social and economic programs. Into the situation came the alphabet agencies of the New Deal attempting to alleviate, if not solve, the problem of rural poverty. In his book, Holley has elected to focus on these attempts of the Federal Government to decrease farm poverty. As he said, the idea was simple: "The government would take impoverished families off land too poor to yield a decent living and convert it to forest, recreational, or other nonagricultural uses. The displaced families would be resettled on productive soil and eventually they would become owners of their farms" (p.i.). Farm communities and subsistence homesteads command most of Holley's attention; rural rehabilitation (rehab farms) and tenant purchase farms are only incidentally treated. *Uncle Sam's Farmers* is more an account of the Agencies and the men of these Agencies, especially their operations in Arkansas and, to a much lesser extent, in Louisiana and Mississippi during 1933-46. The book provides a history of attempts at cooperative farm efforts.

Holley has performed a much needed service in his recapitulation and discussion of the times, the events, the Agencies, and the people involved in innovative programs which attacked rural poverty, particularly farm poverty. He is primarily concerned with the large costly projects, such as Dyess, Plum Bayou, Terrebonne, Transylvania, and Lake Dick but some of the references stem from the tenant purchase (Bankhead-Jones Act) and the farm rehabilitation programs. The book provides a detailed story of Region VI operations of the Resettlement Administration and the Farm Security Administration that concerned community farms. In many respects, Holley's work is also a defense of the men and their actions, the policies and the Agencies involved.

People like Rexford G. Tugwell, Harry L. Hopkins, Carl C. Taylor, W. R. Dyess, T. Roy Reid, E. B. Whitaker, Floyd Sharp, and T. B. Fatherree were some of the principal actors in the drama of the "war against poverty" in the 1930's. Some of these men were not known outside Region VI, but others operated at the national level. It is important to have their contribution documented.

But as the author says: "Although the government divested itself of control over the resettlement projects, the communities themselves remain monuments to the idealism of a nation fighting economic collapse. Some thirty five years later Dyess is occasionally mentioned as the place where Johnny Cash grew up, while projects like Plum Bayou and Terrebonne have fallen completely into obscurity" (p. 282).

An interpretation and an evaluation of the social and economic impact of the experiments would have contributed to the book. One major conclusion reached by Holley was that the small size of the farm units (usually less than 40 acres) contributed to the lack of longrun success of the projects as farming ventures. He also concluded that the selection of individual families for participation in the projects was less than optimum. Though the conclusions are probably correct, he presents no supportive evidence. Nor did he assess the economic and social impact of the projects on the farm families or on the region.

Holley's book provides an excellent history of the U.S. Government's attempt to solve poverty among a selected group of people in a restricted geographical area during a most adverse economic time. But the broader implications were not discussed, and in this sense the book is lacking.

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THE ECONOMICS OF NATURAL ENVIRONMENTS

By John V. Krutilla and Anthony C. Fisher. Studies in the Valuation of Commodity and Amenity Resources. For Resources of the Future, Inc. The Johns Hopkins University Press, Baltimore, Md. 21218. 292 pages. $16.95.

In a work which boldly tackles a difficult subject, Krutilla and Fisher have demonstrated the possibilities of theoretical and empirical economic analysis for practical problem solving. They present "operational models" for conducting quantitative analyses of the amenity value of environmental resources and conventional analyses of commodity resources.

The volume is divided into two basic sections (actually three if the advanced mathematics information is considered): one which lays an institutional and theoretical framework (four chapters) and one which applies the framework to five specific cases. Although much of the text draws upon Krutilla and Fisher's research, three of the cases represent a condensation from other research efforts of Resources of the Future, Inc. (RFF).

The authors set the tone in chapter one with an adequate introduction to management of natural environments, particularly public lands. Early on, they discuss the idea that land in its natural state is not necessarily unproductive. In perhaps their strongest point, the authors single out the critical importance of direct and indirect Government subsidy in the alteration of wild lands.

Chapter two presents a discussion of failure by markets to allocate efficiently the resources of natural environments. Topics covered include common property resources, public goods externalities on public lands, and the relationship between assignment of property rights and resource valuation.

The important issues of irreversibility and time are considered in chapters three and four. A very lucid discussion appears on society's potential attitude toward the risk associated with the irreversible (in a technical, polyperiod sense) conversion of natural environments to developmental purposes. Because of the existence of option value and newer interpretations of the possible gains from trade among generations, traditional benefit-cost analysis of a natural resource development project may be incomplete as a basis for a public decision. In a model using optimal control theory, the authors demonstrate that:

where benefits from development of a natural environment are decreasing over time relative to benefits from preservation, the instantaneous optimum level of development is also decreasing (p. 57).

In chapters five and six, the authors apply the theoretical framework to the hydroelectric power plant proposals for the Hell's Canyon reach of the Snake River. They demonstrate how a critical review of a natural resource project may reveal some of the social costs (accounting for asymmetrical technological change and adjusting for subsidies), exclusive of the environmental costs. After determining that one of three proposals demonstrated net economic benefits, they evaluated the amenity resources, using the ecological carrying-capacity concept. The amenity valuation established a case for preserving Hell's Canyon by demonstrating that "quantitative analysis can be very useful even in the absence of its capacity to capture all of the values potentially attributable to preserving rare natural environments" (p. 135).

In chapters seven and eight, Krutilla and Fisher apply the framework to the White Cloud Peaks case (in which a marginal molybdenum extraction and processing facility has been proposed) and to development in the Mineral King Valley (in which additional capacity has been proposed within an existing system of intensive recreation facilities). Once again, the authors show that strong arguments against development, based solely on private market criteria, can be developed. The optimal capacity concept was used, in both cases, to ascertain what recreational demand levels might occur.

The final two cases are less site-specific. Chapter nine addresses the problem of optimum allocation of prairie wetlands for breeding and habitat use by migratory waterfowl. The problem involves private and common property interests. In chapter ten, the authors evaluate alternatives for Alaskan oil exploitation and transportation systems.

Assessing this book is difficult enough because of the biases introduced through a raising of expectations, only to find that the problem remains as tough to crack as ever. However, a noticeable dent has been made towards the valuing of environmental resources. One can expect too much from people in an organization (RFF) which has continuously produced a rich body of knowledge on natural resource management. The amenity resource valuation work (recreational mainly) stems from the long line of research beginning with Marion Clawson in the fifties. Krutilla and Fisher attempt to value environmental costs, saying that "ultimately the environmental damages reckoned as economic costs will have to be assessed" (p. 279).

The feeling exists, after reading the volume, that environmental damages continue to be viewed mainly as uneconomic (except recreational), and that they represent an intangible (albeit important) value to society. Though this feeling may be an overreaction to the research caution (scientifically correct) of the authors, this reviewer remains ill at ease, given the influence of these two economists. For example, there are economic costs from the environmental damage of tidal marshland alteration, a specific not covered in the book. These costs include erosion and flood control plus waste assimilative capacity—to name a few. But the point is that ecology science disciplines may have knowledge beyond economics, which when given an economic interpretation (for example, the prairie wetland work discussed above), allow a management tool to be applied in the context of broad social efficiency. Though a wealth of additional scientific data already exists, I believe much more exists than is apparent, based on the dearth of major publications on social costs (other than health and recreation). While agreeing with the authors that environmental issues constitute a methodologically difficult front, this reviewer contends that analysis must be pushed forward beyond normal economic consideration. Like it or not, we are allocating resources that are scarce (in quantity and quality) and unique, the longrun effect of which is often irreversible.

These specific criticisms of the work perhaps stem from unfair expectations of a broader perspective. However, when considering the use of natural resources, one needs a broader brush analysis because of the possibility of future option foreclosure. When considering alternative energy sources, not only the *in situ* or direct production costs should be analyzed, but also the relative environmental costs. The environmental risk of a nuclear alternative was not even lightly considered in the Hell's Canyon case, although so-called ecocatastrophe issues were briefly discussed in the Alaskan Oil case. Damage to the Arctic tundra ecosystem would be hard to value in an economic sense, but damage to West Coast fisheries may occur and require economic evaluation. Similarly, in the bioeconomic optimum allocation of wetlands, the authors did not consider the increased cost of plowing around the potholes, the assertion of flood losses (though the wetlands are purported to control flood levels and ground water recharge), and the lost agricultural production. While increasing the complexity of already complex problems, ecological solutions to ecological problems require this expanded approach.

On balance, the book provides a useful view of the state of the art. It is well written and well referenced. Both authors and the other researchers involved should be commended for continuing to push the capabilities of the dismal (and too often conservative and provincial) science into policy areas requiring the analysis of tradeoffs.

Based on the book's preface statements that it represents an "early effort" and that the "volume doubtless raises more issues than it is capable of resolving satisfactorily," a final comment by RFF's Marion Clawson is appropriate. In their 1974 annual report, Clawson states: "The partial and piecemeal approach to environmental problems . . . ignored the maxims of ecology . . . everything in an ecosystem is related to everything else in that system."

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FOOD AID AND INTERNATIONAL GROWTH

By Earl O. Heady, Leo V. Mayer, Keith D. Rogers, and Uma K. Srivastava. Iowa State University Press, Ames, Iowa. 1975. 160 pages. $7.95.

The effects of food aid programs on producer and consumer welfare, agricultural progress, and fiscal structures in recipient countries are quantified by the methods reported in *Food Aid and International Economic Growth*. The presentation suffers somewhat from dated information. Statistical tables generally contain information only up to the late 1960's, excluding data on projections. Despite this shortcoming, the book is a very useful addition to the literature on food aid.

The authors use India as the reference country. They focus their analysis on conditions under which consumer welfare can be enhanced and farmers insulated from negative price impacts. According to some analysts, assert the authors, food aid has, through its effects on the market, dampened agricultural development of the low-income countries. Other analysts believe that the net effect of food aid has been positive.

Future usefulness of food aid, say the authors, will depend on the answers to the following critical problems that have reduced the efficiency of food aid as a tool for economic development:

- Negative price and production impact on domestic producers in recipient countries
- Hardening of the terms of food aid and lowering of the aid component in the shipments
- Problems associated with excess accumulation and use of counterpart funds from past aid agreements.

Their expressed objective is to solve these problems empirically and to provide some policy guidelines for both developed and developing countries to increase the effectiveness of food aid in economic development.

In the book's theoretical background, the authors present the necessary and sufficient conditions for preventing the food gap from becoming a constraint on the growth process. They examine the price disincentive effect of food aid by developing a theoretical model to test the hypothesis that the negative effect on prices and production is much less or else absent when markets are differentiated. If this hypothesis is correct, previous work which neglected the real-income effect on demand seems to have overstated the negative effect of P.L. 480. Of course, some earlier studies referred to by the authors are not strictly comparable. For example, the Mann study was based on 1952-63 while the authors' study, which changed the specification of various equations in the Mann study was based on 1956-67.

Using India's differential market system of commercial and "fair price" shops as an example, the authors concluded that the negative impact of P.L. 480 on domestic production and prices could be reduced to insignificant proportions if the commodities are distributed to create new demand. To ensure that their farmers experience no price dampening impacts, recipient countries should be required to channel aid supplies through differentiated markets, such as India's fair-price shops.

The authors state that the hardening of food aid terms has reduced the real-aid component of P.L. 480. Pricing food aid at world market prices has created a debt-servicing burden which threatens to cut through the foreign exchange resources of recipient nations in coming years. However, the inflationary impact of large accumulations of counterpart funds can be overcome. The writers maintain that, to solve this problem, surplus local currency counterpart funds should be given back to aid-recipient countries in the form of grants. They also estimate that food aid can be priced at lower levels with little additional net cost to the United States.

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TOWARD MORE ACCURATE FARMING DATA

The cornerstone for a new farm statistical structure in the United States was laid in 1966, when the Statistical Reporting Service (SRS) of the U.S. Department of Agriculture put a probability sampling scheme into operation in the 48 contiguous States. The scheme, a long time in the making, started with the master sample for agriculture originally developed at Iowa State University during World War II. SRS began experimenting with the application of this area sampling frame to crop and livestock estimating in 1953. In that year, the Congress authorized the Service to research alternative ways of making these estimates, following an obvious breakdown in estimation of cotton production in 1951.

Introduction of the new method was approached carefully and deliberately, because trouble was encountered at every step. Eight years of research and pilot operation preceded the initiation of probability surveys to collect data in 11 Southeastern and 4 Midwestern States where the master sample could be adapted with relatively little modification. Thereafter, SRS introduced the enumerative surveys in a few additional States each year after it had suitably modified the area sampling frame to allow for different farming conditions, such as those found in range areas, irrigated valleys, specialized fruit and vegetable growing areas, and areas of developing urbanization. The objective of this new survey system was to provide estimates for major crop and livestock items with a sampling error at the national level of 2 percent.

By 1969, with probability sampling a reality in 48 States, a revolutionary change occurred in SRS Crop Reporting Board procedures. A major hurdle was overcome: internal opposition among long-experienced statisticians. Before that time, national estimates had been derived by summing estimates for the individual States, estimates which had been arrived at by various sampling methods. To gain the real advantage of a

national probability sample, necessarily small, statisticians had to determine the national estimate for a particular crop first, after which they scaled or adjusted individual State estimates to conform with the national estimate. SRS introduced this change in Board procedures only after much discussion of the likely benefits and risks. The new system soon clearly proved itself superior for wheat estimates and it was adopted for other crops and for livestock.

A major challenge to the new system arose in 1967. Results of the 1964 Census of Agriculture became available, and these indicated that total cattle estimates made by SRS needed to be increased 2 percent. Larger percentage adjustments would have to be made in the subdivisions of cattle numbers if the SRS projections were to be compatible with the Census benchmarks. Since the probability surveys were just being put into effect, they could hardly be held responsible, but they were held suspect. After all, the census method was an old established system, never challenged.

Three conclusions emerged from this experience. One, the area probability sample served better for estimating crops than for livestock. Acres did not move, but livestock did. Livestock numbers changed substantially seasonally; acreages, less so. Most important, very large numbers of livestock and poultry were often concentrated on small areas of land, causing large sampling errors in the estimates based on area samples.

Two, the goal of achieving a 2-percent standard error for national estimates of major crops or livestock would no longer be adequate for a rapidly changing agriculture. Cattlemen made it abundantly clear that a 2-percent deviation from the mark was too misleading for their planning. They had been led to believe by the analysts interpreting the estimates that the cattle cycle was on the down side and that price prospects were favorable. Consequently, these producers had retained more cattle than would be profitable to raise.

Three, a less costly method was needed than simply expansion of the size of the area probability sample, the usual method for gaining accuracy. As a method for data collection, mail surveys cost much less than the personal interview technique required for an area sample.

To achieve the benefits of a mail survey approach, SRS began using list sampling frames to supplement the area sampling scheme while retaining a probability survey design. With research help from Professor H. O. Hartley of Texas A & M University, Service analysts developed a methodology that combined these two sampling methods to get a single probability estimate. The result: "multiple-frame" sampling.

The approach was tried first with livestock, where improvement was most needed. Again adaptation was made cautiously and carefully. Hog and pig estimates from multiple-frame samples were introduced in five States in 1970. By 1975, they were being used in 23 States for 95 percent of the hog population. Simultaneously, cattle multiple-frame samples were introduced in 38 States for 96 percent of that population. The accuracy of results proved remarkably good, correctly calling the changes in direction of these populations during periods of rapidly changing growing and cultural practices that caused analysts to question these estimates repeatedly. A series of unexpected developments, unprecedented in recent times since the use of large-scale feeding has become prevalent, caused price and profit outlooks to change rapidly and drastically. Grower behavior in reaction to such events as inflation with unprecedented rises in feed and fuel prices, peacetime price ceilings, and a series of erroneous economic forecasts (especially of food prices and farm income) took unexpected, and, to older generations of analysts, unbelievable turns. Time after time, accuracy of hog and cattle inventory estimates was vindicated by the subsequent marketings, though such marketing occurred on different schedules than the analysts had anticipated.

Superiority of multiple-frame sampling had been clearly demonstrated. Then, as the need developed for more accurate estimates of farm data generally, because of urgent world food problems, SRS sought to adapt the method to other estimates. To do so, it needed as complete as possible a mailing list of farms, classified by enterprise and size, to serve as a list sampling frame. Research on how to get such a list indicated that no national list was available to serve as a good starting point. Many lists from various sources would have to be merged to attain a reasonably complete list. Because of the variation in sources, list sampling frames would best be compiled State by State. Two more difficulties became apparent: identifying the person able to give authentic, current information on each farm or establishment so that it appeared once and only once in the list, and keeping the list up to date. A multimillion dollar budget would be required for specialists to compile a suitable list in every State.

The SRS budget for 1976 contained an appropriation of $1,250,000 to get started. This amount allows analysts to prepare the foundation for a restructuring of the farm statistical system which will make the investment well worthwhile.

First to benefit from the availability of multipurpose list frames will most likely be the crop and livestock estimates. Very soon, however, a major beneficiary will be the economic estimates made for the Economic Research Service and other Federal and State agencies for which SRS collects data. Currently, analysts collect much of the economic data as part of the comprehensive national probability surveys made each year. The primary purpose of the June survey is to collect data on planted acreages of crops; the other, in December, is taken mainly for livestock data. A third survey is being introduced in 1976, basically to obtain economic data. Demand has grown for such data to be more current than now, obtained as they are through the quinquennial census of agriculture.

The flexibility of a system of annual sample surveys will allow most data to be collected on a more timely basis. Further, much duplication between long- and short-term surveys can be eliminated and, over a 5-year period, all data heretofore collected through the census can be acquired.

The principal distinguishing feature of the census of agriculture today is that it represents the main source of farm data by counties, because it is the largest sample taken. In the two most recent censuses, about 85 per-

cent of the farms were covered. With a controlled probability sample, such as the one SRS is preparing to take nationally, about a 25-percent sample will probably yield county data of sufficient accuracy. Success with such a system would substantially reduce the overall reporting burden on farmers. The new system would, however, require the full cooperation of persons selected in each survey's samples.

The Office of Technology Assessment of the U.S. Congress has reported favorably on this proposed method for acquiring agricultural data. SRS is developing its list-building capabilities as rapidly as the new appropriations permit. By the time necessary changes in the laws have been made to authorize an integrated agricultural data system, SRS hopes to have developed the means to bring this system into being.

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Statistical Reporting Service

A CRITIQUE OF THE FARM INCOME TASK FORCE REPORT

The magnitude of upward revisions made in the 1973 net farm income figures between January and July 1974 created both political and professional concern. As a result, the ERS Administrator set up in mid-1974 a Farm Income Task Force to provide an out-of-house evaluation of Service performance in this key area of estimates work. Some of the task force members were ERS economists; most were not.

The revisions turned out to have been necessary because, in a period of disruptive change, ERS had been using procedures designed for periods of gradual change. To find corrective solutions, the taskforce had three objectives:

- To recommend changes to reduce the magnitude of revisions possible in the future
- To integrate the figures more accurately with the national income and product accounts (NIP)
- To reflect more accurately the major organization changes which have occurred in the farm production sector.

The task force report contains a number of important observations and recommendations. As a major contribution, members integrated a set of concepts, emphasized the need for more accurate, complete data, and pinpointed these data deficiencies as the real "villains" in the 1973-74 faulty estimates. They found that the percentage revisions required for farm income were the largest of any component of national income, and that successive revisions regularly zeroed in on what became the final estimate. To reduce both frequency and magnitude of revisions, the task force proposed that substantial changes be made in data collection, handling, release, timing of revisions, accounting rules, and definitions. Task force members noted especially the problems created by organization change in the farming sector, and that some errors in the estimates result from use of concepts or definitions that fail to square with behavior in the real world.

"The most significant improvements are possible in the area of basic data," concluded the task force members. Certainly this conclusion holds if one emphasizes the minimization of revisions objective. I would argue that some of the suggested changes in concepts, discussed later, are more significant in achieving the other two objectives of the task force.

It is of particular importance to note that most of the data changes the task force recommends must be made by agencies other than ERS, especially SRS. The report calls for monthly quantity data on crop and livestock movements to parallel the monthly price data already collected. Availability of these additional statistics would eliminate reliance on historical monthly marketing patterns in making preliminary estimates. Use of such historical patterns was a major factor contributing to the need for revision in the 1973 estimates. Other priorities within the area of basic data collection, according to the task force, are more frequent statistics on production expenses and inventories of livestock and purchased inputs.

A second level of data improvements would support the objectives of improving comparability to the NIP accounts and of recognizing farm organizational change. Most importantly, the committee recommends adopting the "establishment basis" to replace the current mixture of establishment and product bases in the accounts. As a result, the definition of the farm sector would be closer to that used in the NIP accounts for other sectors. The farm sector would include all output of establishments whose primary business was farming, including ancillary products and services produced by them. Accompanying this basis change would be four other modifications:

- A shift to the concept of "income from farms" from the concept of "income of farm operators"
- An emphasis on gross value added or gross income originating in the sector rather than net value added or net income
- A more complete accounting of interfarm transfers
- The separation of capital formation from current production expense (procedures now treat breeding herds and construction as operating expenses).

These changes would shift emphasis from the farm as a consumption unit to the farm as a business, they would provide more complete measures of economic activity, and they would distinguish more clearly between production and investment activities. The conceptual changes yield a number of further data needs: interfarm movements, activity in secondary farm enterprises, and separation of breeding stock from fattening animals (especially onfarm or own-account capital flows).

There can be little question that the changes proposed by the task force would contribute in a major way to the three objectives. This reviewer has little to add within that context. The committee also suggests a few administrative changes to improve timing and to facilitate necessary revisions, but admittedly and by assignment gives only peripheral attention to improved techniques of program operation. The committee

appears to accept uncritically that current staff are "at least fully occupied" on current operations and argues that ERS should give high priority to adding new staff to lead program development. Given the present size of this operation and the severe competition among ERS priorities, the current staff might have appreciated some suggestions on how to squeeze more out of what resources they now have.

As one who has read reports of earlier ERS task forces on the farm income and balance sheet, AAEA concept committees, and OMB task forces, and who has served on internal ERS study groups on farm income and balance sheet work, I cannot help being impressed by the extent to which the committee report is consistent with previous suggestions.

I am under the impression that the report is largely an original effort, though they obviously drew on various previous studies, such as that by the inhouse Farm Income Committee chaired by Eldon Weeks, as well as consultant expertise in developing it. Regardless of the source of inspiration, the task force has served a valuable function in assembling and rationalizing a set of proposals, as well as in validating prior internal ERS studies. It is a pity, and yet an undeniable fact, that legitimizing of staff ideas most often takes place by the stamp of outside approval.

What are the prospects for implementation of the ideas? Mixed, I suspect. A major portion of the improvement requires large infusions of budget to SRS to collect data more frequently. At least through the current budget crunch, I would anticipate only marginal shifts in current data instruments. Provided that we don't encounter another economic roller coaster of 1973 proportions, that will do for the short term. In a longer horizon, it is to be hoped that the suggestions will serve as a blueprint for shifting and for adding data resources. Once the budget situation is brighter, it behooves economic analysts to press for the resources required.

Events seem to be moving toward conceptual adjustments to recognize changes that have taken place in the farm sector. With the major initiatives being made in the 1974 census, I hope we can also look forward to the farm income accounts adjusting in the directions recommended. The existing system evolved by building bridges of assumptions over various data chasms. No less, the proposed system also could be constructed from available data, given some manpower devoted to it. As the assumption framework is developed, it needs to be thoroughly documented so that researchers outside the farm income group can participate in evaluating the work and making refinements, and so the new data base can substitute for assumptions as it becomes available. At the same time, the framework needs to be converted into a computerized program to improve operating efficiency and timeliness of the estimates. At least one economist and one programmer assigned full time would provide a start. Perhaps this is the groundwork to be laid while efforts to augment the data base are ripening to fruition. The latter requires SRS concurrence, and thus is not solely under the ERS Administrator's control.

The committee's adoption of the establishment basis and "net income of farms" begs a larger question on data, albeit one they were not assigned. Should not the Department collect economic data to enable aggregations by product and by persons classed as farm operators? The general answer is that USDA should and it does.

The derivative question becomes whether these accounts should not be planned in conjunction with the accounts reported by establishment. The task force recognized and noted that some of the commodity quantity data have parallel payoff in situation and outlook work. A product account basis is a natural way of organizing such data. Since commodity work consumes a major part of ERS resources, it would seem efficient to integrate commodity data by product account with the farm income work. The task force also could have noted that gathering data on ancillary farm activities goes some distance toward measuring personal accounts of farm operators, thereby addressing social welfare issues. Integrating data and accounts here with those for enterprise and product may offer further efficiencies. The ERS Administrator should examine the feasibility of integrating the task force recommendations with needs of other ERS areas of activity. We need look no further for a start than the report of the previous, inhouse Farm Income Committee study.

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"NORMALIZED" PRICES FOR PROJECT EVALUATION

INTRODUCTION

The economic evaluation of public investment projects requires a vector of product and factor prices to be used in the calculation of expected net returns to investment. The most important concern in the selection of this price vector is that it correspond as closely as possible to the prices that will prevail over the life of the project.[1]

Of course, because of uncertainty about the future and the absence of binding forward markets for all goods, one cannot know *a priori* what these future product and factor prices will be. Thus, current expectations of future prices are used. In addition, so that the merits of any particular public investment project may be judged relative to the merits of other projects, it is desirable to standardize the way in which these price expectations are formed. The U.S. Water Resources Council, which coordinates water and related land use

[1] It might be argued that the prices used should be those that *ought to*, rather than those that *will*, prevail. This normative point of view is crucial if society's preferences regarding distributional equity, public health and safety, and environmental quality (to mention three principal examples) are to be incorporated into the evaluation process. However, these general welfare values are currently not considered in terms of price, a convention that will be maintained here.

planning in the United States, has accomplished this task by determining:

> . . . relative price relationships and the general level of prices prevailing during the planning study will be assumed to hold generally for the future, except where specific studies and considerations indicate otherwise.[2]

Though the Council's assumption might be questioned, the meaning of its directive is beyond dispute: in general, future prices are to be approximated by using current prices.[3]

The Council does, however, recognize, in a systematic fashion, some exceptions to its directive. One exception concerns the evaluation of costs and returns to projects involving agricultural production. In general, the prices of agricultural commodities and inputs fluctuate widely because of such unpredictable or uncontrollable factors as changes in the weather or in Soviet grain purchases. In recognition of this variability, " . . . the Water Resources Council will periodically publish data on prices of agricultural and other goods and services for all planning activities" that indicate what prices would have been, had market forces been somehow "normal" in the current year.[4] Again, *current* prices are emphasized; the "abnormal" influences are netted out and only "normal" market forces prevail. These "normalized" product and factor prices are used to calculate a stream of constant normal net revenues which are discounted over the life of a project.

DEFINING NORMALIZED PRICES

It is a highly ambiguous idea that a normalized price is the price that would have prevailed in a market if supply and demand conditions had been "normal." The ambiguity is both theoretical and operational. Theoretically, the very existence of an objective set of normal market conditions is subject to debate. Use of the concept "normal" implies that each factor which influences prices must be seen as following a stochastic, rather than deterministic, time path.[5] That is, each influence would be viewed as random, with a characteristic probability distribution moving along some path over time. This concept implies that a fundamental ambiguity associated with the notion of probability exists in any discussion of normalized prices. This ambiguity relates to the objective-subjective spectrum along which the principal theories of probability may be roughly arranged.

At one extreme, the classical notion of probability implies that there exists some unique and objectively determined set of conditions (in our case, for a normal market), described by the mean of the probability distribution for each influence at each point in time. For our purposes, the normalizing procedure is used to estimate as accurately as possible the prices resulting from this set of conditions.

Elsewhere along the objective-subjective spectrum, such a unique, objectively determined set of normal conditions does not exist. Under either the Bayesian or Keynesian notions of probability, for example, no set of conditions (here, for a normal market) exists independently of what persons believe these conditions are. The purpose of a normalizing procedure becomes that of forming a consensus or common belief about what normal conditions are, and hence, what normal prices are.

In short, it is not theoretically clear that an objective set of normal market conditions exists. Attempts to compose a precise general definition of a set of normal conditions which may or may not objectively exist are therefore likely to fail. Further clarification of the meaning of "normal" can probably only come at an operational level.

There seem to be three types of procedural or operational ambiguities. First, it is not abundantly clear which causal market forces are relevant, or which are of first-order importance and which, of second-order importance. Second, even if it is agreed which influences are relevant, it is also necessary to agree on the values of these variables. Third, agreement must exist as to the quantitative impacts of these normal conditions on prices.

These definitional problems are great enough so that no precise general definition of normal conditions and prices can be made. Let us focus instead on two procedures for normalizing prices that are flexible enough to resolve these definitional ambiguities at an operational, rather than conceptual, level.

PRICE-NORMALIZING MODELS

The first procedure for normalizing prices is the use of a quantitative empirical model of the agricultural sector to simulate the level of current prices resulting from market forces agreed on as normal. This approach has two great conceptual advantages. By requiring the specific identification of model structure, normal exogenous variable values, and parameter estimates, the technique becomes an educational and analytical as well as price-normalizing tool. And it is inherently flexible enough to incorporate changes in the consensus about what constitutes normal conditions. The chief disadvantage is that this approach requires substantially greater funding than is currently allocated for price normalizing work. Yet the magnitude of quantitative empirical

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[2] "Water Resources Council: Water and Related Land Resources–Establishment of Principles and Standards for Planning," Fed. Register, Monday, Sept. 18, 1973, p. 24783.

[3] It has been contended that use of long-term price forecasts is more appropriate than use of current prices. The magnitude of errors involved in such forecasts relative to the errors involved in using current prices is the principal argument in support of the Council's position. For an earlier statement of the price forecast contention, see M. L. Upchurch. "Price Levels for Use in Evaluating Irrigation Development: The Problem." In *Water Resources and Econ. Dvlpt. of the West, Direct and Indirect Benefits*, Conf. Proc., Committee on Econ. of Water Resources Dvlpt. of Western Agr. Econ. Res. Counc., Ogden, Utah, December 1951.

[4] *USDA Procedures for Planning Water and Related Land Resources*, U.S. Dept. Agr., March 1974, p. III-7. Since the publication of these procedures, the Water Resources Council has adopted the policy of updating these prices annually.

[5] Deterministic time paths must be ruled out because, in such an economic system, only one set of prices would be observed, and the need for normalizing prices would never arise.

research on agricultural price behavior by the agricultural economics profession makes this method a feasible option.[6]
research or agricultural price behavior by the agricultural economics professional makes this method a feasible option.[6]

$$P_t = P_t^n + u_t \quad (1)$$

Where:

P_t is the observed price at time t; P_t^n is the normal price in time t which would have been observed if market conditions had been normal;

u_t is the short-term fluctuation component of observed price.

As time passes and prices change, a discrepancy may emerge between the current observed price and the price believed to be normal in the previous period. If so, the process of normalizing prices consists of incorporating some fraction of this discrepancy into one's beliefs about what normal prices are in the current period. Algebraically, this process can be expressed as:

$$P_t^n = P_{t-1}^n + \lambda(P_t - P_{t-1}^n) \quad (2)$$

Where λ is a real number between zero and one, exclusive.

Equation (2) can be shown as equivalent to:

$$P_t^n = \lambda P_t + \lambda(1-\lambda)P_{t-1} + \lambda(1-\lambda)^2 P_{t-2} + \ldots \quad (3)$$

That is, the normal price in each period is simply a weighted average of all previous actual prices, in which the weight distribution is identified by one parameter, λ. This series of weights declines; each successive earlier price contributes less to the current normal price than does each more recent price. The series is also infinite, and its sum is unity. The infinite nature of the series presents no practical problem, since the series may be truncated when it approaches sufficiently close to one. Equation 3 is used to calculate a single set of normalized product and factor prices for the current year. Use of the set yields normal annual net income from the project being evaluated. This income is assumed to remain constant over the project's life. In other words, equation 3 is not an autoregressive projection procedure. It is applied once in the current year. The constant normal income stream is projected, not the prices themselves.

Empirical implementation of this second approach requires that an estimate of the parameter λ be obtained. Such estimation is impossible using ordinary least squares' regression techniques, because the normalized price in each period is not an observable variable. ERS economists have used two methods to take care of this problem.

In the first of these—technique A—the weight coefficients, rather than the parameter λ, were estimated directly from the price time series for each commodity over 1950-74. The Almon polynomial distributed-lag method was used over a 5-year period; the weight distribution was approximated by a second-degree polynomial constrained to approach zero after the fifth year.[7] All regressions included a correction for serial correlation, made with the Cochrane-Orchutt iterative technique.[8] Each estimated coefficient was divided by the unconstrained series sum to make the coefficients sum to one.[9]

In the second approach—technique B—a value of λ was specified *a priori* for each commodity. The primary advantage is that normalized prices can be as responsive to the movement of actual prices as one desires. A value of λ close to one yields a highly responsive normalized price. A value of λ close to zero yields a less responsive normalized price. As a refinement, judgments of persons familiar with a commodity market could be included when determining the weight distribution for that commodity.

Each of these estimation techniques has yielded normalized-price series that are dampened images of the actual price series. Both techniques compare quite favorably to other normalizing procedures.[10] They represent a significant contribution to the available methodology. ERS has proposed use of technique A to normalize prices for future economic evaluations of development projects.

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IMPACTS OF HIGHER GASOLINE PRICES ON RURAL HOUSEHOLDS

Automobiles consume over half the energy used by the Nation's transportation sector. Efforts to curtail petroleum imports have focused on reducing gasoline consumption because private motor vehicles are viewed as significant, sometimes inefficient energy users. Also, adverse impacts on income and disruptions in lifestyle were thought to be minimized by concentrating on passenger transportation. Higher gasoline prices, increased taxes, and rationing have been discussed as methods of achieving this reduction, and of the three, higher prices seem to be the alternative adopted. The focus here will be on both the empirical and theoretical reasons for the belief that higher gasoline prices have a greater adverse

[6] See first article in this issue: "Comprehensive Forecasting and Projection Models in the Economic Research Service."

[7] See Almon, S., "The Distributed Lag Between Capital Appropriations and Expenditures." *Econometrica*, Vol. 33, No. 1, January 1965, pp. 178-196. Additional treatment appears in Johnston, J. *Econometrics*. 2nd ed., pp. 294-298.

[8] Cochrane, D., and G. H. Orcutt. "Application of Least-squares Regressions to Relationships Containing Auto-correlated Error Terms," *Jour. Amer. Statis. Assoc.*, Vol. 44, 1949, pp. 32-61.

[9] The full results of this estimation are available as a working paper by Niehaus, R. D. "A Suggested Methodology for Normalizing Prices for Resource Development Project Evaluation." Natural Resource Econ. Div., Econ. Res. Serv., U.S. Dept. Agr.

[10] *Ibid.*

impact on rural households than on urban ones.[1] belief that higher gasoline prices have a greater adverse impact on rural households than on urban ones[1] [4,5].

Increases in gasoline prices adversely affect both household incomes and consumer welfare. The relative price change induces users to substitute less desired modes of transportation; the income effect reduces real purchasing power of households. The severity of the impact depends on several factors, including distance to jobs and shopping, the number of trips required by household needs, vehicle gas mileage, availability of alternative transport modes, and household income. Rural households potentially face relatively more severe impacts because the above characteristics generally involve more difficulties for them than for urban households.

Consider two households, one rural, the other urban, with similar preference patterns and net income (after job commuting costs have been subtracted). Initially, both households are in stationary equilibrium purchasing identical quantities of the goods. Both purchase two goods whose prices, for purpose of this analysis, consist of the market price plus the transportation costs associated with purchasing the item or service. This approach differs from other indifference analyses of gasoline pricing and rationing.[2]

Now introduce a rise in fuel prices which increases commuting costs and, thus the relevant prices of both goods. The price ratio may change if one of the goods has a larger transportation cost component associated with it. Different quantities of the goods are now purchased at a new equilibrium point. Both urban and rural households would adjust their use of transportation to offset some of the welfare loss from higher prices. Either household may switch to less fuel-intensive modes, reduce the traveling distance, or consolidate trips in attempting to offset the higher relevant prices of the goods. For example, carpooling or public transit may be used for work trips, which reduces commuting costs and increases the household's net income to purchase other goods. Consolidating trips and reducing travel distances would lower the absolute relevant prices and also increase net purchasing power.

The rural household perhaps cannot make substitutions as readily as the urban household can. For example, the rural household may find it difficult to reduce the transportation costs for obtaining food or medical care. Fewer alternatives to private motor vehicles, such as public transportation, normally exist in rural areas; and carpooling may be difficult to implement because of more scattered origins and destinations.

Urban households, on the other hand, may have more favorable options available among distances and modes. Thus, under energy conservation policies, the urban households would tend to suffer less loss of welfare and purchasing power than would the rural households. Additionally, public transit may receive preferred treatment through lower fuel prices or guaranteed quantities of fuel. Again, urban households would tend to benefit more, which further exacerbates the rural-urban differences.

Thus, higher fuel prices might mean losses of purchasing power because of fewer transport options for rural than for urban households. Data on rural-urban transportation characteristics are available for a preliminary evaluation of this hypothesis. However, some of the data rely on a residential classification—unincorporated areas and incorporated places—that does not exactly conform to the standard rural-urban designation, a limitation to keep in mind.

Private Vehicle Ownership and Alternative Modes

Rural households depend more on private vehicles than do urban counterparts. In 1972, 96 percent of the nonmetropolitan households with incomes over $5,000 owned at least one automobile or light truck; the comparable urban figure was 85 percent. Nonmetropolitan households also tended to own more than one vehicle.[3]

Rural households rarely use modes other than private motor vehicles for work trips and, given the superior modal characteristics of private vehicles, the same pattern likely holds true for other trips. Only 1 percent of rural farm and nonfarm workers used public transportation, while 85-90 percent in each group either drove or rode in cars for home-to-work trips. In comparison, 12 percent of urban workers used public transportation and 80 percent traveled to work in cars.[4] Rural households would find themselves hard-pressed to substitute among modes in the short term.

Trips and Vehicle-miles

One-way automobile trip lengths for all trip purposes generally average longer in unincorporated areas, incorporated places of under 5,000 people, and incorporated places of 1 million or more population. There, trip lengths average approximately 10, 10½, and 11½ miles, respectively.[5] Intermediate-sized incorporated places with 5,000 to 1 million persons have shorter average trip lengths. Farmers and farm managers have the longest average trip lengths for family business trips, over 11 miles, more thnan double the length for other occupational groups.[6]

Persons from households in unincorporated areas make about 1,600 trips a year on the average. This total is almost 15 percent more than the national average of 1,400 trips and over twice the number made by household

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[1] Rupprecht, Erhardt O., Jr. "Impacts of Higher Gasoline Prices on Rural Households." Paper presented at annual meeting of Amer. Agr. Econ. Assoc., Columbus, Ohio, August 1975. "The Gas Price Hike: New Dilemma for Country Folks." *The Farm Index.* Vol. XIV, No. 9, September 1975.

[2] Edwards, Clark. "Exchangeable Coupon Gas Rationing," *Agr. Econ. Res.*, Vol. 26, No. 3, July 1974, p. 56.

[3] U.S. Bureau of the Census. *Current Population Reports, Consumer Buying Indicators, Household Ownership of Cars and Light Trucks: July 1972.* Series P-65, No. 44, U.S. Govt. Print. Off., Wash., D.C., February 1973, pp. 11-12.

[4] U.S. Bureau of the Census. *Census of Population*, 1970: U.S. Summary PC(1)C1, table 87.

[5] U.S. Department of Transportation. *Nationwide Personal Transportation Study: Purposes of Automobile Trips and Travel.* Rpt. 10, U.S. Govt. Print. Off., Wash., D.C., May 1974, p. 16.

[6] *Ibid*, p. 71.

occupants in the largest incorporated places. Household residents in unincorporated areas travel 15,400 vehicle-miles a year, averaging 42 vehicle-miles a day—more than households in any other residential grouping.[7]

Households in the smallest incorporated places have particularly interesting trip characteristics. They make next to the lowest average number of annual trips, about 1,050. Perhaps they meet some of their trip needs by walking. However, they have the fourth highest number of vehicle-miles because their average trip length is rather long. The highest number of annual trips, 1,900, and the second highest vehicle-mile figure, 14,700, were logged for households in incorporated places with 5,000-24,999 people.[8]

Household members in the largest incorporated places make the fewest automobile trips annually, 700. They also log the lowest annual vehicle-miles of all residential groupings at 8,200. As the population of the city increased, vehicle-miles of travel went down, perhaps partially explained by increased use and availability of public transportation. Over 50 percent of the vehicle-miles of households in the largest incorporated places were logged on work trips; in contrast, for residents of other jurisdictions, such trips accounted for only about 40 percent of the annual vehicle-miles.[9]

People in rural areas usually lack alternative transport modes.[10] They use their automobiles more, as shown by the trip and vehicle-mile figures currently available. In addition, a greater proportion of the miles are incurred for other than work trips, especially for family business trips such as shopping and medical care.

From the data on vehicle-mileage, some preliminary analysis can be made of the differential impact of higher fuel prices on urban and rural households. In a congested urban environment, motor vehicles have poorer gas mileage than on relatively open roads. For example, urban autos require approximately 8,100 British thermal units (Btu's) per passenger mile, more than all other modes except airplanes. Going between cities, however, cars are more than twice as efficient as they are within the city, requiring 3,400 (Btu's) per passenger mile.[11]

Using the above data on vehicle mileage and given that urban fuel consumption was 11.5 miles per gallon (mpg) while rural consumption was 15.5 mpg in 1974, we can estimate the gallons of gasoline consumed.[12] A household in an unincorporated area would use about 1,000 gallons while one in a larger incorporated place would use about 700 gallons. In these polar cases, the rural household consumes about 40 percent more gasoline but its members travel almost twice as many vehicle-miles as do those in the urban household.

Thus, a gasoline tax or price hike of 25 cents a gallon would increase the annual cost of transportation by $250 for the household in the unincorporated area. Householders in the largest urban area would pay only $175 more, assuming no change in travel habits. However, since the urban households probably have more opportunities to reduce travel distances or switch to alternative modes, welfare impacts would potentially be less than $175 for them. Even if a portion of the gasoline tax for a stipulated number of gallons was refunded through a tax rebate program, inequities could occur because of the welfare aspects of the substitution effect.

A goal of national energy policy could be to allocate the burden of conservation among the urban and rural population to minimize any excessive dislocation on either group. In this event, energy policies should account for rural-urban variations in transportation characteristics and vehicle efficiency. However, more specific data by income classes and travel requirements could help assure that policies are both efficient and equitable.

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[7] U.S. Department of Transportation, Federal Highway Administration. *Nationwide Personal Transportation Study: Household Travel in the United States.* Rpt. 7, U.S. Govt. Print. Off., Wash., D.C., December 1972, pp. 16-17.

[8] *Ibid.*

[9] *Ibid.*

[10] U.S. Senate, Committee on Agriculture and Forestry. *Prelude to Legislation to Solve the Growing Crisis in Rural Transportation: Part I, Transportation in Rural America.* U.S. Govt. Print. Off., Wash., D.C., Feb. 10, 1975, pp. 173-191.

[11] Hirst, Eric. *Energy Intensiveness of Passenger and Freight Transport Modes 1950-1970.* Oak Ridge National Lab., ORNL-NSF-EP-44, Oak Ridge, Tenn., April 1973, p. 32.

[12] Healy, Timothy J. *The Energy Use of Public Transit Systems.* Univ. Calif., Santa Clara, Calif., 1974, p. 41.

LAND USE ADJUSTMENTS THROUGH COMPETITIVE BIDDING

For almost four decades, American agriculture was characterized by supply in excess of amounts that would clear the market at prices acceptable to farmers. Agricultural programs were developed which offered price supports and limited production either by restricting the acreage of certain crops or by removing land from production.

The programs proved relatively effective in meeting their objective. But they were very expensive to operate. The Federal Government spent billions of dollars in farmer payments and storage costs for the surplus commodities. All farmers were paid at the same rate, regardless of their production costs; and the rate was usually high enough to keep inefficient producers in operation. Thus, for the efficient producer, a portion of the payment represented pure profit or an income transfer above the amount actually required to continue production. Programs from the late fifties on were generally designed to remove land from production. Thus, great incentive existed to increase production per acre.

In the early seventies, the situation changed drastically. Poor weather conditions caused the Soviet Union to purchase large quantities of U.S. grain, as did several other countries. These purchases depleted U.S. surplus stocks. Food prices soared, and poor weather conditions

prevented stocks from being rebuilt. Also, there is much concern that population growth will soon cause food demand to outstrip U.S. ability to produce food sufficient to meet the needs of other countries. Thus, many people now think programs are needed to induce, rather than limit, agricultural production.

A Competitive Bid System

As a policy administration tool, a competitive bid system could be used to either limit or stimulate production at lower cost to the Government than with other approaches. In such a system, each farmer would specify the price at which he or she would take land out of production if needed.

This sytem can incorporate features which provide consideration of any number of factors before the final selection of bids is made. Development of these features would require coordination of several Agencies' research and specification of data on compatible terms.

In theory, a producer should be indifferent to choices if the returns are equal. Thus, producers should be willing to adjust cropland use if the compensation for adjustment equals the net profit they would have made from production without the adjustment. A producer's decision would be made based on expected net returns: expected revenue (normal yields times expected price) minus the expected variable cost of production (normal inputs times expected input prices).

A competitive bid system would allow farmers to specify the compensation rate they require to make a specified land use adjustment. The rate could be different for each producer. No income transfer would occur because no farmer would be paid more than was required to induce performance.

Evaluation of a Pilot Bid System

The competitive bid system concept has been discussed for several years. Research has indicated that, theoretically, the system is more efficient than other methods for land retirement.[1] A pilot program was tested in four States in the late fifties in which only whole farm units could be offered. Farmers were asked to submit a bid per acre that they would accept for participation in preference to a compensation level set by the Government. They submitted bids through the county Agricultural Stabilization and Conservation Service (ASCS) office, which sent bids to the State offices. The bid summaries were sent to the Soil Bank Division of ASCS in Washington for final approval.

J. Carrol Bottom and his associates analyzed some characteristics of these bids.[2] They also surveyed the participants to find out more characteristics. In the pilot program, the farms' bids per acre increased as the crop value per acre increased. However, as a percentage of crop value, bids declined as the crop value per acre rose. Of farmowners in Nebraska who were questioned about the program, 63 percent favored it while 29 percent did not. Persons other than farmers in the area reacted less favorably; 60 percent expected the farm families to move from the area and seek employment elsewhere, thus hurting the local economy.

The competitive bid program was not set up. Though no reasons were specified publicly, two were commonly advanced. First, compiling the bids would have been difficult. Second, some persons believed that the bidding system did not allow for a fair evaluation of the land. That is, the land would be retired based on the bid and not on an independent evaluation of the land's productivity.

If these were the actual reasons, computer technology can be used to overcome them. A computerized system can be designed that will adjust the bid based on productivity or any other desirable adjustment criterion, array the bids nationwide, and accept each based on a specified acceptance criterion. These steps can be completed rapidly and efficiently so that within a few weeks after bidding has closed, the bids could be analyzed and the successful bidders notified.

Operation of a Competitive Bid System

The basic premises of a bid system are these:

- A policy proposal can be specified in detail with definite adjustment objectives and constraints
- Producers, after evaluating performance requirements, can make a bid indicating the payment they require to comply
- After producer bids are received, they can be evaluated based on a prescribed adjustment criteria.

The policy proposal could be used to induce production or change production practices as well as reduce output. The program objective could be stated in terms of the number of acres to be adjusted—either through retirement or use in production. Total cost of the program could also be specified as a goal. The basis for operating the system would be the same for any objective. To reduce production, one would bid to take land out of production. To induce production, one would bid to change output, from the farmer's viewpoint, from a more profitable to a less profitable alternative. For instance, payments could be made for converting pasture land to cropland, cropland to pasture, conventional tillage to a specified alternative, one crop to another, or to use of specific crop rotations instead of certain fertilizer and pesticide applications.

The producer would determine a bid based on an evaluation of the program alternatives compared with all other enterprises on the farm plus an assessment of the risk involved in program participation. Producers would probably evaluate cost, returns, risk, labor requirements, and cash flow of the adjustment as they would do for

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[1] Carr, A. Barry and Luther G. Tweeten. *Comparative Efficiency of Selected Voluntary Acreage Control Programs in the Use of Government Funds*, Okla. State Univ. Agr. Expt. Sta. Rpt. P-696, June 1974. The author of this review has also made a more comprehensive study of this topic: "Land Use Adjustment Using Competitive Bidding," U.S. Dept. Agr., Econ. Res. Serv., Commod. Econ. Div. working paper, February 1976.

[2] Bottom, J. Carrol, John O. Dunbar, Richard L. Kohls, Donald L. Vogelsang, Gene McMurtry, and Sidney E. Morgan. *Land Retirement and Farm Policy*, Purdue Univ. Agr. Expt. Sta. Res. Bul. 704, September 1961.

any other enterprise. They would determine the value forgone by meeting the performance requirements of the adjustment program.

Following these evaluations, the producer would develop a gaming strategy for the bid to be sumitted. He or she would want it low enough to have reasonable assurance of acceptance but high enough not to feel discriminated against if other higher bids are also accepted. Thus, a producer's final bid would incorporate the income calculation of expected returns over variable costs but it would also include other factors and considerations.

Bid adjustment criteria could be varied. Major criticisms of past programs have been their costs and their inadequate consideration of intangible factors. Within a bid system, different combinations of criteria can be used to evaluate bids. For instance, bids could be evaluated on a cost per acre basis. The bid with the lowest per acre cost would be accepted first regardless of the land's location. However, concern might exist about the overall economic effect on a community, on conservation, on resource use, or other factors. In such cases, an index of the effect of these factors could be used to increase or decrease the relative value of each bid before the final selection was made.

A bid system would increase the possibility of meeting the specified objectives of the program. Specified Government cost, acres of adjustment, or quantity of production adjusted could be controlled by the level of bid acceptance.

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