



AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search
<http://ageconsearch.umn.edu>
aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

RESEARCH REVIEW

FOOD POLICY FOR AMERICA

Halcrow, Harold G., New York, McGraw-Hill Book Company, 1977. 564 pp. \$19.50.

*Reviewed by Lowell S. Hardin**

The U.S. Department of Agriculture, according to one of its policy-makers, is no longer a department of agriculture. Rather, it is a department of food, agriculture, and rural development and resources. With this assertion Harold Halcrow would surely agree. For, as reflected in its title, his book emphasizes food as a subject broader than agriculture, and he reinforces the point by including a final chapter on nutrition policy.

This wide-ranging, often descriptive book effectively argues that, in today's interdependent world, national food policy goals can no longer be achieved in a narrow sphere. Concerns about energy, a food reserve, exports, environmental protection, equity, income distribution, nutrition, and general welfare merit simultaneous consideration—if not equal billing—on the extensive food policy agenda.

The author brings us to this comprehensive view by reviewing the evolution of U.S. food policy through three eras. Era I—from Jamestown to 1920—was characterized by policies to encourage land settlement during our national encounter with the frontier. Throughout his 300-year period, our land-based growth model of settlement, development of transportation, and markets was pursued with policies thought to be generally favorable to the family farm.

Policy Era II—1920's to early 1970's—was based on science and technology. Fundamental to this cost-reducing, output-increasing "green revolution" in U.S. agriculture were public policies and programs:

- (1) based on research and education;

*The reviewer is a program officer with the International Division, Ford Foundation.

- (2) designed to assure a flow of capital into agriculture;
- (3) striving for greater standardization of Federal-State rules and regulations; and
- (4) generally lenient in their support of public developmental services. With in this 50-year period, our own scientific revolution spawned spectacular advances in farm machinery, crop improvement, and the use of chemicals, all of which yielded unprecedented increases in output per worker.

In the early 1970's we entered food policy era III which is characterized by a new international interdependency. Major changes in the world markets have shifted requirements more heavily toward the late-developing countries. Simultaneously problems of energy availability and prices and widespread concern for the quality of the environment have become critically important. Now food policy must

help stabilize markets against the types of violent fluctuations that have occurred without being restrictive in regard to production and trade. A new policy in regard to food reserves must emerge, based on a new consensus between producers and consumers and involving an important new element of rural-urban understanding and cooperation (p. 84).

Having set out to link U.S. food policy to the welfare of people at home as well as abroad, the author stresses the importance of setting food production goals (chapter two). Here both short and longer run U.S. and world population and food production potentials are analyzed. The tone is one of cautious optimism, not of impending catastrophe. Understandably, export market management is seen as critically important to the future welfare of the United States.

How policies relating to trade, exchange rates, aid, and income subsidies influence the demand for food is treated in chapter three. Here we are taken through the fundamentals of elasticities, market structure, and our varied experiences with supply-management programs.

Having established the probable need for greater food supplies, the author (chapter four) considers production potentials and how policies influence the way we develop and use our resources, especially land and water. We are introduced to the determinants of the size of farm, become acquainted with the economic structure of the farm machinery and equipment industry, and are updated on the use of fossil energy, and the economics of fertilizer and pesticide application. Here we are shown why taxation, credit, and development policies tend to favor larger farms, to concentrate production in fewer hands. However, Halcrow concludes that "increases in supply will tend to become more slowly as the transitional growth in input industries tends to stabilize" (p. 137).

Chapter five introduces us to the politics of national policymaking, the roles of interest groups, and the historical roots of current food policies and programs. Important recent transitions in food policies are seen as not generally led by the power of the federal government or even encouraged by it. They came largely from movements and groups outside of government—especially an awakening knowledge about hunger among the poor (p. 187).

Generally government is given low marks in the areas of consumer protection, and pricing and competitive practices within the food industry. Chapter six acquaints us with the important farm organizations, their effectiveness (or lack of it) in exerting influence on the national scene. Halcrow sketches for us the development of farm organizations, tracing their origins to farm and agrarian discontent concerning low incomes and limited educational and alternative employment opportunities.

The last half of the book presents more specifically some alternatives in product pricing, management, and trade (chapter seven); and markets for agricultural land, capital and credit, human resources and incomes (chapters

eight, nine, and ten). The book concludes with a chapter on our unresolved nutrition problems and ways to integrate food and nutritional concerns with each other. Here again, heavy emphasis is placed on the need for more research into the nature of poverty-mainutrition linkages and increased nutritional education for all—especially the lower income groups.

To whom is the book addressed? To all of us who are interested in public policy, including students of the world situation and the U.S. role in furthering food security and development. At once, the book is a comprehensive introduction, a text, a reference, and a well-documented guide to more study. Policy goals, means, and the author's generalized conclusions are set forth in a straightforward and understandable manner.

Few blueprints or results of original research on emerging issues are offered. These are not the book's objectives. It describes, analyzes, criticizes, and, while it seldom prescribes specific detailed solutions, it sensitizes. Because of the breadth of coverage, the book gives us little more than an introduction to such important topics as nutrition policy or possibilities for widespread improvement in the quality of life for the less advantaged. Primary emphasis is on policies designed to obtain a secure, safe food supply at acceptable prices—with progress, prosperity, efficiency, and equity. A tall order, yes. However, to this reviewer, the book accomplishes much of what the author set out to do—to help launch all of us into an expanded food policy agenda that now, of necessity, requires a global perspective.

SEMINARS ON FOOD POLICY *

By William T. Boehm and
Thomas A. Stucker**

Human nutrition and food policy analysis have been designated as areas of increasing priority in the U.S. Department of Agriculture and its Economics, Statistics, and Cooperatives Service (ESCS). Pressures for an integrated domestic food policy continue to build. Increasingly there will be requests for analytical support as these complex issues are debated in the policy arena.

To help provide needed information and perspective, ESCS sponsored a series of five national food policy seminars. The issue-oriented papers presented at these seminars will be published in a 1978 issue of *Agricultural-Food Policy Review*.

Objectives of the seminars are these:

- To identify, describe, and discuss the key food policy issues which will need to be resolved over the next 2 or 3 years.
- To assess current research evidence and to stimulate additional food policy research.
- To help define boundaries and establish priorities for an expanded food policy research program in ESCS.
- To acquaint the research and policy community with food programs research in ESCS.

Food Policy Seminar I: The Emerging Concern for Human Nutrition and World Hunger November 28, 1977

The first of the food policy seminars set the stage for the discussion of contemporary issues in food policy. Kenneth Farrell, Acting Administrator of ESCS and moderator of the first session, stated that development of a comprehensive national food policy would require meshing the food production and nutrition elements and consideration of marketing and regulatory policies. This

*Editors' note: Reports on the remaining two seminars will appear in the July issue of this Journal.

**The reporters are agricultural economists with the National Economic Analysis Division, ESCS.

policy would be linked with the international dimensions of food production, trade, and aid. The linkages among elements in a national food policy, such as food production, food consumption, and human nutrition are not well identified nor understood, said Farrell. This condition persists, despite large public investments in research, for several reasons—among them, lack of knowledge, segmented policies, and too narrow a focus. Drawing together the various segments of food policy to meet this challenge, added Farrell, implies the synthesis of USDA research. He emphasized the need for interdisciplinary coordination of knowledge about food and nutrition.

Howard Hjort, USDA's Director of Economics, Policy Analysis, and Budget, discussed the role and underlying motivation for food policy analysis in the Department. He emphasized the importance of recognizing that the "food system" is a system, and that analysts must trace impacts of shocks throughout the system. Our domestic food system is part of an international one, and the "openness" of the U.S. food system dictates that our food sector is subject to greater shocks than are some other national food systems. Our domestic food system is a major source of world food supplies. It is tied to world economic activities and worldwide variations in weather. The scope of food policy includes factors as diverse as farm prices and the U.S. balance of payments.

Hjort characterized broader participation in the policy process as a manifestation of the diversity and complexity of the food system components, and as an opportunity to open new lines of communication to better serve the public. The Congress reflects this expanded group of participants in the agricultural and food policymaking process. Adding to the complexity of the decision-making process is the importance of the judiciary in resolving conflicting socioeconomic questions. The policy agenda can be influenced, he stated, by conducting good research and communicating results in a way which brings significant economic issues to the public's attention.

Sol Chafkin of the Ford Foundation cautioned of the danger of addressing food programs rather than policies, and of the danger of too

much research and talk without substance and action. These reflect the difficulty in approaching food policy because of its size and complexity. Chafkin described human nutrition as a "growth industry" with much current activity but noted that real and significant changes are difficult to achieve. The concept of malnutrition has changed, he said, and it is now recognized as a separate problem from hunger. We are dealing, worldwide, with an immensely large number of people suffering from mild malnutrition, both in the United States and abroad.

Food policy changes imply a basic reordering of priorities with respect to nutrition and welfare compared with other social objectives, added Chafkin. When dealing with an interdependent food system, several new policies have to be adopted at the same time to change one part of the system, a difficult task. In some senses, we have to focus on only a part of the system and decide on our primary concern. The real policy choices and decisions will be made when pain is felt on one side or the other of the consumer-cost/farm-income tradeoff.

Lynn Daft of the Domestic Policy Council said that food policy has become an important issue, yet our current programs and policies leave much to be desired. Responsibilities among Federal agencies, other institutions, and even among countries are as yet unclear. Daft said we are uncertain about the role of government and about the facts and reality of nutritional problems. Diverse viewpoints complicate the policy process.

He concluded that a food policy is beginning to unfold. The executive branch is now sorting out institutional roles and responsibilities. To be effective in handling and resolving conflict, the U.S. Department of Agriculture will need to broaden its interests and cover a broader range of concerns. Yet it also needs to maintain a distinction between the research process and the advocacy of policy.

Carol Foreman, USDA's Assistant Secretary for Food and Consumer Services, stated that the growing concern over human nutrition, one both domestic and international, is being strongly reflected in the changing attitudes of the Department. Both consumer and producer interests must

be considered in a national food policy, Foreman said. The policy has several elements:

- A research program to determine people's nutritional needs and the production needed to meet them
- Consideration of international food needs
- Measures necessary to stimulate an adequate level of production at reasonable prices
- Assurance of a safe and high-quality supply of food
- Assistance programs for those who cannot afford adequate food at market prices
- Consideration of distribution as well as production.

The Department of Agriculture, Foreman stated, is an important part of any attempt at a cohesive food policy. The fact that the Secretary of Agriculture is required legally to protect the public interest in food safety and quality, and food assistance programs, she concluded, assures that the Secretary and the Department will not be forced into a narrow role.

Food Policy Seminar II: Public Assistance Programs and Food Purchasing December 14, 1977

Resource transfers through public assistance programs influence the quantity and distribution of food. These relationships served as the topic of the second food policy seminar, chaired by Lyle P. Schertz, ESCS Acting Deputy Administrator for Economics.

Richard Nathan of the Brookings Institution opened the second session from the point of view of a social welfare policy economist. Those who came expecting to hear Nathan defend continuation of the Food Stamp Program, based on its influence on food purchasing by low-income people, were disappointed. Nathan did not refer to its food purchasing implications or effectiveness. Instead, he argued for continuation of current welfare assistance programs, including the Food Stamp Program, because they largely satisfy stated political and social objectives.

Recalling his days as chairman of the President's Task Force on Public Welfare in 1969, Nathan stated that

the proposed Family Assistance Plan (FAP) in 1969 had the following objectives:

- Assist the working poor
- Set minimum national benefit standards
- Aid the aged, blind, and physically disabled
- Help welfare family heads find and keep jobs through work incentives.

While the FAP was never adopted, Nathan argued that other legislation has been adopted since 1969 to accomplish all four objectives. The Food Stamp Program, he said, provides assistance to the working poor and helps reduce regional inequities in public assistance. The program "does important things in an acceptable way and helps millions of people. It helps people more during recession periods and that, to me, defines a good program in the income security field."

Nathan addressed his concept of "welfare incrementalism." "What we need is next steps—not total welfare reform." We should, he recommended, evaluate elimination of the food stamp purchase requirement as a next step instead of trying to put everything together in some grand scheme. "I don't think we should go the full way faster than we can digest change and faster than change is really understood," Nathan said.

The belief exists that welfare reform proposals today must start with a premise that no more money in total can be spent on public assistance, the speaker pointed out. Given that premise, it may be even more important, he believes, to have incremental changes from current programs, and to have targeted programs to accomplish specific legislative objectives.

Dr. Sylvia Lane, an agricultural economist from the University of California at Davis, focused on poverty, food selection, and nutrition. Food selection tends to be highly correlated with the income and educational levels of the shopper. Public resource assistance (coupons or cash) cannot be expected to ensure that participating households have adequate diets.

According to studies reviewed by Lane, approximately 70 percent of all U.S. households in 1976 had the resources needed to "afford" the foods implied by USDA's lowest cost food plan but only 21 percent could "afford" the "liberal" plan.

Because people make food substitutions, "not affording the plan does not necessarily mean that they (the households) were under or malnourished."

Lane said "the 'poor' could obtain a nutritionally adequate diet for less than they now spend on food, but the less they spend, the less palatable, the starchier, and the more monotonous the diet becomes." The poor, she said, are limited in their access to food because of low incomes and they are probably paying higher prices. Nonetheless, she concluded, they "appear to be relatively efficient in obtaining nutrients per dollar of food expenditure." People with high incomes often eat unbalanced diets, and obesity is an important nutritional problem for them.

Lane also reviewed studies which support a program for increased nutrition education and a targeted food program for which the policy objective is to improve the nutritional adequacy of low-income people who have smaller budgets, less nutritional knowledge, and are likely to pay higher prices.

The relationship between food programs and nutritional intake was reviewed by Benjamin Sexauer, agricultural economist from the University of Minnesota:

Nutritional evaluations present a number of complicated, in some cases insolvable problems which cannot be overlooked. Our current understanding of dietary needs is incomplete, there are recommended daily allowances for only 17 of the more than 45 known essential nutrients.

In addition, "nutritional needs vary tremendously between individuals, not only because of sex, age, body size, and activity, but also due to genetic make-up and physiological state." Therefore, studies which attempt to assess the nutritional impact of USDA's food program will likely not be conclusive.

Sexauer's evidence tended to indicate some nutritional improvement due to Food Stamp Program participation, "but not a marked change." The reasons, he suggested, include: (a) coupon substitution (or some of the cash income food stamp participant households had previously spent for food, and (b) continued purchase by these households of

types of food they are familiar with "rather than items which would remove the nutritional deficiencies in their diets." However, Sexauer made the important point that, for many, the program has "eliminated the kind of chronic hunger among the poor that shocked the public in the late 1960's."

Studies on the nutritional consequences of USDA's other food programs reviewed by Sexauer also indicate some, but limited, improvement. Supporting Lane's conclusion, Sexauer said that "the existing studies seem to indicate that food programs should include a nutrition education component."

William T. Boehm and Paul E. Nelson, ESCS agricultural economists, reviewed the aggregate food expenditure consequences of the proposed Better Jobs and Income Program (BJIP), the Administration's proposal for comprehensive welfare reform. The research issue was how a simple cash transfer system, as is proposed in BJIP, might influence aggregate food expenditures relative to continuation of the present welfare system with a targeted food assistance program. They conclude that "aggregate food expenditures would be largely unaffected by implementation of BJIP." Their estimate is that with BJIP, food expenditures in total would fall \$1 billion—less than one-half of 1 percent if current programs were retained, and by only about \$300 million with the food stamp purchase requirement eliminated.

The authors provided the following explanation of their estimates. The BJIP would increase the total grant to the poor by about \$2.8 billion. "This increased level of funding helps to explain, in an important way, why food expenditures and farm incomes will, for practical purposes, not likely decline as a result of the proposed change." Aggregate expenditures are not expected to change significantly as a result of the BJIP. However, the authors stressed a cash transfer scheme is "simply not as effective in influencing the food purchasing behavior of recipient households as is a targeted program like the food stamp program."

Only about 50 percent of those eligible to receive food stamps actually participate in the program. A cash assistance scheme, said Boehm and Nelson, would likely affect more

of the target population. A food stamp program is more effective in increasing the food buying of *participating* households. But variability of participation rates alone makes it difficult to indicate which type of program is likely to influence aggregate food purchases the most.

Food Policy Seminar III: The Equitable Distribution of Food Aid January 17, 1978

Equity of food distribution rather than efficiency of food programs was emphasized in the third food policy seminar. Bob Greenstein, Special Assistant to the Secretary of Agriculture, the moderator, said that most discussions of equity relate to concerns about equitable distribution *within* the eligible target group. But analysts should not forget that the food aid programs were designed to reduce the vertical inequities generated when some members of society do not have the resources to purchase nutritionally adequate diets. Greenstein cautioned that program rules must accomplish other than equity goals. They must be operationally sound and easily understood, and adjust to conflicts among different interest groups:

When program funds are relatively fixed because of budget considerations, we may well opt for a set of program rules which sacrifice some horizontal equity in order to increase the proportion of total funds actually going to the target population.

Keynote speaker C. Peter Timmer, Professor of the Economics of Food and Agriculture at Harvard University, recalled that the tools of economic analysis are mostly suited to considering questions of efficiency. "But," he added, "when the familiar equity-efficiency tradeoffs become the real agenda item, economists feel a God-given right to have the last word."

Two fundamentally different approaches exist to the equity issue, Timmer said. The micro approach "would look carefully at each of the food aid programs, and determine the 'fairness' or 'equity' of the legis-

lative rules for each." The macro approach

would look at the entire U.S. economy and ask how it *generates* the inequality... If manipulations of variables in these mechanisms do not provide a satisfactory distribution of material well-being then a sequence of more targeted programs can be brought to bear on the problem.

His remarks are based on the macro approach.

Focusing on the analytical setting for policy analysis, Timmer indicated that it was fundamental to understand the linkages among three variables: agriculture, food, and nutrition. Any of the three could serve as the planning focus; however, both agriculture and nutrition were too narrow a focus, he said. The political constituency of either is "too small for this [macro] approach to be implemented." The alternative is a "food sector perspective," which recognizes that food is the primary intermediary between agriculture and nutrition. Planning from this perspective has the advantage of a central focus on individual markets, still the most efficient mechanisms available for distributing commodities.

A food policy based on a broader perspective would be far enough removed from agriculture so as not to be dominated by producer interests. At the same time, nutrition would not be seen as the only element. Such a policy, Timmer indicated, also provides the proper orientation for equity questions in the context of analysis and planning.

Although no harm exists in starting on a piece of the problem, it is important "to understand where that piece fits in the broader scheme of things." Referring to past dairy policy for an example, Timmer said, "The issue is not milk prices, but the policy perspective that permits manipulation of prices on producers' behalf and relegates consumer interests to the program level." Such programs may transfer income from the higher income nonfarm sector to the lower income farm sector, as intended. But they may also result in income support to farmers who are wealthy relative to certain nonfarm poverty groups who face higher milk prices. "The obviousness of the unequal perspective in terms of historical evolution and political realities

should not hide the fact that it produces bad policy analysis."

These remarks served as the basis for suggesting a research agenda which would contain five broad research questions, corresponding to five levels of equity issues:

- What are the linkages between the world food economy and the U.S. domestic food policy?
- What is the impact of U.S. agricultural price policy on income distribution, food consumption, and the nutritional status of the poor?
- Can minimum standards for food programs be defined that reconcile the major philosophical differences between participants' need for dignity and taxpayers' concern for program costs?
- What are the social, cultural, and health factors that prevent use of existing programs?
- How do the poor spend their money, and what factors cause the purchase of nutritionally inadequate diets?

The next three papers in the seminar contained reports on inequities which likely result from current program rules regarding the distribution of benefits. Thomas Stucker, Michael Belongia, and Robert Rizek looked at problems with the benchmarks: poverty and the Thrifty Food Plan. Larry Salathe and Rueben Buse examined the household as the consumption unit, and Thomas Carlin,

regional versus national eligibility standards.

Differences in the costs of living and the rules allowing for various deductions from earned income were two of the major reasons given for generating inequitable distribution of aid under current programs. Carlin indicated that Federal jobs programs, in particular, pose a real problem for rural areas (where many of the unemployed poor now live) since public service jobs in such areas are limited.

The speakers presenting these three papers concluded that, while technical improvements in the equitable distribution of aid could undoubtedly be obtained by changing current program rules, such improvements could not logically be expected without substantial increases in administrative complexity and, thus, costs.

The final speaker, Maurice MacDonald, from the University of Wisconsin's Poverty Institute, discussed the factors affecting participation. He asked whether the Government had a responsibility to do more than just *offer* public assistance. Wasn't there also a responsibility to see to it that aid was *accepted* by all those in the target group? He has found that some in the target group do not receive the aid for which they are eligible because of the societal stigma attached to the acceptance of public assistance. He suggested that cash assistance would be less apt to be stigmatized than a targeted program using, for example, food stamps.

In Earlier Issues

The price indexes of the Bureau of Agricultural Economics are widely used not only for general purposes but also in the administrative calculation of parity prices which current legislation provides are to be so determined as to give farm commodities generally the same purchasing power in terms of "articles and services that farmers buy, wages paid hired farm labor, interest on farm indebtedness secured by farm real estate and taxes on farm real estate" as prevailed during the base period January 1910-December 1914. This means that the indexes must measure broad changes over something more than four decades. This requirement sets a most difficult task in constructing farm price indexes, especially the parity index covering prices and cost rates paid by farmers owing to the great shift in farm production methods and, equally, farm family living patterns since 1910.

O. V. Wells
Vol. II, No. 2, April 1950, p. 33.

AGRICULTURAL CENSUS DATA AS A SOURCE OF LINEAR PROGRAMMING VECTORS

By Daniel G. Williams*

Agricultural production functions vary by region in the United States. To study agricultural production in alternative regions, analysts require regionally specific data for the functions. If these data are to be obtained from primary sources, it can be both expensive and time consuming. In this note, I describe a method for constructing the agricultural sector of a linear programming model which is used for planning economic development in a rural, multicounty area. The method may prove to have a wider use than for the agricultural sector, perhaps for the manufacturing sector as well. The table gives a simplified representation of the agricultural subsector of the larger model.

Model

The prototype model was developed originally by the Stanford Research Institute (SRI) under contract to the U.S. Department of Agriculture.¹ The agricultural subsector of that model relied on primary local data. Work was initiated by SRI and completed by the present author at USDA to reformulate the agricultural subsector to use secondary data. The results of this reformulation are included in the current version of the model: Rural Development, Activity Analysis Planning (RDAAP), based upon a model foundation in which both size and scope of industry mix were expanded by SRI from the prototype version.

Three additional articles by this author explore other areas of the research.² Also, two manuscripts by

the author summarize certain aspects of the entire model research. The first³ is essentially a recapitulation of some of the more important research results, including a portion of the material from this note and from the other three papers mentioned. The second⁴ presents the structure and mathematical framework of the model.

Agricultural Sector— Production Vectors

In SRI's development of the model, one problem involved the reconciliation of two conflicting objectives. The model was to be useful for many different areas of the country, yet also as specific as possible for any one area. In the manufacturing and service sectors, this conflict was resolved by "ruralizing" the vectors from the national input-output table.⁵ For the agricultural sector, however, it was thought that the production functions would vary more between regions than for the manufacturing or service sectors. Thus, the methodology for constructing the agriculture sector had to be more area specific. Yet, SRI

gramming Planning Model (unpublished paper).

(b) *Use of Multiple Regression Analysis to Summarize and Interpret Linear Programming Solutions: Application to a Rural Economic Development Planning Model* (unpublished paper).

(c) *On the Problem of Attracting Industries Specified by the Solution to a Linear Programming, Rural Economic Development Model* (unpublished paper).

³ *Planning for Multicounty Rural Areas: Application of a Linear Programming Economic Model in Northwest Arkansas* (unpublished manuscript).

⁴ *Structural Details of a Linear Programming, Rural Economic Development Planning Model: Northwest Arkansas* (unpublished manuscript).

⁵ SRI used the "base" data of the U.S. Department of Commerce 1958 input-output table (approximately 4-digit SIC), and used what would be, in essence, "5 or 6 digit" SIC data. These were separated into rural (non-SMSA) and urban (SMSA) components. The former was used to create the manufacturing and service vectors in the RDAAP Model (at approximately the 4-digit SIC level).

did not wish to require the gathering and use of separate primary agricultural data for each area to which the model was to be applied.

The usual methods for constructing agricultural production vectors did not seem appropriate. Generally, the agricultural sector of a model involves separate production vectors for each individual output, including, for example, distinct vectors for cash grain, farm animals, fruits and vegetables, and forage crops. This commodity-specific procedure is used by Spiegelman, *et al*, in the forerunner to the RDAAP Model. It was suggested to SRI⁶ that both secondary agricultural data, and a noncommodity-specific agricultural format could be employed. Instead of focusing on separate products, one could focus on farm types to exploit regionally specific data available from the U.S. Census of Agriculture.⁷

However, the multicounty "regional" data, including State parts, do not exist in the most recent U.S. Agricultural Census. Since the 1954 Agricultural Census, no detailed data have been published for economic areas. But from the 1959, 1964 (used in this study), and 1969 censuses, ESCS obtained a special tabulation for multicounty areas (including State parts). Such tabulations can no longer be obtained at the detail used in the RDAAP Model. At the State level, however, approximately the same data detail is still provided in the published U.S. Agricultural Census documents. These data are not, of course, as "regionally" specific as before, but are more area specific than if national average production functions were used.

To implement this procedure using the 1964 data, I obtained a detailed computer printout from the census for Washington and Benton counties combined, rather than for the more aggregated geographical areas in the published volumes. The farms are classified by economic

⁶ By Clark Edwards, ESCS.

⁷ For the RDAAP Model, applied to the BMW Region, consisting of Benton, Madison, and Washington counties in northwestern Arkansas, the 1964 U.S. Census of Agriculture, Arkansas, Bureau of the Census, U.S. Department of Commerce (detailed computer printout for Washington and Benton counties combined) was used.

*The author is a regional economist with the Economic Development Division, ESCS.

¹ Robert G. Spiegelman, E. L. Baum, and L. E. Talbert. *Application of Activity Analysis to Regional Development Planning: A Case Study of Economic Planning in Rural South Central Kentucky*. U.S. Dept. Agr., Econ. Res. Serv., Tech. Bul. 1339, Mar. 1965.

²(a) *Objective Function Tradeoff Curves in a Rural Economic Development, Activity Analysis, Linear Pro-*

class, as well as type. The classes run from Class I (the highest-income farms) through VI, and part-time. Types of farms for the BW Region⁸ are poultry, dairy, general livestock, fruit and nut, cash grain, and vegetable.

Agricultural Sector— Transformation Mechanism

The model "transforms" regressive farms (Classes IV through part-time) into progressive farms (Classes II and III). The jump from Class IV or below to Class I is thought to be too large to be realistically obtainable.

⁸Data from the computer printouts are given for only Benton and Washington counties combined, not for the whole BMW Region. This omission is satisfactory since the data are being used to create prototypes for the area-specific production vectors. And, it is assumed that these vectors will be sufficiently accurate, especially since Benton and Washington counties are both much larger agriculturally than Madison county.

If progressive sectors enter a model optimal solution, it implies that higher economic class farms embody more efficiency in their use of land and other resources than lower economic class farms, for the particular objective function and constraints assumed. Each farm type generally produces the entire full range of agricultural outputs.⁹ Of course, cash grain farms produce relatively more wheat and other cash grains, vegetable farms produce relatively more vegetables, and so on. Columns 2 and 3 of the table illustrate two progressive types of farm: poultry and general. Each type of farm produces the full range of farm commodities; shown in the table are sorghum, barley, and hogs.

The progressive sector in the complete model includes 12 farm production vectors.¹⁰ The regressive sector,

⁹29 different detailed (disaggregated) agricultural commodities are considered.

¹⁰7 types times 2 classes = 14 different farm varieties. However, Economic Class II farms for 2 of the 7

for simplicity, is not disaggregated (as to type and/or class). Thus, the agricultural regressive sector consists of only one production vector (column 1 in the table).¹¹ The upper limit on the amount of land able to be converted for use by the progressive sector is the total amount of land in the regressive sector in the BMW Region.¹²

What is the exact mechanism of transformation from regressive to progressive agriculture? Crop outputs from the progressive sector are indicated by plus signs on the coefficients. Livestock outputs appear with minus signs in the progressive farm columns because these coefficients function as feed requirements. Hog

types do not exist in the BW Region. Class II farm "units" are 15 individual farms; Class III farm "units," 25 individual farms.

¹¹One farm "unit" is calculated to be 50 individual regressive farms.

¹²Land is classified into 5 types: total farmland, cropland harvested, cropland pasture, improved pasture, and unimproved pasture.

Simplified representation of the agricultural subsector in the RDAAP Model

Columns	Agriculture								Manufacturing			
	Production			Feed hogs	Barley		Feed grain transfer	Grains and seed		Prepared animal feed		
	Re-gress	Poultry	General		Imports	Exports		Transfer	Imports	Produce	Imports	Exports
Agriculture:												
Sorghum	-a ₁	+b ₁	+c ₁	-d ₁								
Barley	-a ₂	+b ₂	+c ₂		+1.0	-1.0	-g ₁	-1.0				
Hogs	(¹) -b ₃		-c ₃	+1.0								
Feed grain	+a ₃			-d ₂			+g ₂					
Grains and seeds								+h ₁	+1.0	-i ₁		
Manufacturing:												
Prepared animal feed	+a ₄			-d ₃						+1.0	+1.0	-1.0
Soybean oil	+a ₅	-b ₄	-c ₄							-i ₂		
Land:												
Cropland	-a ₆	+b ₅	+c ₅									
Labor:												
Skilled	-a ₇	+b ₆	+c ₆							+i ₃		
"Foreign" sector:												
"Foreign exchange"	+a ₈	-b ₇	-c ₇		-e ₁	+f ₁			-1.0	-i ₄	-1.0	+1.0

¹For technical reasons, the regressive sector livestock rows (which would be positive) are converted into their individual vector components, such as "feed grain commodity," at positive ("supply") levels.

production from all farms in the region is indicated by the +1 coefficient in the feed hogs column of the table. Except where indicated, all signs on the coefficients in the regressive sector are reversed from those of the progressive sector.

Before a net increment¹³ of production of a particular agricultural commodity can be produced, the "loss" of the regressive sector has to be "made up" by the progressive sector. If it is not, the loss has to be made up by imports.¹⁴ Column 5 in the table illustrates this with imports of barley. With respect to sign change, both labor and nonagricultural inputs are handled identically to the agricultural outputs. The nonagricultural inputs¹⁵ are calculated by use of the 1963 national input-output table for the United States.¹⁶ However, only farm type, not economic class can be distinguished.

"Foreign exchange" coefficients (on "capital" and "current" account), depreciation coefficients, and animal "stock" coefficients are also estimated using the above-mentioned sources, plus other sources for the capital and depreciation estimates.¹⁷

¹³ The RDAAP Model is an incremental and terminal year model, in which only increases from the base year to the target year are considered, over the planning span (10 years).

¹⁴ These are not necessarily "true" imports. In a sense, they are an "accounting device" showing the cost to the region of such a transformation, for the particular row alone, in terms of "foreign exchange" cost (purchases from outside the BMW Region).

¹⁵ Aggregated agricultural inputs also are included here. To avoid double-counting these inputs with those required by the animal feed unit vectors (7 feeding activities), the "overlap" is deducted from these aggregated agricultural input coefficients.

¹⁶ Office of Business Economics, U.S. Department of Commerce, "Input-Output Structure of the U.S. Economy: 1963," *Supplement to the Survey of Current Business*, 1969 (the 478 level on computer tape).

¹⁷ Description of this capacity methodology as well as the labor requirements procedure is given in *Generalized Model for Rural Development Planning* by Robert G. Spiegelman and Edward W. Lungren,

Farm products can be used by other farmers. Column 7 in the table illustrates the transfer of barley grain produced on one farm to be used as feed grain. This can be used as hog feed (column 4) on another farm. Such feed grains include wheat, oats, and rye as well as barley. Activities such as shown in column 7 aggregate the individual grains into common-unit feed grain commodities which can be fed to farm animals, including hogs. A disaggregated agricultural commodity such as barley can be exported for use outside the multicounty region by activating column 6.

Industries in the manufacturing sector—a major user of farm products—are aggregates defined by national input-output definitions. The manufacturing sector uses barley as an input in an aggregate called grains and seeds.¹⁸ Column 9 of the table allows for imports of the aggregate grains and seeds as an alternative to local production.¹⁹

Column 10 illustrates one manufacturing use of grains and seeds: production of prepared animal feeds. Columns 11 and 12 provide for imports and exports of the manufactured product. Prepared animal feeds can also become available for use by activating the regressive sector, column 1. This means that feeds formerly used by that sector are released for other uses. The feed grain commodity is similarly made available. Prepared animal feed, one of the constituents of hog feed via the conversion in column 4, is made available for use by the poultry and general farms in columns 2 and 3.

Stanford Res. Inst., Prog. Rpt. III, USDA Contract No. 12-17-091-1-398, Menlo Park, Calif., Feb. 1969.

¹⁸ Only the "aggregated" agricultural commodities can be used by the "manufacturing" vectors (which include such industries as meat and poultry processing) in the RDAAP Model.

¹⁹ A "marketing" surcharge is added to the import price for the disaggregated agricultural commodities to eliminate the possibility of "cycling" with the export vectors. This surcharge also insures that aggregated, rather than disaggregated commodities will be imported for "real" uses (uses other than for the previously mentioned "accounting function").

Agricultural Sector— Specific Results

Of the 12 possible types of farms considered, only poultry, class II, and general, class III, tend to be consistently selected at sizable levels by the optimal solution for most types of objective functions.²⁰ The first result (poultry) is "supportive" of the model's accuracy, in that poultry is, in fact, the leading agricultural activity of the BMW Region.

For land use, only cropland is used fully, while significant surpluses remain in the three pasture categories, and in the total farmland category.²¹ These results are, of course, due partially to the intrinsic rigidities of activities in a linear programming format. But they are not inconsistent with the observation that pastureland is not used to capacity in the Ozarks. If transformation vectors between the land categories were added to the model, some of this rigidity could be removed. Still, these results do show that cropland is preferred to pasture in the progressive agricultural sector compared with the regressive agricultural sector. This makes sense in that, generally, crops generate more net income per acre than pastureland. Thus, it is efficient to shift from regressive to progressive agriculture, even though significant surpluses of formerly used land are created.

Conclusion

To obtain useful agricultural production function data for a linear programming economic development model, we need not be tied to primary sources. A nationwide set of area-specific data is available in a widely known secondary source. This was available at the multicounty level in 1969 and earlier censuses, but currently is available only at the State level. Use of such data becomes

²⁰ The model has been run for many different types of objectives, such as maximization of "balance of trade" surplus, "balance of payments" surplus, gross regional product, value added, local wages, local employment, total private profits and industry rate of return index.

²¹ These results virtually are invariant among different objective functions, and the surpluses vary from 1/3 to 2/3 of the formerly used pastureland.

possible if the researcher modifies his usual concept of the farming sector into farm types (and economic classes), rather than using the usual concept of individual commodities. This innovative agricultural production "core" can be augmented with appropriate transfer activities to create a complete agricultural sector for an economic development model.

This procedure can perhaps be used to create any such vectors or activities for an input-output or linear programming model with joint outputs. For example, one can obtain (by special request) from the U.S. Census of Manufactures a listing by 4-digit SIC category of not only the "major" SIC category output, but also of several "minor" SIC category outputs, leading to, of course, a joint output manufacturing vector. Thus, the researcher can use inexpensive secondary data sources as an alternative to expensive primary surveys to obtain production function information.

In Earlier Issues

Is the concept of *allocative efficiency* the most appropriate one when the purpose is to compare the efficiency of agriculture with that of other sectors of the economy? When inefficiency in agriculture is described in terms of too much labor and too little capital, does this not mean, by definition, that other sectors of the economy are inefficient because of too little labor and too much capital?

Donald C. Horton
Vol. II, No. 2, April 1950,
p. 67.

LICENSING OF VETERINARIANS AND THE INCIDENCE OF REPORTED ANIMAL DISEASES

By Sidney L. Carroll
and Robert J. Gaston*

The Role of Veterinarians

Veterinarians, primarily, stand between the health of the human population and more than one hundred animal diseases that may affect people (such as rabies, brucellosis, tuberculosis, and psittacosis).¹ Their effectiveness in preventing and reporting the spread of these diseases has several determinants. In this note we pay particular attention to how differential licensing and schooling of veterinarians across States have affected the reported cases of animal rabies and brucellosis. It is claimed that "veterinarians, both private practitioners and regulatory officials, have played a major role in controlling rabies and bringing about a continuing decline in the number of cases reported (authors' emphasis) each year . . . [Nevertheless] rabies remains a potential health threat that requires constant vigilance and control by veterinarians . . ."²

While there seems to be little question regarding the instrumental role of veterinarians in the control of rabies, we know of little or no

*The authors are economists at the University of Tennessee, Knoxville.

This research was conducted with the support of National Science Foundation grant no. APR75-16792. Any opinions, findings, conclusions, or recommendations expressed are those of the authors and do not necessarily reflect the views of the National Science Foundation. They gratefully acknowledge the research assistance of George Choksy.

¹U.S. Department of Health, Education and Welfare, Public Health Service. *Health Resources Statistics, 1972-73*, Washington, D.C., p. 319. Center for Disease Control. *Zoonoses*, Atlanta, Ga., various years.

²Pamphlet, American Veterinary Medical Association, "Today's Veterinarian", Chicago, 1973, pp. 14-15.

attempt to systematically analyze the trade off between presumably higher quality but fewer practitioners and the incidence of animal rabies reports in the United States. We undertake such an attempt here; moreover, we reinforce our analysis for rabies with one for animal brucellosis.

The State, in the name of protecting the "public interest", has imposed an impressive array of requirements that veterinarians must satisfy before they can be licensed. Such requirements vary by State but rather generally include such things as: gaining entry into and graduating from an "approved" school of veterinary medicine; passing competitive written, oral (sometimes, these involve actual casework) State board examinations; being a U.S. citizen; having prior residency in the State; being sponsored by existing practitioners; and others.

The Model and its Results

Using a recursive system of two equations, we first estimate the number of licensed veterinarians per household (density of veterinarians) as a function of licensing restrictiveness factors and some general control variables. Next, we relate that "density" number to the number of reported cases of rabies in dogs and cats by State.

Rabies Analysis

Cross-section data for States were available for 1970 and 1974. As the equations in table 1 show, density of veterinarians is clearly and significantly related in a positive manner to the density of farm animals (domestic farm animals in thousands per household) and the number of graduates of in-State schools of veterinary medicine. The occupational licensing requirement explicitly entered into table 1 is that of citizenship. If a State requires U.S. citizenship of a license applicant, this is given a value of 1 and, if not, a value of 0 is assigned to the State. Requiring citizenship prior to practice is considered more restrictive than not doing so.³

³Of 49 States where data were available for 1970, 35 required U.S. citizenship prior to licensing. Results for a wide variety of other licensing

Table 1—Three-state-least squares estimates, recursive equation system, data pooled, 1970, 1974¹

Density	Intercept	Time	Density of veterinarians	Farm animal density	School index	Citizenship
Veterinarians	0.3570581*** (0.025631) t=13.9310	0.0286627*** (0.024305) t=1.17929		0.026795*** (0.00164) t=16.3208	0.8030479*** (0.229061) t=3.50583	-0.0566023** (0.0266646) t=-2.1228
Rabies reports	-0.0083340 (0.004230) t=-1.96910	0.0012848 (0.002959) t=0.43416	0.0308268*** (0.00735) t=4.19407			

Time: 1974 = 1; 1970 = 0.

Number of observations = 98.

*Significant at 10% level, 2-tail t-test.

**Significant at 5% level, 2-tail t-test.

***Significant at 1% level, 2-tail t-test.

¹ Reported rabies cases in domestic animals is dependent variable; citizenship requirement is licensure variable.

Note: Source data available from authors on request.

Table 2—Three-stage-least squares estimates, recursive equation system, data pooled, 1970, 1974¹

Density	Intercept	Time	Density of veterinarians	Farm animal density	School index	Citizenship
Veterinarians	= 0.33293545** (0.02590346) t=12.85294	0.02821018 (0.02430521) t=1.16066		0.02622825*** (0.00164414) t=15.95254	0.89240918*** (0.23547287) t=3.80440	-0.02180551 (0.02733826) t=-0.79762
Brucellosis reports	= -0.40318324 (1.56355600) t=-0.25786	1.29405158 (1.09368802) t=1.18320	5.19092362* (2.71652585) t=1.91087			

*Significant at the 10% level, 2-tailed t-test.

**Significant at the 5% level, 2-tailed t-test.

***Significant at the 1% level, 2-tailed t-test.

Number of observations = 98.

Note: Source data available from authors on request.

¹ Brucellosis in animals is dependent variable; citizenship requirement is licensure variable.

The negative sign on the coefficient "citizenship" is consistent with its use as a restrictive device via its association with reduced density of practitioners. Further, the statistical significance of the coefficient lends some empirical support that such requirements function as barriers to entry into the field of veterinary medicine.

Particularly striking in table 1 is the importance and positive effect of the presence of an in-State school of veterinary medicine on the density of

requirements showed basically the same result as that with this measure, but they are omitted for brevity. Further, the statistical results were "strongest" with this measure of restriction.

practitioners in that State. This strong relationship, found in every statistical sample tested, highlights the importance to a State of having its own system of veterinary medical education. It also suggests that the school entry requirement is a significant licensing barrier and that the functioning of license reciprocity among States does not fully compensate for lack of an in-State school of veterinary medicine.

It is abundantly clear in table 1 that, as the density of veterinarians in a State increases, so does the number of reported cases of rabies. This relationship is significant at even the most stringent level of statistical testing. More veterinarians equals more reported rabies, when other influences are held constant. This relationship

obviously does not suggest in any way that veterinarians cause rabies; rather that more existing rabies cases are detected and reported the more veterinarians there are practicing.⁴ One possible implication is

⁴The number of reported cases of rabies also depends somewhat on State laboratory budget and testing policies which vary from State to State and over time. These policies dictate under which circumstances animals will be tested and, of course, after the discovered (reported) number of rabies cases. Further testing with 3-year averages of reported cases of animal rabies to reduce the influence of transient changes in public laboratory examination policies revealed no changes in any coefficient sign or significance level.

that in those States most restrictive in the licensing of veterinarians (most demanding of high quality or stringent with educational funds), there may be systematic under-discovering of existing cases of rabies, and an increase in the risk of exposure to other animals and, ultimately, to people.⁵

Animal Brucellosis Analysis

The equation system and variables used in table 1 were tested to examine the incidence of brucellosis in animals (table 2). The most striking finding from a comparison of the rabies and brucellosis analyses is that, with minor exceptions, the results for brucellosis almost exactly mirror those obtained for rabies. Namely, as the density of veterinarians increases, so do the reported cases (per household) of brucellosis in animals. The citizenship variable retains the expected sign but shows little statistical significance.

Testing of additional licensing requirement variables (such as practical examination reciprocity and written examination pass/fail rates) revealed the same positive and significant relation between density of veterinarians and density of reported cases of animal brucellosis. However, the results were sometimes positive and sometimes negative, but not statistically significant, in the relationship between various explicit licensing requirements tested and the associated density of veterinarians. The veterinary school influence was always highly significant in any model tested.

Conclusion

We can tentatively report that, the more strict the barriers in a State to obtaining a veterinary license, the fewer the practitioners in the State. As a result, some cases of rabies and brucellosis are not being discovered. Thus, the risk of infection increases, for healthy domestic animals and, ultimately, for people.

⁵ Alternative explanations are not excluded, such as "higher quality" vets reducing the number of actual cases and hence, the reported number. However, we have no knowledge of the effect of fewer veterinarians on the number of actual cases of animal rabies.

ESTIMATING THE NUMBER OF HIRED FARMWORKERS COVERED BY SOCIAL SECURITY

By Bertram M. Kestenbaum*

The number of farmworkers in a given year covered by social security differs from the number of employer-employee reports because one worker may have several employers. For a significant number of reports the employee's identity cannot be determined, and it becomes necessary to estimate what number should be added to the count of identified workers to arrive at a total. In this note, I present a solution, an innovative application and extension of methodology developed originally to treat the problem of multiple listings in a sampling frame.

Hired farmwork has been covered under the Social Security Administration's (SSA) old age, survivors, disability, and health insurance program since 1951. Each farm operator is required to report at the year's end the name, social security number (SSN), and cash wages of any employee who either earned at least \$150 or was paid on a time basis (hourly, weekly, and so on) for 20 or more days of work during the year. The size of the hired farm workforce covered by social security can be used to assess program coverage and describe trends in noncasual farm employment.

Although many of these workers are employed by two or more farm operators during the year, the number covered by social security in a given year could be determined, in theory, simply by counting the number of different SSN's appearing on farm employer reports. Actually, because SSA's statistical data base consists of a 1-percent sample of social security numbers (described elsewhere¹), one would count the number of different SSN's in the 1-percent

sample that appear on farm employer reports, then multiply by 100.

However, the name/SSN identification on reports of farm employment is sometimes incomplete or incorrect. Perhaps the worker couldn't produce an SSN; or perhaps the employer misplaced the information and was unable to contact the former employee. To illustrate: for 1974 there were 3,042,000 farm employment reports; only 25,919 of the 30,420 reports expected in the 1-percent sample had acceptable name/SSN identification.

The properly identified 25,919 reports yielded 19,874 different SSN's. I denote these two quantities by "y" and "x", respectively. "Y" and "X," respectively, stand for the numbers of reports (30,420) and unique SSN's expected in the 1-percent sample if all reports had acceptable identification. The objective is to determine the value of X.

A first approximation is obtained by solving the equation:

$$X = \frac{x}{y} \cdot Y \\ = \frac{19,874}{25,919} \cdot 30,420$$

from which $X = 23,325$ for 1974. This procedure would be satisfactory if every farmworker were correctly identified either by all his employers or by none. But, because it is possible that a farmworker will be properly reported by some employers and not by others, the procedure yields an overestimate: that is, the extent of duplication in a list is understated by a partial examination of the list.

To solve the "unduplication" problem, I expand upon methodology originally developed by Leslie Kish for calculating probabilities of element selection from a sampling frame with replicate listings.² It consists of applying a binomial model with

¹ *of the American Statistical Association*, vol. 48, no. 263, September 1953, pp. 462-475.

² Leslie Kish, *Survey Sampling*. New York, 1965, pp. 392-393. Also, see estimating techniques used in the 1969 Census of Agriculture as described by Gurney and Gonzalez in "Estimates for Samples from Frames Where Some Units Have Multiple Listings," *1972 American Statistical Association Proceedings, Social Statistics Section*, 1973, pp. 283-288.

*The author is a mathematical statistician with the Social Security Administration. He is indebted to Miles Davis for his help.

¹ Social Security Administration, Office of Research and Statistics, *Earnings Distributions in the United States, 1969*. Washington, D.C., 1975, pp. 316-318. See also Mandel, B. T. "Sampling the Federal Old-Age and Survivors Insurance Records. *Journal*

parameter "p"—the probability of proper identification—constant from trial to trial (report to report).

For a worker with "i" employers, according to our model the probability that exactly "j" (j=1,2,...,i) of his employments are correctly identified is given by:

$$p_{ji} = \binom{i}{j} \left(\frac{Y-i}{Y-j} \right) \left(\frac{Y}{Y} \right)$$

This expression can be approximated by the jth term in the expansion of $((1-p) + p)^i$, where $p = y/Y$; and this is the relationship used:

$$p_{ji} = \binom{i}{j} (1-p)^{i-j} p^j$$

For 1974,

$$p = \frac{25,919}{30,420} = 0.85204.$$

Next, it is necessary to know, among correctly identified farm employment reports, how many SSN's appeared on exactly one report, two reports, three reports, and so on (see table).

It is unlikely that any worker has more than, say, 14 employers. Let $C = \{c_j, j=1,2,\dots,14; c_{12}=c_{13}=c_{14}=0\}$ be the column vector whose elements are the numbers of SSN's appearing on exactly j correct reports, and $T = \{t_i, i=1,2,\dots,14\}$, the column vector whose elements are the numbers of SSN's which would appear on exactly i reports if all reports were properly identified. The objective is to solve for $X = \sum t_i$, by assuming that the values (c_j) derive from the values (t_i) , according to the probabilities:

$$p_{ji} = \binom{i}{j} (1-p)^{i-j} p^j.$$

We array these probabilities in a 14 X 14 matrix, P:

	i=1	i=2	i=3	i=4										
j=1	.85204	.25214	.05596	.01104	.	.	.	.	.	.	.	.	.	.
j=2	0	.72597	.32225	.09536	.	.	.	.	.	.	.	.	.	.
j=3	0	0	.61855	.36609	.	.	.	.	.	.	.	.	.	.
j=4	0	0	0	.52703	.	.	.	.	.	.	.	.	.	.
.
.
.
.

P is an upper triangular matrix whose elements along the main diagonal, p^i , are all nonzero. Therefore, its inverse, P^{-1} , must exist, and we may solve the matrix equation $PT = C$ for $T = P^{-1}C$.

The result is a total of 22,629 farmworkers in the 1-percent sample in 1974. The number of workers

Hired farmworkers and total correct reports for workers with exactly j correct reports, 1974

Number (i) of correct reports per worker	Number of workers with exactly j correct reports	All correct reports
1	16,254	16,254
2	2,351	4,702
3	694	2,082
4	284	1,136
5	135	675
6	75	450
7	48	336
8	18	144
9	12	108
10	1	10
11	2	22
Total	19,874	25,919

Source: Social Security Administration's 1% statistical sample.

added, $X \cdot x$, is 2.755, substantially less than the workers added (23,325-19,874=3,451) according to the first approximation.

This method, a general one, can be applied in other subject areas when it is necessary to estimate the duplication in some file after most of the duplication has been determined by random observation.

RESEARCH, EXTENSION, AND TEACHING UNDER TITLE XIV

By James Nielson*

"Title XIV is the most comprehensive and important legislation in the area of agricultural research and extension ever undertaken by the Congress." Thus spoke Congressman Tom Foley when he presented the conference report on what was later called the "Food and Agriculture Act of 1977." Title XIV is called the "National Agricultural Research, Extension, and Teaching Policy Act of 1977." This act indicates priorities for programs, and specific organizational structures and procedures for carrying out the programs.

The legislation names USDA as the lead agency for food and agricultural sciences in research, extension, and teaching. It carves out for the Department and cooperating universities a dominant piece of the action in all areas of agriculture, forestry, aquaculture, home economics, human nutrition, family life, and rural and community development. There is to be increased cooperation, coordination, and planning in the food and agricultural sciences among Federal departments and agencies, the States, colleges, universities, private research and extension organizations, agricultural libraries and user groups. The Congress—in Subtitle B—established a committee, a council, and two boards to accomplish these activities.

The committee, to be called the Subcommittee on Food and Renewable Resources, will be under the Federal Coordinating Council on Science, Engineering, and Technology. It will review Federal research and development programs relevant to domestic and world food and fiber production and distribution, and will promote planning and coordination within the Federal Government.

The council, to be named the Joint Council on Food and Agricultural Sciences, will assist the Department in carrying out its research, extension, and teaching responsibilities through coordination of regional

*The author is Acting Director, Science and Education, Science and Education Administration, U.S. Department of Agriculture.

and national planning. The Council will develop recommendations and reports describing current and long-range needs, priorities, and goals.

One of the two boards is to be called the National Agricultural Research and Extension Users Advisory Board. It will contain persons representing producers, consumers, farm suppliers, processors, marketing interests, environmentalists, rural development, human nutrition, animal health, transportation, labor, and private international development activities. The responsibilities are to review, assess, and provide recommendations on national policies, priorities, strategies, and programs of research and extension for both the short and long term.

The second board is to be called the Animal Health Science Research Advisory Board. Its duties are to make recommendations on the animal disease provisions of the legislation and on priorities for animal disease research programs.

There are 11 subtitles under Title XIV. Subtitle A emphasizes that research, extension, and teaching are distinct missions of the Department. Food and agricultural sciences are defined to include economic considerations of all aspects of agriculture and forestry, including, among other areas, aquaculture, human nutrition, family life, and rural and community development.

As mentioned, Subtitle B sets up the committee, council, and boards. Their primary purpose is to foster coordination of the research, extension, and teaching activities of the Federal Government, the States, colleges and universities, and other public and private institutions and persons involved in the food and agricultural sciences. I think this multidisciplinary and multi-institutional effort is a major issue for agricultural economists. ESCS has not been highly supportive of regional research but has participated actively and effectively in the regional and national planning effort. It is important that we have appropriate

mechanisms and enthusiastic support for multidisciplinary, multi-State, multiagency projects, some of which need large blocks of resources to succeed.

Subtitle C strengthens the USDA competitive grants and fellowships program by broadening Department authority to extend grants and awards for research that furthers USDA programs. Agricultural economists are eligible to compete for the mission-oriented basic research grants in human nutrition being offered in FY 1978.

Two annual National Agricultural Research Awards are set up by Subtitle C. One will be given to an outstanding senior scientist. The other will go to a research scientist in early career development or to a graduate student. The awards will be in the form of research grants up to \$50,000 annually for a period of 3 years.

Subtitle C also contains a provision for grants for research on alcohol and industrial hydrocarbons and for pilot projects on their production and marketing. Agricultural economists will be called upon to assist in assessing the economic feasibility of such research.

Subtitle D makes food and human nutrition research and extension programs a major thrust for the Department. Research is encouraged on nutritive requirements and their relation to health, and on the nutritional impacts of USDA's food programs. Studies are encouraged of the impacts of food preferences and habits on nutrition and of practices related to production, handling, and processing.

Subtitle E promotes research, teaching, and extension related to improved health of domestic and wild animals. Both regional and national problems are to be considered.

Subtitle F contains authorization for small farms research and extension. It amends the Rural Development Act of 1972 to provide for improved programs on production, management, and finance. A small farmer means any farmer with gross sales from farming of \$20,000 or

less per year.

Subtitle G provides continuous funding to 1890 institutions and Tuskegee Institute for research and extension while Subtitle H provides for competitive grants in solar energy research.

Subtitle I calls for expansion of USDA's role in international research and extension with developed and developing countries, in coordination with other Federal agencies. It authorizes stationing of U.S. scientists in national and international institutions of other countries, assistance to U.S. colleges and universities in strengthening their capabilities in development activities overseas, and assistance in career development of scientists who specialize in international programs.

Subtitle J requests special studies and reports that will involve both Federal and State personnel. The studies are to be on the cooperative extension service, weather and water allocation, organic farming, research facilities, human nutrition research centers, a nutritional status monitoring system, and a plan for implementing a national food and human nutrition research and extension program.

Subtitle K authorizes appropriations for existing and certain new agricultural research programs.

The charge from the Congress to all of us is to increase cooperation and coordination in research, extension, and teaching. In carrying out this cooperation and coordination, the Congress also made it clear that the traditional land-grant USDA system, effective as it is, must be broadened to include other research and educational institutions and organizations. This broadening of participation is to include the private sector to the extent possible.

We have two major challenges before us in regard to coordination and planning. One is to improve the existing system; the other is to work more closely with others and bring them into the partnership.

