ECONOMIC FORCES INFLUENCING VALUE-ADDED FOOD INDUSTRIES: IMPLICATIONS FOR SOUTHERN AGRICULTURE

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During the past few decades, U. S. agriculture has experienced remarkable gains in productivity and efficiency. While the number of farms has declined, the economic activities supporting production agriculture continue to comprise a major sector of the U. S. economy. The value-added[1] food and fiber complex serves as an important link between production agriculture and the larger U. S. economy. Value-added products from agriculture have a retail value of more than $700 billion annually and engage about 20 percent of the U. S. labor force (ESCOP). Post-farm-gate activities account for 75 percent of the retail price of food and fiber products, and only 5 percent of the value of foods purchased by consumers is unprocessed. Understanding the forces that shape this sector will help researchers, industry participants, and public policy makers understand the factors which influence the performance of the U. S. food system.

Numerous professional activities attest to the notion that researchable problems exist beyond the farm gate. Polopolus, in his 1982 AAEA presidential address, challenged agricultural economists and public policy makers to think about some important issues facing our contemporary food system beyond the farm gate. In 1985, an AAEA Invited Paper Session was devoted to the future of the U. S. Food-Processing Industry. In addition to organized symposia and journal articles, several major books have appeared on the economics of food processing during the 1980s (Connor et al., McCorkle, and Connor). Moreover, agricultural economists in many states have been drawn to gubernatorial task forces to examine the relationship of value-added markets to the state economic development (1987 AAEA Organized Symposia, "Value-Added Research Investments: Boom or Boondoggle?").

Traditionally, the dynamic nature of the food processing industry has focused attention on the impacts on food producers and consumers. In more recent years, much attention has been given to the questions of value-added activities of the food processing industry for the purposes of economic development. These issues are more pronounced at the state level, where the discussion focuses on questions of employment impacts and new income sources for rural communities. Another recent topic area concerns trade policies that support the export of high value-added food and fiber products. How value-added industries have evolved to accomplish these objectives has direct impacts on southern agriculture. This paper explores the economic forces shaping value-added food industries and their implications for southern agriculture.

Specific objectives of this paper, which are discussed successively, are:

(1) to discuss the economic forces shaping the U. S. value-added food industry;

(2) to evaluate regional differences in U. S. food industries and predict future growth trends; and

(3) to suggest an expanded role for Land Grant-supported research in food distribution and manufacturing sectors.

THE DYNAMICS OF PROCESSED FOOD MARKETS

Long-run change in the food manufacturing sector is influenced by three major forces:

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Invited paper presented at the annual meeting of the Southern Agricultural Economics Association, Nashville, Tennessee, February 6-8, 1989. Invited papers are routinely published in the July *SJAE* without editorial council review but with review of the copy editor (as per Executive Committee action June 25, 1982).

[1]Connor identifies two definitions of value-added. The first, the gross margin approach, compares the value of food products shipped from a factory with the costs of all material inputs and services purchased from other industries. The second, the factor-payment approach, sums all income received by factors of production internal to a food processing enterprise.

economic, technological, and institutional. The economic forces influencing food manufacturing include domestic demand, market structure and organization, and international factors. Technological change brings forth new products and processes, thereby altering the input mix and comparative regional cost advantages. Institutional forces include public policies at the national, sectorial, and state level. Although these three forces are logically separable, a great deal of interaction exists among them. For example, international forces have economic impacts which are very much a part of the institutional or policy environment from which they emerge. Finally, one factor important to all economic and social change is the human resource. We find scant treatment in the literature concerning the influence of human resources as a force in changing the food manufacturing sector. Examining the forces influencing the food manufacturing sector provides some context for understanding how this sector may grow in the future.

The Demand for Processed Foods

The demand for processed foods is a function of income, prices, and population. A combination of other factors influences the changing mix of food demand to include consumer preferences and demographics.

The relationship between changes in income and the demand for food has been well established by economists. Engel's Law is widely accepted: the share of a family's income spent for food falls as income rises; that is, aggregate food demand in developed countries has an income elasticity between zero and one. This statement needs some qualifications in the case of individual processed foods and beverages. Some highly convenient food items are almost luxuries (income elasticities greater than one). Inferior (negative income elasticity) processed foods include processed milk, shortening, cooking oil, cereal products except prepared flour mixes and bakery goods, lunch meats, sugar, jellies, and canned potatoes. Processed foods with income elasticities higher than the average are frozen fruits and vegetables, meat substitutes, dips, cream, cheese, and canned and fresh vegetable juices (Kinsey and Heien). An indirect impact of increases in consumer income on the demand for food must consider the away-from-home food market. Food expenditures away from home (FAFH) are more income responsive than food expenditures for use at home. Indirectly, the changing composition of the labor force influences the per-capita demand for processed foods as dual-income families become more common.

Relative price trends also can influence the demand for processed food. Empirical evidence suggests that the price elasticity for most food is inelastic (Brandow) although elasticities for various categories of food differ. Price elasticities for fresh fruits and vegetables appear to be higher than for their processed counterparts. Price trends show that the ratio between food prices and non-food prices has remained constant over the past several decades. However, when food is broken down into categories, some insights into food price trends can be better understood. For example, prices of most processed foods have increased faster than fresh foods, while food away from home and food prepared at home rose at the same rate.

Another factor influencing the aggregate demand for food is population. The demand for food increases almost in proportion to the rate of population growth. Since the 1960s, the rate of U. S. population growth has declined; in the future, growth is expected to be 0.7 to 0.9 percent per year. As a result of this slower population growth rate, total food demand will not grow as rapidly in the future as it did in previous decades.

Several factors influence the composition of food demand. Consumer preferences for food are certainly evolving as today's diet-oriented, nutrition-conscious consumers place more and different demands on the U. S. food manufacturers than ever before.

The demographic composition of the population also becomes a major factor affecting the food demand mix. One fundamental change that has occurred in the U.S. population is the decline in household size. Research has shown that smaller households spend more per capita on food and consume more poultry, fruits and vegetables, bakery products, cheese, fish, and soft drinks than the larger households (Connor et al.). Another major demographic trend has been the change in age distribution of the population. While the average age has increased slightly, a significant growth in younger (under 18) and older (over 64) age groups is expected to continue. The changing age distribution will have a substantial impact on consumption of some foods, such as milk and infant formulas. Other demographic factors affecting the demand for food include participation of women in the labor force (beyond

the income effect discussed above, this change in the labor force alters household roles), ethnic composition, regional location, urbanization, and education. The influence of these factors is difficult to isolate since they are often associated with some other major factor.

Structural and Organizational Changes

During the last 20 years, food manufacturing industries have experienced structural and organizational changes of historic proportions, largely brought on by technology and the basic conditions in the industry. Some segments of the food processing industry have grown more concentrated over the past two decades up to 1982, while other segments have become more competitive (Connor and Wills). Increasingly concentrated markets include prepared meats, breads, pasta, confectionery products, snacks, beer, and most other beverages. Markets where concentration ratios have declined include flour mixes, most dairy products, animal feeds, and frozen seafoods. While 1987 Census data would provide a more up-to-date description of such structural changes, these data will not be available until 1990. However, USDA and trade sources indicate large increases in flour milling, poultry dressing, and meat packing concentration since the 1982 Census. With the accelerated merger activity within the food industry during the 1980s, the vast changes in market structure that have characterized the food processing sector are likely to continue.

Until recently, the major factor contributing to imperfectly competitive markets has been product differentiation, which has been fueled by large advertising expenditures. More recently, the new wave of food firm mergers has affected commodity firms as well. New selling practices, such as "renting" retail shelfspace from grocers, have given advantages to larger companies.

Organizational changes in food manufacturing industries, or changes in the vertical channel, appear with changes in exchange arrangements, new joint ventures, new firm organizations and/or as advancements of legal monopolies, such as cooperatives. These are some of the changing institutional arrangements accompanying structural changes. Among those institutions altering the structure of markets, cooperatives have not significantly altered the structure of food manufacturing industries. With the exception of the dairy industry, cooperatives have not for the most part participated in value-added activities. Organizational changes in the food processing sector with respect to firm ownership are largely stemming from investor-owned corporations.

Changes in both structural and organizational features of food markets have implications for producers and consumers. Factors influencing the structure of one segment of the food system influence other segments. Decisions made by large, diversified food marketing firms, as part of their corporate policy, significantly affect farmers because of the contractual relationships (terms of trade) which link production to processing and affect consumers via large expenditures for advertising. Therefore, the impacts of structural change in the food industry are best understood from the perspective of a food marketing system.

Public Policy

Public policies affect the food manufacturing industry at different levels. These levels include: 1) macro policy, 2) sector policies, and 3) state and local policies.

Macro policy, fiscal and monetary, influences the food processing sector in many significant ways. Macro policy bears directly on interest rates, thus on the availability of capital for industry. National policies affect the value of the dollar, levels of taxation, wage rates, and the employment rate. All of these factors directly influence the cost of products and output levels of food manufacturers as well as affecting the purchasing power of the consumer. Regulatory policies at the national level are related to the economic performance of food manufacturers. Laws directed toward safety, antitrust, and public health impact food manufacturers.

Agricultural policies are directed toward maintaining income for farmers via a number of policy instruments ranging from direct price intervention to supply control. Historically, these policies have not had as an objective the maintenance of a structurally competitive food system. Such policies have indirectly maintained a processing sector, assuming that agricultural sectoral policies are necessary for the maintenance of raw producers. For example, sugar policies, while maintaining the existence of sugar farmers, also help keep sugar mills operating.

Although macro and agriculture sector policies clearly influence food manufacturers, so does a growing and largely unrecognized

policy set—state government. Food manufacturing firms respond to a whole set of factors influencing their location beyond economic considerations, such as source of raw product, transportation costs, bulkiness of raw products, and perishability of processed products, to name a few. They are influenced by local taxes, educational policies, capital market (regulations), and environmental policy, which are all enacted at the state level. In recent years, several states have attempted to enhance their competitive position in food processing.

Technological Change

Preservation and other technologies employed in food manufacturing have undergone significant changes. McCorkle identifies six broad objectives for which new technology has been developed and adopted:

(1) encase a safe product for a mass consumption market;

(2) increase efficiency in conversion of raw to finished products;

(3) reduce cost through substitutes of capital for labor and achievement of economies of size;

(4) increase quality and shelf life of products;

(5) enhance the market appeal of products; and

(6) increase efficiency and reduce costs of storage, transporting, and handling.

By most standards, adoption of new preservation technologies within the food industry has been relatively slow. An exception is the relatively rapid pattern of labor productivity growth (Connor). Perhaps this slow rate of technical innovation is tied to an early market structure (pre World War II) that essentially consisted of decentralized competitive small firms. Many segments of the food manufacturing sector have become more concentrated. This change in market structure has encouraged technological adoption in two ways: 1) by increasing rivalry in new product development, a strategy that can maintain or increase market shares; and 2) by broadening the financial base of firms to facilitate adopting new production techniques either through greater retained earnings or enhanced ability to borrow (McCorkle).

Internationalization of Food Markets

Over the past few decades, world food markets have experienced a greater degree of interdependence. Although most countries, developed and developing alike, impose varying degrees of protection for their agricultural sectors, the volume of food traded internationally has steadily risen. From the U. S. perspective, a close examination of agricultural products traded will reveal that a significant portion consists of raw commodities. A recent Experiment Station Committee on Organization and Policy (ESCOP) study reveals that the United States has a disproportionately low share of the world's total value of agricultural products. More work is needed to expand the processed share of U. S. agricultural products on world markets.

Another aspect of the interdependence in world food markets considers the fact that most food companies are internationally owned. Therefore, to understand the trade behavior of such firms becomes difficult. Information resulting from these transactions is often the private property of world food conglomerates.

REGIONAL DIFFERENCES IN FOOD MANUFACTURING: FOCUS ON THE SOUTHERN FOOD SYSTEM

Regional Comparisons

We have chosen three indexes to chart the relative regional growth patterns of the U. S. food manufacturing industries: the number of plants, the number of employees, and the value of shipments. Plants are separate operating manufacturing facilities, including in most cases adjacent storage and office spaces. Employees are paid production and nonproduction workers located in plants, including part-time workers and workers on paid leaves; the annual totals are averaged over four seasons. Value of shipments is the net selling values of all products produced or sent from a plant, plus some miscellaneous receipts. A fourth index of economic activity considered but rejected was value added. Value added is dominated by payroll, and previous work has shown that state employment tracks changes in value added quite closely so long as wage differences are not pronounced. Moreover, value of shipments can also serve as a surrogate for value added in making regional comparisons because state industrial mixes tend to remain the same for long periods.

In defining geographic divisions, we have followed Census Bureau conventions. The *Northeast* Region consists of New England, New York, New Jersey, and Pennsylvania. The *North Central* (Midwest) Region has two

TABLE 1. CHANGES IN THE NUMBER OF U.S. FOOD MANUFACTURING PLANTS BY REGION, 1963-1985

Region	Number of Plants			Change in Number of Plants	
	1963	1972	1985	1963–1972	1972–1985
				Percent	
Northeast	9,102	6,308	4,080	-31	-35
North Central:					
East North Central	7,661	5,503	3,655	-28	-34
West North Central	4,228	3,103	2,253	-26	-27
South:					
South Atlantic	4,624	3,635	2,777	-21	-24
East South Central	2,145	1,652	1,165	-23	-29
West South Central	3,490	2,739	2,030	-22	-26
West	6,279	5,218	4,807	-17	-8
United States	37,521	28,193	20,700	-25	-27

Source: adapted from Connor.

large divisions: in the East the five Great Lakes States between Ohio and Wisconsin and in the West the Dakotas and five states in the Western Corn Belt. The *South* has three divisions: the *South Atlantic* (Maryland to Florida), the *East Central* (Kentucky south to the Gulf), and *West South Central* (Arkansas, Oklahoma, Texas, and Louisiana). The *West* consists of eight Rocky Mountain and five Pacific states. For summary purposes, the Northeast and West are treated as units because their constituent divisions have comparable growth patterns.

The number of U. S. food processing plants has fallen dramatically in recent decades (Table 1). From 1963 to 1972, the number of operating plants fell by one-fourth, and after 1972 fell by an even larger proportion. In the most recent period, more than 4 percent of the nation's food processing plants were closing on average each year; at the same time about 100 new plants are built each year (Connor). The rate of decline is strongly related to plant size. From 1963 to 1982, fully 50 percent of the food processing plants with less than 100 employees closed, whereas the net number of plants with 250 or more employees increased by 23 percent.

No region escaped the trend of declining plant numbers. The rate of decline was higher than the national average in the historical U. S. industrial heartland—the Northeast and North Central regions. The South had lower closing rates than did the United States in the 1960s, but since 1972 the South's experience has closely paralleled the national trend. Approximately 30 percent of all U. S. food processing plants are located in the South today, up from 27 percent in 1963. The rates of decline in food processing plants varied considerably across the states of the South. Florida, Virginia, and Texas have had the smallest de-

TABLE 2. CHANGES IN FOOD MANUFACTURING EMPLOYMENT BY REGION, 1963-1985

Region	Changes in Employment		
	1963–1972	1972–1982	1982–1985
		Percent	
Northeast	-17	-22	-3
North Central:			
East North Central	-6	-14	-25
West North Central	-7	-4	-4
South:			
South Atlantic	4	3	-1
East South Central	3	4	-9
West South Central	6	8	-5
West	2	8	-7
United States	-5	-5	-4

Source: adapted from Connor.

TABLE 3. ANNUAL CHANGES IN FOOD MANUFACTURING SHIPMENTS BY REGION, 1963–1985

Region	Shipments Corrected for Inflation			
	1963–1972	1972–1982	1982–1985	1963–1985
	Percent Per Year			
Northeast	1.4	1.7	4.8	1.9
North Central:				
East North Central	3.1	2.5	6.3	3.3
West North Central	4.5	3.1	2.0	3.5
South:				
South Atlantic	4.3	4.5	6.3	4.6
East South Central	4.0	3.2	6.0	3.9
West South Central	4.2	4.6	4.5	4.4
West:				
Mountain	5.9	2.0	5.1	4.0
Pacific	3.0	4.1	3.5	3.5
United States	3.5	3.1	4.5	3.5

Source: adapted from Connor.

clines, while Delaware, Oklahoma, West Virginia, and the District of Columbia have lost more than half their plants since 1963.

Employment losses in the U. S. food processing industries were small but steady: roughly 5 percent in each of the 1960s, 1970s, and early 1980s (Table 2). From 1963 to 1982, a strong pattern is the rapid disappearance of food processing jobs in the Northeast, a less rapid, but still substantial reduction in the Midwest, and modest growth (less than one percent per year on average) in the South and West. The South now has one-third of U.S. food processing employment. Several southern states had outstanding records of employment growth in food processing during 1963–1982. One group of high-performing states benefited from the rapid expansion of poultry dressing and poultry processing, including Delaware (33 percent increase), Virginia (15 percent), North Carolina (33 percent), Georgia (21 percent), Arkansas (70 percent), and Mississippi (33 percent). Other states were lifted by rapid population increases and the expansion of local-market food processing investment (Florida and Texas). Only five states in the South had substantial job losses in food processing: Maryland (-35 percent), West Virginia (-22 percent), Louisiana (-22 percent), Kentucky (-20 percent), and Oklahoma (-12 percent). These states were affected by having a mix of industries with very low employment-generation potential, such as meatpacking, dairy products processing, bread, cane sugar, cottonseed oil, whisky distilling, or coffee roasting.

Since 1982 a quite different pattern of employment change has asserted itself (Table 2). Food processing employment dropped in every region of the country during 1982–1985. More surprisingly, except for a huge drop in the East North Central Division, the declines were all fairly close to the national average. The historical pattern of employment growth in the West and South and shrinkage in the Northeast and Midwest is no longer in evidence. It is too early to tell if 1982, a deep recession year, was a watershed, but the widespread employment losses during the 1982–85 recovery bear close scrutiny in the future.

The picture is more sanguine if we examine patterns of unit output growth (Table 3). Real production (value of shipments corrected for inflation) of U.S. food processing increased by 111 percent from 1963 to 1985. In eight states, production more than tripled, and four of the eight were located in the South: the Carolinas, Arkansas, and Florida. Only three southern states suffered growth rates well below the U. S. average (Kentucky, West Virginia, and Louisiana). Three of the four fastest growing U. S. geographic divisions were southern: the South Atlantic (171 percent increase from 1963 to 1985), West South Central (157 percent increase), and East South Central (131 percent increase).

Real production of the U. S. food processing industries averaged 3.5 percent per year for the whole study period. Until 1982 output growth generally paralleled employment growth. The high growth rates in the South required substantial hiring (this also holds for the 1960s in the Mountain Region and the

1970s in the Pacific Region). The low growth rates in the Northeast and Midwest were accompanied by large labor contractions.

However, in the three-year period following the end of a sharp 1981-1982 recession, growth patterns are greatly altered. Except for the oil-patch states of Texas and adjacent states, the South enjoyed its most rapid spurt of growth, well above the U. S. average. Unlike the previous periods, the South was joined by food processors located in the historical U. S. industrial heartland stretching from Chicago to Boston. The Pacific states' growth was modest and the West North Central states' was low. Another surprising feature of post-1981 growth was that it was accompanied in every region by employment declines, some quite substantial (Table 2). Because capacity utilization in the average food processing plant did not change appreciably, the major explanation for this paradox lies in rather large increases in labor productivity.

Labor productivity has increased handsomely in U.S. food processing since 1963 (Table 4), averaging around 4 percent per year. Until 1982 labor productivity growth was relatively slow in the South, and this is one reason that rapid expansion required increases in the labor force. However, after 1982 the southern food processing industries brought about rapid productivity growth, so rapid that rising output was accomplished with a diminishing labor force. It is also interesting to note the resurgence in productivity growth in the Northeast and Great Lakes States.

Factors Affecting Growth of Food Processing

The long-term growth of a set of industries of a state is affected by four main factors. First is growth in effective demand for foods and beverages. Ignoring for the moment changes in the market basket of goods purchased, food demand is strongly proportional to the level of disposable domestic income. The demand facing a state's food processing industry may be purely local (as is much the case for fluid milk or bread), essentially national in scope (e.g., raisins), or more at a regional level (e.g., beer). Foreign demand is unimportant for most processed foods, but there are exceptions (e.g., milled rice).

A second important factor is the vector of input supply prices. For food processing these include, in descending order of importance, food and agricultural raw materials, labor, containers and packaging, capital-related expenditures, wholesale distribution services, taxes, and business services (Connor). Growth in the short run can be accomplished by tapping underutilized capacity in plants located in regions with comparative cost advantages. This type of growth is limited by the usual 10 percent to 15 percent excess capacity found in the average food processing plant and by the costs of shutting down a plant or additional transportation of goods to market. Thus, in the long run, it is investment in plant expansion or new equipment that will handle demand growth. Investment decisions will be

TABLE 4. PRODUCTIVITY CHARACTERISTICS OF U.S. FOOD MANUFACTURING BY REGION, 1963—1985

Region	Average No. Employees per Plant, 1982	Value Added per Employee 1982	Average Annual Change in Labor Productivity		
			1963–1972	1972–1982	1982–1985
	Number	$ Thousands	Percent		
Northeast:					
New England	44	46.9	3.0	3.7	8.5
Middle Atlantic	58	68.0	3.6	4.3	5.5
North Central:					
East North Central	71	68.9	3.8	4.1	17.0
West North Central	76	62.1	5.4	3.5	3.4
South:					
South Atlantic	77	52.8	3.8	4.2	6.6
East South Central	80	51.2	3.6	2.8	9.4
West South Central	72	52.0	3.5	3.8	6.3
West:					
Mountain	52	48.9	4.7	2.0	5.8
Pacific	65	58.2	3.1	3.0	6.9
United States	67	59.4	4.1	3.7	5.9

Source: adapted from Connor.

strongly affected by expected future regional differences in the costs listed above. Note that energy costs are usually negligible (less than 2 percent of total costs).

Measuring many of these costs across regions is not easy and in some cases not relevant. Bulk purchases of many food and packaging materials do not vary significantly in prices across the country; flour, vegetable oils, and cardboard cartons are examples. For other food processing materials, local unit costs will vary a lot across regions; for example, farm milk, coffee, seafood, livestock generally, and several fruits and vegetables. Labor cost differences will certainly affect expansion decisions, though the regional disparities, when adjusted for quality, are not as pronounced now as in previous decades. Capital and business services are mostly purchased in national markets from Chicago food engineering firms, Wall Street banks, or Madison Avenue advertising companies.

Having made estimates of future demand growth and major cost calculations, a food processing planner is likely to find that each of several final candidate locations is about equally cost-effective. Often in this case, it is business climate or managerial preferences that ultimately tips the balance in a location decision. Quantifying these is difficult. Local taxes or subsidies play often minor roles in setting the tone for business climate. The intangible quality-of-life factors that must influence managerial location preferences are equally difficult to measure.

Finally, the mix of industries will, in an arithmetic sense, condition the growth of a state's food processing industries. Food industries rarely enjoy rapid growth that persists for more than 10 years (Connor). From 1963 to 1985, only one food product class enjoyed growth that was double the average of all food processing throughout the period (processed poultry products). Other industries have exhibited 5-or-10-year bursts of growth (frozen dinners, dried soup mixes, cheese, wine), but none has maintained sustained growth or declines. However, during the past quarter century, there are certain broad categories of foods whose growth paths have been distinctly above or below average (Connor). Generally speaking, these growth patterns were consistent with consumer desires for less salty, less fatty, fresher, and more convenient foods.

Projected Growth of Food Manufacturing

The above discussion suggests a model of long-term growth of state food processing industry shipments that could be fitted against historical data. The model takes the general form:

$$\Delta VS = f(\Delta D, \Delta W, C),$$

where VS is value of shipments, D is effective demand for food, W is a vector of input prices, and C is perceived local business climate. If levels of state output are in equilibrium at the beginning of the period, then expected future changes in demand (ΔD) and input prices (ΔW) are the relevant determinants. To predict such future levels, planners might naively use actual differences at the beginning of the period, or they might use immediate past changes. Because cultural and institutional change is usually very slow, contemporaneous measures of C would probably suffice. The VS should cover a period long enough to encompass changes in the business cycle and average payback periods on investments. For predictive purposes, the model should be fitted to historical data and the resulting coefficients employed for the future period.

We estimated by OLS regression the following equation using data from the 50 states:

$$\Delta VS = a + b_1 \bullet \Delta D + b_2 \bullet \Delta W,$$

where ΔVS was 1972–1982 percentage change in value of shipments of processed foods; ΔD was represented by percentage change in state population 1972–1982; and ΔW was 1977–1982 percentage change in annual wages of production and nonproduction employees in the state's food processing industries. In testing a few alternate models, it was found that 1972 wage levels (W) were a better predictor of ΔVS than ΔW; W and ΔW were highly collinear. So the best model was:

$$\Delta VS = 207.8 + 1.48\ \Delta D - 0.01\ W,\ R^2 = 0.21,$$
$$(3.6)\quad (2.8)\quad (-1.4)$$

where t values are given in parentheses. As expected, our proxy for demand growth is positive and highly significant, with an elasticity of state output with respect to population change of 1.48. The coefficient on W implies that for each $1,000 per year difference in state food processing wages, state shipment

growth changes inversely by 1.0 percentage point per year.

We used these results to predict 1985–1995 growth in value of shipments in the southern states. For population change, we employed BLS estimates of resident population in 1995. Results, in geometric annual growth rates (undeflated), are in Table 5.

All the southern states are projected to have positive growth rates, and 13 southern states have predicted growth of food processing greater than the national average. Only three states, West Virginia, Kentucky, and Tennessee, are projected to experience below average national growth trends in food processing. It appears that the southern region, on the whole, will have a healthier growth rate in its food processing sector than other regions of the U.S.

IMPLICATIONS FOR PUBLICLY SUPPORTED RESEARCH IN AGRICULTURE AND CONCLUSIONS

We take the position that the objective of publicly supported agricultural research is to, in part, understand and evaluate the system of markets and related institutions which organize economic activity of the food and fiber sector and to make recommendations to improve the performance of the system. Therefore, publicly supported economic research has a responsibility to evaluate the relationship between current (and potential) markets structure (policies) and resulting economic performance, and to suggest new policies to stimulate desired market performance.

In view of the radically changing food and fiber system (e.g., structural, organizational, and value-added trends) our perceptions are:

(1) Publicly supported research has invested relatively little of our marketing research resources on system-wide problems. The agricultural research system spends less than 15 percent of its budget on research and development in the post-harvest technology area (ESCOP).

(2) We have focused our activities too close to the farm sector, where the value-added has stabilized. Hence, increasing efficiency in the production of food may not result in appreciable benefits to consumers. Some would argue that those research activities directly related to producers do not sufficiently focus on identifying alternative products to meet consumer approval and increase utilization of agricultural commodities for new food and non-food uses.

(3) We have not done an effective job on issues beyond the farm gate, perhaps because marketing firms view public scientific processes as too slow, expensive, or not contribut-

TABLE 5. PREDICTED GROWTH OF SOUTHERN FOOD PROCESSING, 1985–1995

State	Annual Growth of Shipments of Food Processing
	Percent
Delaware	5.6
Maryland	3.6
Virginia	5.0
West Virginia	1.9
North Carolina	5.2
South Carolina	5.1
Georgia	5.3
Florida	5.2
Kentucky	0.1
Tennessee	1.4
Alabama	5.0
Mississippi	5.4
Arkansas	5.7
Louisiana	3.4
Oklahoma	2.4
Texas	3.6
United States	2.1

ing to their organizational goals (profit). Some new joint ventures between the university and private food marketing firms are developing. It may be too early to evaluate these arrangements.

(4) Agricultural scientists are just beginning to learn about the ultimate consumer. We know that changes in income do not directly translate into changes in the demand for food; we see changes in the demand for food services.

(5) Finally, our basic premise is that significant benefits are available from improved organization and coordination of economic activity. We must develop a new relevant professional role in a radically changing world. Shaffer observed some 20 years ago that the role of the agricultural scientist, particularly the social scientist, is critical in our day because for the first time in history, we seem to have the technical capacity to control the physical environment, but we lack the capacity to construct the necessary social institutions to take full advantage of this capacity.

It is time that we reexamine our goals and objectives, seek to enhance professional dialogue, and develop system perspectives to our work. For the future is indeed ours to shape!

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