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CHANGES IN DOMESTIC DEMAND FOR FOOD: IMPACTS ON SOUTHERN AGRICULTURE

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Since the early 1970s, the economic environment and the agricultural sector in particular have been characterized by constant change. Technologies are rapidly changing from the farm level through the various processing stages to the marketing of food products. New food products and markets, both domestic and international, are continuously emerging (Connor). Unprecedented linkages to world markets and to domestic macroeconomic policies have also been factors shaping the agricultural and nonagricultural sectors in the past 10 to 15 years. For the most part, the effects of these changes on the demand for agricultural products have not generally been empirically determined. Little attention has been paid to keeping abreast of changes and their implications for farmers and processors in any systematic fashion.

This paper attempts to address the impacts of changes in the domestic demand for food on the agricultural sector in the South. For clarification purposes, the South encompasses: (1) the Appalachian states of West Virginia, Virginia, Kentucky, Tennessee, and North Carolina, (2) the Southeastern states of Alabama, Georgia, South Carolina, and Florida, (3) the Delta states of Arkansas, Mississippi, and Louisiana, and (4) the Southern Plains states of Oklahoma and Texas. Adequate warning of incipient changes can be invaluable in enabling Southern agriculture to capitalize on new opportunities and to reduce or counteract adverse effects.

The effectiveness of public policies directed toward the well-being of consumers, farmers, and various intermediaries of the food and fiber sector is most likely to occur with improvements in the understanding of

the structural elements of food demand. Estimates of demand parameters are necessary for sound policymaking in order to assess the impacts of alternative food, nutrition, and agricultural policies. The capability to adequately forecast future patterns of food consumption is of extreme importance to private economic agents (e.g. producers, food processors as well as commodity associations) who must deal with uncertainty about future demand patterns in their decisionmaking.

The objectives of this paper are fourfold: (1) to describe, via historical trends, changes in domestic food consumption and food spending patterns, (2) to pinpoint factors responsible for such changes, (3) to discuss impacts of changes in domestic demand on the agricultural sector in the South, and (4) to identify research challenges for demand analysis.

HISTORICAL TRENDS

Per capita consumption figures (not necessarily synonymous with demand) of several food items of particular importance to Southern agriculture for various time periods since 1970 are exhibited in Table 1. By focusing on changes in year-to-year food consumption patterns, it is difficult to recognize long-term patterns. Within any year fluctuations in food consumption are typically more dependent on supply changes and price changes than on shifts in demand. To overcome this difficulty, multi-year periods are used in this analysis: specifically the 1970-74, 1975-79, and 1980-84 periods.

Total per capita food consumption has only increased roughly 2 percent from the 1970-

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TABLE 1. PER CAPITA CONSUMPTION* OF FOOD ITEMS,
UNITED STATES, SELECTED TIME PERIODS SINCE 1970

Food Item	Time period			Percent change ^f
	1970-74	1975-79	1980-84	
	pounds			
Total food:	1,375.0	1,387.2	1,405.2	2.2
Animal products	604.6	588.2	581.8	-3.8
Crop products ...	770.4	799.0	823.4	6.9
Red meat:	161.6	158.2	153.1	-5.2
Beef	83.8	87.9	77.6	-7.4
Veal	2.0	2.8	1.6	-20.0
Pork	62.5	56.0	63.2	1.1
Lamb	3.2	1.5	1.5	-53.1
Fishery products ^b	12.1	12.8	12.9	6.6
Poultry:	49.6	54.4	64.2	29.4
Chicken	40.7	44.8	52.9	30.0
Turkey	8.5	9.1	10.9	28.2
Eggs	37.9	34.7	33.6	-11.3
Dairy products: ^c ..	325.8	313.4	299.7	-8.0
Whole milk	198.1	163.1	133.9	-32.4
Cheese	18.2	20.7	24.0	31.9
Fats and oils: ^d	55.9	57.3	61.3	9.6
Animal	14.0	11.4	13.0	-7.1
Vegetable	41.8	45.9	48.3	15.5
Flour and cereal products	139.3	146.5	150.0	7.7
Fruit:	131.0	136.2	138.4	5.6
Fresh, citrus	27.1	26.3	25.3	-6.6
Fresh, noncitrus	49.0	54.7	60.3	23.0
Processed	54.9	55.2	52.8	-3.9
Vegetables: ^e	224.2	229.6	234.9	4.8
Fresh	144.7	147.5	154.2	6.5
Processed	79.5	82.1	80.7	1.5
Sugars and sweeteners	129.0	133.6	141.1	9.3

*Retail weight equivalent.

^bExcluding game fish.

^cWhole milk, other milk beverages, cream and specialties, cheese, frozen desserts, and dry milk products.

^dButter, margarine, shortening, lard and tallow, other fats, and oils.

^eIncluding potatoes and sweet potatoes.

^f1980-84 relative to 1970-74.

Source: USDA.

74 level to the 1980-84 level. However, the mix of foods eaten, the methods of preparation, and the place of consumption have changed considerably. Since the early 1970s, per capita consumption of animal products has declined approximately 4 percent, while per capita consumption of crop products has increased by almost 7 percent. In terms of per capita consumption, the fastest rising food groups have been cheese products, poultry, fresh noncitrus fruit, and vegetable fats and oils. Per capita consumption of sugars and sweeteners, flour and cereal products, fishery products, and fresh vegetables has also risen steadily.

On the other hand, several food groups have been adversely affected by changing food consumption patterns. Total red meat consumption and total dairy consumption have fallen 5 and 8 percent, respectively, from their 1970-47 levels. On a per capita basis, beef, veal, and lamb consumption has declined monotonically since the 1970-74

period. Beef is still the most popular of meat types, but poultry and fishery products are on the advance. Similarly, due predominantly to the emergence of low fat milk, whole milk consumption has declined more than 30 percent since the 1970-74 period. In addition, per capita consumption of eggs has fallen slightly more than 11 percent from the 1970-74 level. Further, the consumption of animal fats and oils and the consumption of fresh citrus fruits have decreased roughly 7 percent and 6.5 percent, respectively, since the 1970-74 period.

Food spending patterns for the 1970-74, 1975-79, and 1980-84 periods are depicted in Table 2. In current dollars, food expenditures totaled \$338.3 billion (\$250.4 billion for food at home and \$87.9 billion for food away from home) in the 1980-84 period, up considerably from the 1970-74 level of \$135.1 billion (\$104.4 billion food at home and \$30.7 billion for food away from home). In constant 1967 dollars since the early 1970s, total food expenditures, expenditures for food at home, and expenditures on food away from home have risen 19, 16, and 30 percent, respectively.

On a per capita basis, after adjusting for changing price levels, total food expenditures have increased monotonically and modestly since the 1970-74 period. Over the past 15 years, real per capita total food expenditures, expressed in 1967 dollars, have risen slightly more than 8 percent. Similarly, real per capita expenditures for food away from home have also increased monotonically (more than 18 percent) since the 1970-74

TABLE 2. FOOD SPENDING PATTERNS, UNITED STATES,
SELECTED TIME PERIODS SINCE 1970

Time Period	Current dollar food expenditures	Constant dollar food expenditures (1967 = 100)	Retail per capita food expenditures (1967 = 100)	Average budget share
	bil.	bil.	dol.	pct.
1970-74:				
At home	104.4	79.6	384.45	12.6
Away from home	30.7	22.6	109.40	3.9
Total	135.1	102.4	494.42	16.6
1975-79:				
At home	164.0	82.9	380.02	12.3
Away from home	54.4	26.6	121.95	4.2
Total	218.4	109.7	502.82	16.6
1980-84:				
At home	250.4	92.5	404.09	11.5
Away from home	87.9	29.6	129.41	4.3
Total	338.3	122.2	533.99	15.8

Source: USDA.

period. On a real per capita basis, expenditure for food at home declined roughly 1 percent from the 1970-74 level to the 1975-79 level, but rose slightly more than 6 percent from the 1970-74 level to the 1980-84 level. Overall, from the 1970-74 level, real per capita expenditure on food at home increased roughly 5 percent.

The average budget share for all food (the proportion of disposable personal income spent on food) has dropped from 16.6 percent in the 1970-74 period to 15.8 percent in the 1980-84 period. Similarly, the average budget share for food at home has declined steadily from 12.6 percent in the 1970-74 period to 11.5 percent in the 1980-84 period. On the other hand, the portion of the budget allocated for food eaten away from home in restaurants, fast food shops, for snacks, and so forth has risen from 3.9 percent in the 1970-74 period to 4.3 percent in the 1980-84 period. However, the average budget share for food eaten away from home has for the most part leveled off since the 1975-79 period.

KEY FACTORS

As noted in the previous section, since 1970 Americans have unequivocally changed their food consumption patterns. Food consumption patterns change with changes in relative prices, changes in real income, shifts in the demographic structure of households, and changes in tastes and preferences. This section deals with the factors responsible for changes in the domestic demand for food. Initially, attention is focused on changes in traditional demand factors: changes in relative prices, changes in real disposable personal income, and population effects, Table 3.

From 1970-74 to 1975-79, the real price of food, either at home or away from home, increased roughly 5 percent. The real price of sugars and sweets and of fishery products rose slightly more than 25 and 18 percent, respectively, while the real prices of fats and oils, cereal and bakery products, fresh fruit, processed fruit, and processed vegetables rose anywhere from 5.6 to 7.9 percent. Declines were evident in the real prices of red meat, poultry, and eggs from 1970-74 to 1975-79. From the mid-1970s to the early 1980s, the real prices of all major food items decreased rather substantially. The most notable declines were for food at home, red meat (primarily pork), poultry, eggs, dairy products, fats and oils, and processed vegetables. On the whole, from the early 1970s to the early

1980s, salient real price decreases were evident for red meat (both beef and veal as well as pork), poultry, eggs, dairy products, and fresh vegetables. Real price increases were evident for sugar and sweets, fishery products, fresh fruit, and food away from home. Real price changes of total nonfood, cereal and bakery products, and processed fruit were for the most part negligible.

Relative price changes can make some foods less attractive and others more attractive. For example, over the last 15 years, the real price of poultry has decreased 28 percent, while the real price of red meat has declined 13.5 percent. In essence, poultry has become a lower-priced alternative to red meat. The per capita consumption of poultry increased roughly 14 pounds from 1970-74 to 1980-84, while per capita consumption of red meat decreased roughly 8 pounds over the same time period. To illustrate further, the expansion of the United States soybean industry brought about a dramatic increase in the supply of soybean oil at competitive prices. Consumers attracted to the lower price, switched to vegetable-based fats and oils rather than animal-based fats and oils.

From 1970-74 to 1975-79, real income rose by 12.1 percent; from 1975-79 to 1980-84, real income rose by 6.5 percent. On a per capita basis, real income increased by

TABLE 3. CHANGES IN REAL PRICES OF SELECTED FOOD CATEGORIES, REAL DISPOSABLE PERSONAL INCOME, AND POPULATION FOR SELECTED TIME PERIODS SINCE 1970, UNITED STATES

Item	Time period		
	1970-74	1975-79	1970-74
	to	to	to
	1975-79	1980-84	1980-84
	percent		
Changes in real prices: ^a			
Total food:	4.7	-7.4	-3.0
Food at home	4.8	-9.1	-4.7
Food away from home	4.8	-3.0	1.6
Total nonfood	-1.3	1.7	0.2
Red meat	-1.2	-12.4	-13.5
Fishery products	18.2	-5.6	11.6
Poultry	-8.4	-21.2	-27.8
Eggs	-13.2	-26.7	-36.4
Dairy products	-0.6	10.6	-11.1
Fats and oils	7.9	13.8	-6.9
Cereal and bakery products	6.6	-5.7	0.6
Fresh fruit	5.7	-1.3	4.4
Processed fruit	5.9	-5.4	0.2
Fresh vegetables	-3.2	-4.1	-7.2
Processed vegetables	5.7	-9.8	-4.6
Sugar and sweets	25.8	-2.1	23.1
Changes in disposable personal income:			
Real ^b	12.1	6.5	19.4
Real per capita	6.4	1.0	7.5
Changes in population	5.4	5.4	11.1

^aConsumer price index of food item divided by consumer price index of all items.

^bDisposable personal income divided by consumer price index of all items.

Source: Computations from USDA.

more than 6 percent from 1975-79 to 1980-84. In short, real income has increased but at a decreasing rate since the early 1970s. The effect of income growth on food consumption patterns depends on the level of income and on the income elasticity of specific foods. As real incomes rise, *ceteris paribus*, demand increased for some foods, for instance beef, poultry, shellfish, fresh fruits, and vegetables, and demand decreased for others, for example, sugar, processed milk, potatoes, eggs, and cereal products (Smallwood and Blaylock). In the domestic market, most foods have positive, albeit small, income elasticities. Consequently, large increases in real income are necessary to generate substantial increases in consumption. In addition, associated with rising real income levels is the increase in demand for service of convenience attributes of food products. Research by Capps et al., Connor, and Redman (1980a) lend support to this claim. Also associated with rising real income levels is the rise in demand for food away from home (Kinsey).

To quote Raunika et al. (p. 43), "*a viable food market is dependent upon the level and distribution of real income or purchasing power.*" As Raunika et al. point out (p. 43), "*prior to the 1980s, the trend was toward the relative enhancement of the lower income groups with a shift in income to improve their purchasing power... However, this trend reversed in the 1980s with a shift in the income distribution toward the high income groups.*" The primary impact of this shift in the income distribution is the emphasis placed on the value of time and the willingness to pay for convenience, value added, quality, and variety. Information on food expenditures in relation to income by income group for 1981 is presented in Table 4. In accordance with Engel's Law, the average budget share for food declines with increases in real income. For the under \$5,000 group, the average budget share for food was slightly more than 53 percent, but for the over \$25,000 group, the average budget share for food was 10 percent. The shift in the income distribution and the increase in real income levels in part account for the decline in the average budget for food and the rise in the average budget share for food away from home over the past decade or so.

From 1970-74 to 1975-79 and from 1975-79 to 1980-84, the population grew 5.4 and 5.7 percent, respectively. The total quantity of food used domestically has changed in

direct proportion to the population. The composition of the population also plays a role in the changing demand for food and for particular types of foods. The proportion of persons in the 18-44 year old and the over 65 year old age groups is on the rise (U. S. Department of Commerce). The number of Americans aged 65 and over has doubled in the last three decades and the total of elderly Americans will be approximately 35 million, roughly 13 percent of the total population by the turn of the century.

Changes in food demand are affected by changes in population distribution. Demographic shifts and changes in the income distribution affect food consumption and expenditures away from home (Sexauer). The age shift of the population accounts, in part, for the decline in whole milk consumption and the increases in consumption of soft drinks, fruit drinks, and other beverages. Also, the changing racial/ethnic composition of the population is of substantial importance to the domestic food market. According to the U. S. Department of Commerce, the non-white population (black and hispanic primarily) is projected to increase between 1980 to 2000 from 14.5 percent to 16.9 percent of total population. In agreement with Raunika et al. (p. 43), "*food consumption, specifically the mix of foods, is conditioned by habit related to racial/ethnic origin.*"

Finally, the distribution of households of various sizes influences the domestic food market (Sexauer and Mann). Single-person households have increased dramatically in the past 30 years. Percentage of single-person households more than doubled from 10.9 percent in 1950 to 22.5 percent in 1980. The growth in the share of two-person households was much more modest, from 28.8 to 31.3 percent over the same period. During the past 30 years, there has been a decline in the proportion of more-than-two-person households from 60.3 percent in 1950 to 46.2 percent in 1980 (*Statistical Abstract*

TABLE 4. EXPENDITURES FOR FOOD IN RELATION TO INCOME BY INCOME GROUP, UNITED STATES, 1981

Income group	Share of total population	Share of total disposable personal income	Share of total expenditure	Average budget share for food
		percent		
Under \$5,000	13.6	2.4	8.6	53.2
\$5,000-9,999	16.9	6.8	11.1	24.3
\$10,000-14,999	14.7	11.5	14.3	18.7
\$15,000-19,999 ..	12.5	15.9	17.7	16.7
\$20,000-24,999 ..	21.2	22.7	21.1	14.0
Over \$25,000	21.1	40.7	27.2	10.0

Source: U. S. Department of Labor.

of the United States). Single-person and two-person households use more convenience foods per person than do more-than-two-person households because time for food preparation is more scarce and there is less tendency for household members to specialize in food preparation.

Besides changes in traditional demand determinants, notable changes are evident in nontraditional demand determinants, such as concern for nutrition and health, changes in lifestyles, changes in technological forces, and the effects of advertising. Concern about the health effects of American dietary habits has led to recommendations by government officials and nutrition experts that consumers change consumption patterns. In particular, medical researchers warn that consumption of too much red meat will contribute to heart disease, strokes, and possibly cancer.

Americans are moderating their intake of foods high in saturated fats, cholesterol, sodium, sugar, and alcohol. Evidence linking saturated fats with heart disease, along with concerns for obesity, have noticeably affected the domestic consumption of fats and oils. In particular, shifts from animal fats to vegetable sources (predominantly soybean oil) have occurred, reflecting efforts on the part of consumers to switch from saturated to polyunsaturated fats and oils. Additionally, because of the emphasis on the reduction of animal fats, the consumption of dairy products and red meat has declined, while the consumption of poultry and fishery products has increased. Dietary constraints on energy consumption are also evident. Animal fats, starches, and sugar are the types of food intake most prone to reduction under energy constraints. The reduction in energy consumption in recent years has led to the increase in consumption of leafy fresh vegetables, fruit, and poultry and to the decrease in consumption of cereals, red meat, and starchy vegetables. Unequivocally, concerns about calories, fitness, and health have encouraged consumers to alter food preferences. Vastly improved information about the links between diet and health (nutrition) to food consumption has led to substantial changes in food preferences.

The effects of nutrient content on food demand behavior is also of considerable interest. Although agricultural and food policies of the United States traditionally have been farm oriented, these policies also have a nutritional orientation. Consequently, nutritional objectives, information, and knowl-

edge will have important impacts on shaping food production and distribution policies. Governmental policies are currently in existence that directly or indirectly influence the nutrient intake of the United States population—for example, the food stamp program, the school lunch program, and the women, infants, and children program. In addition to direct government intervention aimed at affecting the nutritional intake of specific target groups, other agricultural policies indirectly influence nutritional choices through their effects on market prices and quantities. Major policies of this sort include establishing and enforcing food grades and standards, packaging and labeling requirements, and other methods of regulating marketing practices (LaFrance).

The non-static or dynamic nature of food demand is also attributable in part to changes in lifestyles of the United States population. To illustrate, consumers seem to be more willing than in the past to purchase food products that confer status or that yield some psychological kick (Padberg and Westgren). Further, social conscious dimensions of food consumption and expenditure are evident, for example, in meat versus non-meat sources of protein (Redman, 1980b). Moreover, increasingly both spouses work outside the home resulting in less time for food preparation. With more women working outside the home, breakfast habits are changing, contributing to the decline in egg consumption.

New technology in household food preparation, especially microwave ovens, and concomitant innovations in food processing continue to decrease the time needed for at-home meal preparation. Industry studies show that most consumers choose foods that can be prepared in less than 20 minutes (Morris).

Consequently, consumers want the food they buy to be easy and quick to prepare, a dramatic change from previous decades. During the past few decades, a myriad of convenience foods, particularly frozen items, ready-to-serve items, and mixes have been introduced into the marketplace.

Concomitantly, enormous growth has occurred in the number of fast food restaurants. Frozen potato products, cheese, tomatoes, and more recently chicken have benefitted from increased consumption away from home, while the away-from-home food industry has had a negative impact on the demand for most fresh fruits and vegetables (except lettuce) and on fresh milk. Similarly, the pop-

ularity of salad bars in restaurants and fast food outlets has increased the use of oil.

In addition, consumers are allocating progressively more of their income to expenditures which cannot be readily altered in the short run. These expenditures include utility payments, mortgage loan payments, and consumer credit payments. The level of consumer installment debt (credit cards, department store credit, auto loans, etc., exclusive of home mortgages) alone is currently at more than 18 percent of disposable personal income, the highest level in four decades. However, little information is available on the impact of the rise in the level of consumer installment debt on food consumption patterns.

Improvements and developments in processing and marketing have also boosted the popularity of some foods. Sales of fishery products, for example, have risen because of the introduction of seafood delicatessens in supermarkets and the rapid growth of restaurants and fast-food chains. The development of single-serving, boxed fruit juices as well as an increased variety of blends using apple juice have spurred the consumption of fruits. Improvements in processing techniques have permitted production of shortening and margarine made entirely from vegetable oils. Cane and beet sugar consumption have been affected by the development of high-fructose corn syrup.

The impact of advertising also cannot be overlooked. Increased advertising, along with changing lifestyles has resulted in phenomenal growth in yogurt consumption. Generic advertising campaigns for fluid milk and citrus products (grapefruit juice for example (Lee)), designed to achieve market expansion, have shown positive net returns in recent times (Morrison and Armbruster). The increase in avocado consumption is also a prime example of the success of generic advertising.

IMPLICATIONS FOR SOUTHERN AGRICULTURE

In agreement with Buse, the changes in domestic food demand have *"given pause to farmers and the multitudes of other individuals and firms involved in food processing and marketing."* The marketing system coordinates the production decisions of producers with the purchase decisions of consumers. Generally, this coordination is handled by middlemen, the food dealers and

processors, since only a small part of the total production is sold directly to consumers by farmers. Domestic demand changes at the consumer level provide signals to processors and agricultural producers. This section addresses the implications of changes in domestic food demand on Southern agriculture.

The quantity of food consumed per person is not likely to increase substantially. Since the early 1970s, the total quantity of food per person has remained within the range of 1,375 to 1,425 pounds. In light of the evidence of the previous section, numerous factors influence food consumption patterns in the United States, some more so than others. The continually changing food market in the United States has primarily resulted in the substitution of crop products for animal product. This shift from animal to plant products will likely continue. The per capita consumption of red meats, eggs, and dairy products (except for cheese) is likely to decrease, while the per capita consumption of fishery products, poultry, and fresh fruits and vegetables is likely to increase. In particular, apple producers in North Carolina and Virginia and sheep producers in Texas will, in the short-term, face continuing declines in net farm income.

Because of the gradual rise of flour and cereal products, the derived demands for food grains, notably wheat and rice, are expected to increase slightly—a plus for the rice states of Arkansas, Louisiana, Mississippi, and Texas and a plus for the wheat states of Oklahoma and Texas. However, because of the rise of poultry and fishery products, relative to red meats, the derived demands for feed grains (corn for grain, oats, barley, and sorghum grain) and for forage are expected to decrease. The reduction in the derived demands for these primary farm commodities, in concert with declining export markets, have contributed to the surplus dilemma of the agricultural sector in the 1980s.

Using the Food and Agricultural Policy Simulator (FAPSIM—the annual econometric model developed by Gadson et al., 1982 a and b), Crom, under the assumption of a decline in preference for beef, a rise in the preference for chicken, and no change in the preference for pork, simulated the impacts on the livestock and crop sectors over a 10-year period. Relative to baseline projections, retail beef prices fell by 11 percent and retail pork prices fell by 3 percent while retail chicken prices rose by 1 percent. The primary

market prices reflected the same pattern—choice steer prices declined by 17 percent by the 10th year and corn prices fell by 8 percent because of lower feed grain demand. Per capita consumption of beef under this scenario fell by 3.2 pounds, pork consumption declined by 0.1 pounds, and chicken consumption increased by 0.8 pounds. Net farm income fell by 20 percent because of the declines in choice steer prices and in corn prices. The 20 percent drop in net farm income reflected a loss of income to both beef producers and grain farmers, demonstrating the importance of feed use by the livestock sector on corn prices and indicating a rather slow response by corn producers to change production patterns, despite leftward shifts in feed demand. Finally, in the Crom scenario, the relative profitability of livestock production was not affected enough to induce major shifts in such production patterns.

Turning to the dairy sector, the troubles of this surplus-plagued industry are not likely to be abated in the near future. Shifts in demographics, including an aging population and a growing proportion of nonwhites, are behind part of the decline in dairy product consumption as are increased concerns about fat and calories. In agreement with Raunikaar et al., the prospects for expansion of the domestic market for red meats and dairy products, both direct and derived demands, are at best minimal. However, advertising and promotional schemes (for example, generic advertising and/or coupons), such as those developed by the National Dairy Promotion and Research Board and the American Meat Institute, may improve the domestic market for red meats and dairy products. State-legislated programs are also an important source of generic advertising, especially for farm products not covered by Federal programs. As of 1979, 61 state-legislated promotion and research programs existed in the South (Morrison and Armbruster). Additionally, because of the drop in the appeal for beef, some packers, for example Monfort of Colorado, are in the process of developing high-quality, convenient, and healthful products (*Wall Street Journal*).

The demand for seafood in the United States is strong and growing, in fact, reaching well beyond the domestic industry's present ability to fill market needs. Fishermen already harvest many traditional species at or near maximum yields (Miller). Given the shift

towards poultry and seafood from red meats, the increasing concerns about health and diet, the growth of fish and shellfish available in the away-from-home market (where two-thirds of fish and shellfish product sales occur), and the relative importance of the seafood industry in the South, aquaculture—the controlled cultivation and harvest of aquatic plants and animals—merits consideration on the part of Southern producers, especially in the Gulf and Coastal states.

Currently, the domestic aquaculture industry produces fish and shellfish for human consumption including catfish, trout, salmon, freshwater prawns, oysters, clams, and crayfish. Crayfish in Louisiana, for example, are raised in rotation with rice crops. Aquaculture even has some advantages over agriculture. Fish, for example, are more efficient converters of feed to protein than cattle, hogs, or poultry. The feed-to-food ratio is 1.9:1 for catfish; that is 1.9 pounds of feed produces 1 pound of catfish product. The ratio for hogs, cattle, and poultry is 4:1, 8:1, and 2:1, respectively (Stucker and Lipton).

The recent surge of consumer interest in diet, health, and fitness has increased the demand for vegetables, especially broccoli and cauliflower. Although vegetable production is centered in the West, the growing fondness of some items has brought shifts in the location of farms over the last decade (Love). For example, since the mid-1970s, Texas has led all states in expanding production of broccoli and broccoli has been adopted in many Southeastern states, primarily as an alternative to tobacco. With the passage of the 1985 Farm Bill, wherein emphasis is on less government intervention in the marketplace, more and more producers in the Southeast may opt to shift production away from tobacco and toward fresh vegetables such as broccoli. Tomatoes currently rank second only to potatoes in per capita consumption. Due primarily to the growth in demand for processed tomatoes, the increases in popularity of tomatoes has led producers in Florida to expand production by 8 percent since the mid-1970s, more than any other state by far.

Because of the shift to vegetable fats and oils away from animal fats and oils, the derived demands for soybeans, currently the dominant ingredient in salad and cooking oil, baking and frying fat, and margarine, as well as for cottonseed, are expected to grow. This shift to vegetable fats and oils will benefit

soybean producers in the Delta states of Arkansas, Mississippi, and Louisiana, and cottonseed producers in Texas.

The demand for sugar and other caloric sweeteners is likely to increase in the short-term primarily due to the development of high fructose corn syrup (HFCS). Soft drink manufacturers use HFCS as their primary sweetener and presently HFCS represents 30 percent of total sugar and sweetener use (Bunch and Hazera). HFCS, a liquid caloric sweetener made from corn starch, has been substituted for beet and cane sugar in a wide range of processed foods since its commercial introduction in 1972 (Barry). The proliferation of the use of HFCS will undoubtedly result in negative impacts on the net farm income of beet and sugar cane producers in Texas, Florida, and Louisiana.

Domestic population growth rates somewhat below 1 percent annually appear to be the most likely scenario during the remainder of this century. Since the proportion of income spent on food is decreasing and the response of food purchases to increased incomes is generally very low, future increases in income are likely to have little, if any, effect on the farm-level demand for food. Most of the increased income allocated to food will be spent for the most part on services, either in the form of food away-from-home or convenience aspects in food-at-home, that do not add substantially to the price of food at the farm gate (O'Rourke). Continued rising real incomes will probably continue to alter the product forms and the types of foods eaten but probably will not increase overall food consumption very much.

RESEARCH CHALLENGES

In the Presidential address delivered to the American Agricultural Economics Association in August 1985 at Ames, Iowa, William G. Tomek identified demand analysis as a primary area in need of great improvement. Specifically, *"... both models and data have become increasingly inadequate relative to the growing complexity of food and fiber markets. Existing secondary data seem especially inadequate for studying product demands in retail markets, and fundamental work needs to be done to obtain relevant data"* (pp. 913-4). To substantiate this latter claim, data are no longer available from the public sector for some fresh and processed vegetables, processed fruits, and melons.

In brief, there exists the need to develop more complete theoretical and empirical analyses which permit clearer pictures of changing patterns of demand, their causes, and their likely longrun effects. Although previous research efforts on food demand have been fruitful, at present the knowledge of the structure of demand is still quite rudimentary. The need for improved understanding of both the short-term and the long-term structures as well as the dynamics of the demand for the products in the food and fiber sector are in order. Similarly, despite the large number of published research studies with respect to demand analysis, the need exists for more realistic and detailed models describing the allocation of income among alternative expenditures, what variables most affect consumption and nutrition, and how the demand parameters and/or behavior patterns are changing over time. To this end, better information is needed on the elasticities of demand; additionally improved understanding is needed on the form of the demand function, the impacts of demand shifters, and the dynamics of the whole system, i.e., how the producer and the consumer respond to changes in the economic system in which they operate.

A prime example of needed research is the investigation of structural changes in domestic demand conditions (Haidacher; Wohlgemant). Investigating structural change in demand increases the understanding of both food consumption behavior and linkages between food consumption behavior and events in the nonagricultural economy. Structural changes in demand imply that forecasting models constructed and used in the 1960s and 1970s would not be appropriate for use either in the 1980s or in future decades. In addition, structural changes in demand have implications for resource allocation. A change in the demand structure would imply a change in equilibrium quantities if the supply structure remains unchanged. A planned or foreseen adjustment would require less of society's resources than an unplanned or unforeseen adjustment.

The issue of structural changes in domestic demand is still open to question. Research efforts, thus far, have been limited to structural changes in the demand for meat, poultry, and fishery products. Agricultural economists do not unanimously support the contention that structural changes in demand have taken place. To illustrate, Haidacher et

al. claimed that the United States demand structure for red meats, poultry, and fish is characterized by a high degree of stability and that an overwhelming part of the variation in domestic demand for these products can be explained by the economic factors of retail prices and income. Noneconomic factors, according to Haidacher et al., have played a relatively minor role in influencing domestic demand for red meats, poultry, and fish. Moschini and Meilke, using quarterly data over the 1966 to 1981 period, found no evidence of structural change in the demand for beef. On the other hand, Chavas, using annual data from 1950 to 1979, found evidence of structural change in the demand for beef and poultry in the post-1975 period, but no evidence of structural change in the demand for pork. Braschler, using annual data from 1950 to 1982, found evidence of structural change in the demand for beef in the post-1971 period and in the demand for pork in the post-1969 period. Finally, Nynakori and Miller, using quarterly data for 1965 to 1979, found evidence for structural change in the demands for beef and chicken but no evidence of structural change in the demands for pork and turkey.

The policy implications are, however, quite different. If, for example, relative prices are the prime explanation of the change in red meat consumption, then policies designed to improve meat production and distribution efficiencies, which eventually lead to lower retail meat prices, are very appropriate. On the other hand, if information, primarily medical evidence, induces changes in tastes and preferences, the policies designed to change the nutritional attributes of red meat are appropriate. Examples of policies of this sort include the production of high-quality low-fat red meats and the development of information programs on the nutritional qualities of red meat.

Another example of needed research is the focus on retail-to-farm linkages, useful for forecasting and policy formulation as well as for the evaluation of the effects of advertising and promotion programs for different crop and livestock commodities. Quantitative assessments of the impacts of changes in domestic demand conditions at the consumer level on the wholesale and farm levels for disaggregate commodities have typically been lacking. However, the use of existing simulation/econometric systems such as the Removal Impact Model (RIM) (Traub), the National Agricultural Policy Simulator

(POLYSIM), and the Food and Agricultural Policy Simulator (FAPSIM) will allow analysts to conduct normative experiments based on definitive models of the agricultural sector. Further, research efforts to update and expand the structural models developed by Gardner and Heien, which focus primarily on determinants of farm and retail prices, and the structural model developed by Lamm and Westcott, which centers on determinants of food sector input costs and retail food prices, may be worthwhile. Finally, research efforts similar to Huang's to estimate large-scale disaggregate food demand systems may be fruitful in order to obtain reliable (in agreement with the classical and modern restrictions of demand theory) own-price, cross-price, and income elasticities. Such empirical estimates of the demand structure for food are useful for the provision of commodity forecasts and for the analysis of the effects of changes in commodity prices and income.

CONCLUDING COMMENTS

Agriculture and the food processing industry will have to adapt to meet the incessant changes in domestic demand for food. Changes in consumption patterns will ultimately lead to shifts in production patterns. The substantiation of this point is already evident in regard to several commodities, especially meat, poultry, and fishery products. However, cattle producers are not able to react as quickly as poultry and pork producers to changing market conditions due to the biological condition of the birth-to-maturity time. Consequently, cattlemen may face competitive cost disadvantages in the short-run. Major agricultural industries such as beef and dairy should investigate positive product development and promotion programs to service changing consumer preferences. Additionally, in agreement with O'Rourke, greater concentration among food service chains may increase the pressure on processors to contract more acreage from growers on a longer-term basis than at present. Consequently, commitments to production of specific commodities by growers may have to increase. Finally, to overcome the weak domestic demand for red meat and dairy products, as well as for other commodities (notably feed grains) and to maintain world market shares, it may very well be necessary to place more reliance on the already price-depressed and supply-burdened export mar-

kets (Burbee et al.). At present, United States negotiators are trying to pry open the heretofore extremely restrictive Japanese beef market. Producers, processors, and other parties in the agricultural sector may also need to collectively push for reductions in interest rates, accomplished directly by national monetary policy or indirectly by the reduction of the level of government deficits (the Gramm-Rudman-Hollings legislation). The subsequent decrease in foreign exchange rates will, *ceteris paribus*, eventually lower the real price of United States food products in world markets.

It is difficult to distinguish between tem-

porary slowdowns in demand due to general economic conditions and more permanent changes due to changes in underlying tastes. The key lies in the comprehension of the structural elements of food demand from the consumer level to the producer level. In this light, additional research in the area of demand analysis will unequivocally ameliorate public and private decisionmaking. Finally, changes in the domestic demand for food must be considered together with the domestic supply of food along with changes in international markets if successful market-oriented food and agricultural policies are to be implemented.

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