

# Food Marketing and Lumber Processing in Massachusetts, 1958 to 1997

David Damery, David Holm, Daniel Lass,  
and Richard Rogers

---

*Department of Resource Economics, University of Massachusetts  
Amherst*

## **OVERVIEW**

This paper examines the food and lumber processing industries in Massachusetts over the last four decades. We give much more emphasis to processing than to distribution (the next step in the vertical food marketing chain) because processing is directly linked to primary production, the topic of our first white paper, "[The State of Agriculture in Massachusetts](#)." Unlike processing, the distribution of food and wood products is influenced more by where people live than where the primary production is located. Even within processing, though, population plays a role because certain food products (e.g., bread) are more efficiently processed near the consumer, rather than near the primary production areas, therefore separating the usually close link between production and processing.

We begin with a brief summary of food and lumber processing in Massachusetts, then provide a broad overview of the U.S. food marketing system, which allows for relative comparisons. After the national review, the paper examines more fully food processing in Massachusetts and the New England region, as well as the Massachusetts forest products manufacturers. We close with a general assessment of the total food marketing system in Massachusetts in 1997, the most recent year data are available.

### **Food Processing in Massachusetts**

Food processors have long been viewed as the market channel leaders within the vertical food system because they attempt to link consumer demands to producer supplies. Agricultural products are characterized by a biological process that typically starts with the planting season and ends with a harvest. Food processors provide the critical services of preservation and transformation of raw commodities into value-added products, and they begin the distribution process of moving food products to final consumers. They dominate the vertical food system in terms of their economic size and their importance to a modern food system.

The cost of marketing food continues to take a larger proportion of the consumer's food dollar, but Massachusetts farmers have responded by taking on many of the marketing tasks to retain those marketing dollars for themselves. It is a common belief within the agricultural community that "all the money is made by the middle people." Some Massachusetts farmers are testing this belief by directly assuming the functions performed by these middle people. Direct marketing through farmers' markets and roadside stands are such examples. However, such an expansion of duties does not eliminate the marketing functions; it merely shifts them from marketing firms back to the producer, who now performs those duties along with the production duties. Such a trade-off is not always a wise decision because specialization often provides sufficient efficiencies to outweigh the loss of doing more of the marketing functions within the farm enterprise. In Massachusetts, farmers are using both approaches: some have reduced their production operations and expanded their marketing operations, while others have further specialized in their farm operation and allowed others to handle the marketing functions.

Massachusetts is not known as a farm state, yet it retains a significant and healthy agricultural sector (see "The Changing Landscape of Massachusetts Agriculture" by David Holm, Daniel Lass, and Richard Rogers in the Winter '99/'00 issue of

*Massachusetts Benchmarks*). Massachusetts is a small state, and it ranked 43rd in agricultural production in 1997. All six New England States were in the bottom nine states in the country in agricultural production. Large states, such as California and Texas, and Midwestern states led the 50 states in agricultural production. However, Massachusetts is also a densely populated state, and its population and location allow it to have a much higher national rank in food processing (26th) because food processors often locate nearer to consumers, especially for highly perishable products like bread. This population density also makes food service of great importance to Massachusetts, and farmers and food processors should cater to this sector. Retailing is another population-driven business, and Massachusetts farmers need to find ways to benefit from rather than be hurt by population pressures. The state also plays an important role as food wholesaler to the greater New England and northern East Coast region.

Employment in food processing in New England has declined over time, but most of this decline came in the earlier part of the period we examined, from 1958 to 1977, and then stabilized or posted some increases. In 1996, New England employed over 40,000 people in food processing jobs. Within New England, Massachusetts dominates food processing, but its dominance has fallen slightly, from just over 50 percent of the region's food processing employment or value-added in the 1950s and 1960s to just under 50 percent in the 1990s. New York experienced a much more dramatic decline in food processing than any New England state, and Vermont posted a large percentage of increase, but from a relatively small base.

Overall, Massachusetts accounted for 1.3 percent of the nation's value-added in food processing, far more than its 0.2 percent of agricultural production. In a few specific food-processing industries, Massachusetts exceeded its overall average. In dairy processing, mainly fluid milk and ice cream, Massachusetts held over 2 percent of the nation's food processing value-added. However, the other two broad food processing categories—bakery and miscellaneous foods—where the Bay State also exceeded its overall average do not benefit the state's farmers as directly as dairy processing does. The large presence of bakery products in Massachusetts reflects locational advantages to serve fresh bakery items to a large population base rather than locating close to producers of the grains. The miscellaneous food group is a catchall category, which includes the very important fresh and frozen packaged fish industry and numerous other small industries that are both important (e.g., potato chips) and unimportant (e.g., tea) to the state's farmers. The fresh and frozen packaged fish industry clearly benefits from the fisheries located along the eastern coast and accounts for roughly 10 percent of the state's total employment in food processing. Dairy products and bakery products are the leading industries within the state's food processing sector, with each accounting for about 20 percent of the state's workforce in food processing.

The decline in the size of the Massachusetts food processing was largely over by the late 1970s; subsequently the sector has even witnessed minor growth, and some sectors have posted significant gains (e.g., fruit and vegetable processing). Farmers benefit from having processors located nearby, and the state benefits from the substantial economic activity that food processors provide its citizens.

### **Wood Processing in Massachusetts**

For wood processing, we focus on the Lumber and Wood Products major group (SIC

24)in this paper. Like food processing, wood processing declined in Massachusetts, but unlike in food, wood- processing declines came after the 1980s, just when the food processing sector was stabilizing, if not increasing. The number of sawmills in the state fell from 130 in the early 1970s to 85 in 1997. Employment in the Lumber and Wood Products major group fell from over 6,000 employees in 1987 to about 3,500 in 1997.

Our previous paper ("[The State of Agriculture in Massachusetts](#)") focused on the landowner and forest level of the state's wood resource. There we discussed the growing wood and timber base and the species make up of the Massachusetts forest. We can define a breakpoint in the wood and wood products distribution system at the landowner level. Once the harvest decision is made, loggers fell the trees, sawmills provide primary processing, solid wood is dried (primarily with steam-dry kilns), and the dried lumber is then ready for additional processing, fabrication, or assembly.

Transportation and material handling costs between each of these steps is significant. Two of the largest solid wood uses are residential home construction and furniture manufacture. Wood chips, as a by-product of sawmilling, and solid logs of smaller diameter are also used for the third major wood industry: paper. Canada is a large producer of paper and paper products, with the U.S. paper industry found primarily in the Pacific Northwest, Midwest, South, and Northeast. The sources of softwood lumber, used largely in residential construction, come from three broad regions: Canada (British Columbia in particular), the U.S. Pacific Northwest, and the U.S. Southeast. Hardwood lumber, for furniture-making, comes largely from the eastern United States. In addition to its own production, Massachusetts wood consumers use wood from all of these sources and from imports.

Of the three major wood fiber uses, paper is the largest nationwide, and in Massachusetts as well. On the production side, in 1996 Massachusetts employed 19,500 in paper industries, 6,700 in furniture, and 4,500 in lumber and wood products. Looking further down the distribution chain, 10,010 individuals were employed in the wholesale trade for all three sectors and 34,814 in the retail trade. These figures provide evidence of Massachusetts role as a wood products consuming state.

Massachusetts sawmills account for about 0.3 percent of total U.S. production compared to its 2.3 percent of total population. Most of the segments of the selected wood processing manufacturing industry—including logging, wood preservation, truss manufacturing, and wood window and door manufacturing—show similar percentages of national production. However, in the area of custom architectural woodwork and millwork, Massachusetts boasts 2.6 percent of total U.S. employment and 2.8 percent of value-added, higher than its population percentage. Furniture manufacturing categories represent close to 1 percent or less of U.S. totals. Paper industries, however, are a relative strength for Massachusetts. In folding paperboard box manufacturing, Massachusetts accounts for 3.3 percent of employment and 3.2 percent of value-added. The figures for setup paperboard box manufacture are 11.8 percent (employment) and 13.7 percent (valued-added) of national totals. Massachusetts holds a national presence in certain of these downstream fabrication and processing segments of the paper industry.

The wholesale trade and retail trade figures for lumber, furniture, and paper hover close to the state's population share of 2.3 percent, with the exception of paper wholesaling where Massachusetts captures 3.8 percent of national wholesale trade in that industry.

Massachusetts forests have been growing over the last 30 years. The volume of growing stock has increased 68.6 percent over the period from 1972 to 1998 to almost 6 billion cubic feet. This figure represents a large and growing resource base for use by Massachusetts's primary wood processing industries. With growing demand for certified sustainably grown lumber, Massachusetts, with its strict forest management law, is well positioned to meet this niche. New logger registration requirements from the Massachusetts Department of Environmental Management, Forestry Division, further support the move toward certification. The number of sawmills has been declining slowly, but those remaining have invested in new equipment and have developed strong markets both at home and for export. Currently, Massachusetts is largely a forest products-consuming state when compared to forest production. Because transportation costs account for a significant component in the cost of wood products, it would be advantageous to increase local sources of wood to match consumption. Given its growing resource base, Massachusetts has significant potential to expand its wood processing industries. Local sources of timber and wood products have a competitive advantage in transportation costs and in forest products certification that can support this growth.

## **Part One**

### **The U.S. Food Marketing System<sup>1</sup>**

The U.S. food marketing system connects roughly two and half million ranchers, farmers, and fishers to more than 270 million domestic consumers and a much larger and growing number of consumers worldwide. The primary role of the marketing system is to coordinate the vast array of economic activity involved in transporting and transforming producers' products to consumers—when, where, and how they prefer them. This coordination relies on economic markets, legal contracts, and direct ownership of various operations within the vertical marketing system to give order to the vertical flow of food products. Though the exact marketing channels used vary by product, the general vertical flow is as depicted in Figure 1 (see Appendix).

Consumers are the focal point of the marketing system, because it is their demands from which everyone else attempts to profit. It is this interplay of what consumers are willing (based on their needs, wants, and whims) and able (based on their incomes and prices) to buy and what sellers are willing and able to supply—for a profit—that makes the U.S. food marketing system an economic marvel. Americans today purchase essentially all of their food from others—expending \$561 billion in 1997, a record amount for domestically produced farm foods (Figure 2). Nearly 80 percent of that amount goes to pay the marketing bill to cover the costs of all the activities that lie between the primary producers and the ultimate consumers in the vertical system.

The farm value share of food expenditures fell to a record low of 21 percent in 1997 (Figure 3). In 1952, U.S. consumers spent \$51 billion, and farmers received 40 percent of those expenditures. Over time, farmers have dramatically increased productivity with improved technology and specialization and have seen their share of the consumers' food dollar fall. Others, the so-called middlemen, have not only taken on the tasks abandoned by the producers but have also specialized in providing all of the marketing utilities to the eventual consumers by getting the right product (form utility), to the right place (space utility), at the right time (time utility), and at the right price (possession utility). It is these utilities that have increased the price of the marketing bill over time, as consumers demand more and more of these services (see Figures 2 and 3).

#### **An Overview of Trends**

This overview begins with consumers, the ultimate and somewhat elusive target of the entire marketing system. Then the focus shifts back to the starting point of the vertical system to examine primary agriculture, then food processing and manufacturing and, finally, food wholesaling, retailing, and food service.

Consumer demands change along with their preferences and incomes. Consumption patterns have seen some dramatic shifts over time, as shown in Figure 4. In beverages alone, huge changes have occurred since 1970. Coffee consumption has fallen 32 percent, despite the emergence of gourmet coffeehouses. The only growth segments are in the smaller specialty-coffee beverages that include flavorings. Milk consumption is also down 23 percent, with only the no-fat and low-fat segments showing increases. Calcium-fortified products have eliminated one of milk's traditional advantages, as even orange juice companies suggest consumers substitute orange juice for milk. The big winner in the beverage aisle is soft drinks, up some 118 percent. The market for

bottled water, flavored and unflavored, continues to grow as consumers consider tap water inferior.

Eggs and red meat consumption have also declined, 23 percent and 16 percent, respectively, whereas poultry has increased dramatically and rivals beef as the leading meat consumed in the United States on a trimmed and boneless basis.<sup>2</sup> The success of the broiler industry accounts for the majority of the poultry consumed. Fish consumption is up 24 percent since 1974, but remains a small part of the consumers' meat diet despite its known health benefits. Cheese consumption had the largest increase, up 146 percent since 1970. Americans have increased their consumption of fruits and vegetables 24 percent, but also had similar increases in fats and oils and caloric sweeteners. In addition, candy consumption reached a record 25 pounds per capita in 1997.

Much public and private effort has been directed at improving Americans' diets. The Federal Food Guide Pyramid was developed as a simple guide to assist consumers in improving their nutrition. The pyramid was controversial, as industry groups positioned themselves to maximize benefit or minimize damage from the new recommendations. A study of American diets found some improvements but some concerns as well. For example, even though consumption of fruits and vegetables reached a record amount in 1996, the use of caloric sweeteners also was a record as "on average, people consume too many servings of added fats and sugars and too few servings of fruits, vegetables, dairy products, lean meats, and foods made from whole grains ...."<sup>3</sup> The increased popularity of dining out has also contributed to nutrition concerns because consumers tend to eat more healthful foods at home than away from home.<sup>4</sup>

Reasons for the changes in consumption can be grouped into three general areas: demographics, economics, and an explosion in available information.<sup>5</sup> American households have changed tremendously since 1950. Total food consumption in an affluent society is linked to population, because the amount of food consumed per person has not risen much, though we do consume more calories. The U.S. population continues to grow, at roughly 0.7 percent per year, driven by increased life expectancies, immigration, and fertility. In 1999, there were about 270 million Americans, but the Census projects a population of 400 million by 2050. The U.S. population is aging; in 1996, 12.8 percent of the population was 65 and over, and it is projected to reach 20 percent in 2050.<sup>6</sup>

Older people have different food interests and needs, and the marketing system will respond to this major change. Though the average age is increasing, the proportion of young people is also increasing. In addition, the population is becoming more ethnically diverse; by 2050 non-Hispanic whites will make up 53 percent of the population, down from 74 percent in 1996. African-Americans will increase only slightly, from 11.5 percent to 13.6 percent, and Asians will increase from 1.5 percent to 9.6 percent. The majority of the population will be over 45 or under 18 by 2010, with nearly 50 percent of children belonging to an ethnic minority.<sup>7</sup> The increased diversity should be reflected in the food system. People's food choices are related to their cultural backgrounds, including religious beliefs. As the population continues to diversify, the food brought to the American table will reflect this diversity. Additionally, Americans will begin to experiment with the new ethnic foods.

The typical U.S. household has become smaller, older, and more likely to be run by a single parent. In 1955, 23 percent of households were headed by married couples with two or more children under the age of 18 and wives at home.<sup>8</sup> By 1992, only 7 percent of American households fit that description. In 1960, 9.8 percent of households were single-parent households, and in 1995, the number increased to 27 percent.<sup>9</sup>

In 1960, 18.6 percent of married women with children under the age of 6 were in the labor force. By 1997, the figure was up to 63.6 percent.<sup>10</sup> By 1996, nearly 60 percent of households with children under the age of 7 had personal computers.<sup>11</sup> Such households have become very busy places, and the eating habits have changed accordingly. Children often prepare their own meals, usually by microwaving a ready-to-heat-and-eat meal.

Household economics influence consumer demands as relative prices change and as incomes rise, allowing greater spending and increasing the value of leisure time. Rising incomes allow consumers to indulge more of their wants. Americans, on average, now spend less of their disposable income on food than any other country in the world, and the average percentage fell to a record low of 10.7 in 1997 (see Table 2). Of course, this figure is a statement about both America's wealth and its efficient food system.

Averages, however, conceal the diversity that exists among U.S. households. Households with after-tax income of \$5,000 to under \$10,000 spend 34.2 percent of this income on food, whereas the food share for households with an after-tax income of \$70,000 and higher was only 8.7 percent.<sup>12</sup> Average U.S. real wages for traditional blue-collar workers have been nearly flat for 15 years, despite our overall economic success, resulting in a relative reduction in the number of middle-class households and an increased number of affluent and low-income households.<sup>13</sup> Some fear a permanent underclass, left behind by a modern information-driven economy, and a growing affluent segment whose wealth allows dramatic lifestyle changes.

Whereas much of modern business marketing has focused on the mass market and the efficiencies from the one-size-fits-all approach, today mass markets are segmenting. This allows customized marketing to cater to the needs of the various segments—from those with higher incomes to those with lower incomes; from those who stress health issues to those who prefer taste and convenience. Such segments are still large. Combined with new technologies and increased incomes, firms can pursue a strategy of mass customization where they attempt to retain the efficiencies of mass marketing while providing consumers with products better suited to their preferences. Dual-earning households have more money than time, and such consumers demand more convenient foods, higher-quality foods, and other time saving services. Affluent households now hire people to shop, cook, and clean for them. Internet shopping has exploded, yet firms find profits elusive to date. Firms seek to profit from saving consumers time by dramatically altering the way they shop for food. As one founder put it, "There is money to be made simplifying people's hectic lives."<sup>14</sup> Also, with or without Internet shopping—but certainly more so with it—home delivery has returned.



For the middle classes, income growth has stalled and the number of hours worked per week now exceeds 40. Leisure time is short, until retirement, and people are retiring earlier and living longer, which greatly increases retirees' leisure time. Women have less leisure time than men, because they still do 86 percent of the cooking and 91 percent of the shopping.<sup>15</sup> Such time pressure adds stress to busy lives and has consumers looking for relief.

In single-parent households, there is not the benefit of two wage earners, but the time pressure can be even more severe. Adults increasingly view dinner as an impulse purchase. One study found that 71 percent of adults do not plan their weekday dinner before 4 p.m. regardless of income level, marital status, or education.<sup>16</sup> A Nabisco study put the figure at 61 percent but found working parents are denied the fulfillment factor of doing something for their families.<sup>17</sup> Single-parent households seldom have the luxury of using increased incomes to buy services to lessen the strain of their busy schedules, so they turn to convenient, yet inexpensive foods.

The explosion of studies relating health to diet has affected consumer demands. Though many such studies are controversial and are often sensationalized, the media cover them because there is great interest by consumers. Everyone wants to feel and look better—and to live longer. While some consumers have become jaded to the conflicting news, the information still moves markets. The markets for healthful products, including the explosion of nutraceuticals and functional foods, cater to these consumer desires. Consumers still do not want to exert too much effort to achieve dramatic results. The long list of diet and exercise books and the increasing proportion of Americans who are overweight (now a majority) suggest that there is a desire but also a lack of will.

As American households have embraced the economic tenets of specialization and gains from trade, there has been some rethinking of the resulting lifestyle. The additional family income gained from dual wage earners is used to buy timesaving items and prepared meals. Dining out is no longer a luxury to many Americans but done to save meal preparation at home. The dining experience itself must not take too long. Drive-up fast-food windows proliferate because consumers cannot afford the time to have a full-service dinner experience.

This division of labor and everyone entering the paid labor force can lead to frustration, guilt, and even boredom. People long to do the things their jobs prevent them from doing. Gardening and cooking are not dreaded chores—they are considered enjoyable, but constrained by the lack of time. A recent study found only 13 percent of adults disliking cooking, 37 percent actively enjoying it, and 50 percent not minding it.<sup>18</sup> Cooking is second only to pet care as the most enjoyable household task. Cooking has regained some popularity, as 43 percent of adults indicated they often cook in their leisure time, up from 36 percent in 1991. Interest in food is up; the number of food magazines and cooking shows on cable TV is at an all-time high. Consumers, however, are left unable to find the time and energy to try their new ideas. A study found that 30 percent of adults always willing to try new or unusual flavors, with 21 percent having a strong interest in foods from other countries. Younger consumers were more likely to try something new.

The implications for the food marketing system are clear. As Americans move from a mass market where everyone eats similar foods to segmented markets with greater choices, firms will face new opportunities and challenges. Some consumers will avoid bio-engineered foods; others will embrace them as science solving important problems. The controversies will be hotly debated, and food choice will contain plenty of political overtones. Not that this is anything new—even the Pilgrims clashed over whether the making of a minced pie was a violation of their prohibitions against Catholic-style symbolism.<sup>19</sup> Marketing firms strive to give consumers what they want, but firms often avoid full disclosure: “A 1997 survey of 1,000 U.S. consumers found that 93 percent wanted bio-engineered food to be labeled—presumably because many would avoid it.”<sup>20</sup> Firms, however, don’t want to label such foods because they fear consumers are either ill-informed or merely paranoid about such tampering with foods. Instead, firms stress the advantages bio-engineered foods can offer—improved taste, reduced spoilage, and enhanced visual appeal, all factors consumers prefer. As technology advances, consumer sovereignty in the marketplace will be tested.

Rising household incomes allow more purchasing of value-added products, where the value can be in convenience, healthfulness, and quality. The aging baby boomers and other health-conscious consumers will seek more functional foods and nutraceuticals. Time-pressed consumers of all income levels will be searching for quick meals, and families will seek meals children enjoy, thus reducing the stress involved in family dining. Taste remains paramount. Most foods must pass the taste test, over and above nutrition and convenience, especially in the away-from-home segment. McDonald’s reduced-fat burger, the McLean, did not survive the consumer taste test.

Consumers will also respond to environmental concerns, so-called “green marketing.” Again, however, a discrepancy exists between consumers’ desires and their actual behavior. One study that tracks the attitudes of first-year college students revealed less interest in environmental clean-up programs in 1997 than in the early 1970s.<sup>21</sup> Fast-paced lifestyles and demands for fresh produce year-round lead to an increased use of transportation and packaging. Consumers face numerous conflicting decisions in balancing their views with their purchases. In addition to green marketing, consumers will respond to products where the added value is not product-specific but combines nonfood attributes with the food item. Examples include tying products to themes like “Save the Rainforest” and “Save the Family Farm.” Consumers now realize that voting with their pocketbooks can also signal their world views.

The U.S. food marketing system will continue its growing involvement in international trade. Immigration and increased interest in new foods will bring more global trade. Also, the demand for fresh produce year-round will increase shipments from the Southern Hemisphere. Since industry growth is largely constrained by population, U.S. firms will continue to search for growth in overseas markets.

### **Production**

Farming still has the greatest number of businesses in any of the vertical stages in the food system, but consolidation continues. Farming once employed the largest number of people in the food system, but not any longer, as machines have replaced people. It is now the food-service sector that employs the most people (Table 3). The number of farms has fallen in every Census year. The 1997 Census shows 1.9 million farms, accounting for under 2 percent of the U.S. population—a record low number (Table 4).

The other major trend is toward greater dispersion in farm size as the gap between the very small farm and the very large farm widens. In 1992, nearly half of the farms had sales of under \$10,000 but accounted for less than 2 percent of total farm sales, while just over 2 percent of the farms had sales over \$500,000 and did nearly 50 percent of total sales. There is also growing diversity among regions of the country and by crop specialty. California is the largest agricultural state in terms of dollar value, and the top 10 states accounted for nearly 53 percent of farm value in 1997 (Table 5). California is an amazing state. While it is more commonly associated with nonagricultural images, such as Hollywood, it has almost twice the farm value of Texas, the second largest agricultural state. The other leading farm states, like Iowa and Nebraska, are often more closely associated with agriculture and rural communities (see Tables 3, 4, 5).

Increasingly, producers must align their production choices with consumer demands. They can no longer rely on others in the marketing system, such as processors, to alter the primary foodstuffs to match consumer demands. Processors aware of what their consumers are willing and able to buy now ask producers to deliver raw products best suited to these demands. For example, a potato chip company wants potatoes specially tailored for the chip-making process and, hence, invests in research and technology to develop the best chipping potato; it then seeks growers who will grow these potatoes under a legal contract. Even food service companies must align their needs with producers to ensure a good match between consumer demand and product supply. For example, KFC, the fast-food chicken chain, contracts with processors to supply the birds best suited to their cooking procedure.

This increased vertical coordination between farmers and processors has become known as the industrialization of agriculture.<sup>22</sup> Farmers continue to specialize in a narrower slice of the food marketing system. Great efficiencies have been gained from advanced technology and specialized equipment. Inputs that were previously supplied on the farm are now purchased from the input sector. Dramatic growth has occurred in the chemical businesses, because they now supply the fertilizer, pesticides, and insecticides to the farmers. Private seed companies have largely replaced public research and, under protection provided by the 1972 Plant Varieties Protection Act, have invested heavily in patentable seeds. Given the protection for intellectual property rights, these companies now sell designer seeds with favorable characteristics. Others view this as dangerous tampering with the public's genetic seed stock that leaves farmers dependent on the companies who hold the patents to seeds that are unable to reproduce (see the section "Technological Change," below).

The seed companies continue to consolidate into ever larger, worldwide firms. DuPont's announcement to buy the remaining 80 percent of Pioneer Hi-Bred International makes this a dominant two-firm industry with DuPont and Monsanto controlling half of the U.S. soybean seed market and over half of the corn seed market—the two biggest crops.<sup>23</sup> In smaller produce seed markets like lettuce, tomatoes, and cucumbers, similar consolidation has occurred. A Mexican company has quietly amassed a dominant share in many of these markets; for example, it holds a 55 percent share of the U.S. lettuce seeds used by commercial farmers.<sup>24</sup> It has linked with Monsanto to alter its lettuce seeds to make them immune to Monsanto's RoundUp herbicide, used by farmers to kill unwanted vegetation. Many consumers

would love nonbrowning lettuce, attractively priced, but others view this technology as dangerous and turn instead to the organic lettuce aisle.

### **Processing and Manufacturing**

The processing stage has the fewest number of establishments in the vertical food system, but the processor/food manufacturer is often considered the most powerful, influential firm in the system—the marketing channel leader. These are the food firms the world knows by name: Philip Morris, Coca-Cola, Cargill, Kellogg's, and so on. About 80 percent of all raw domestic food products pass through this stage, with only produce and eggs avoiding processing, since they only require minimal market preparation services like cleaning, sorting, and packaging.<sup>25</sup>

Processors and manufacturers, hereafter referred to as processors, add the form utility to the raw agricultural products and have invested heavily in market research to understand consumer demands. They buy or contract from farmers who have been advised (through price signals, among other methods) or legally bound to supply raw foodstuffs with desired characteristics for transforming into the products consumers eventually buy. In terms of value-added, the economist's preferred measure of economic size, processing once contributed a smaller portion of value-added to GDP than farming. Since the 1950s, however, processing has exceeded farming's value-added but remained behind retailing and wholesaling and food service (see Table 6).

Food processors' location decisions involve a calculated trade-off between processing costs, including input costs, and the costs of delivering their finished products to consumers. Since most of the country's consumers live near the coasts and most of the raw agricultural foodstuffs come from the middle of the country, the location decision is not always obvious. Over time, with modern transportation and refrigeration technologies, the balance has shifted to locating where the inputs are produced, rather than where the people live. California is in the unique situation of being both the number-one farm state and the number-one food processing state by far (see Table 5). It has the agricultural commodities and the population. States like Nebraska and Kansas, 4th and 5th in farm value, rank 24th and 27th, respectively, in processing. Overall, there is a strong association between farm value rank and food processing rank, with a simple correlation coefficient of .75. In certain crops it is even more pronounced, like in wine or broilers. Broiler processors prefer to locate within a 25-mile radius of where their chickens are raised to market weight, and the leading states in both production and processing closely follow a geographical pattern known as the broiler belt.<sup>26</sup>

The largest food processors among the roughly 16,000 companies involved in food processing are huge, both in absolute terms and relative to the others. The largest 100 food and tobacco processors accounted for nearly 80 percent of the value-added in 1995 (Figure 5), almost doubling their share since 1954. The top 100 is itself skewed toward the very large, with the top 20 firms accounting for over 50 percent of total value-added in 1995, more than doubling its 1967 share. The remaining 80 firms among the top 100 firms actually lost share over the last 30 years. The sector is best described by a big-small model, where extremely large firms control leading positions in most markets and the smaller companies, including start-ups, operate in a competitive fringe trying to serve a particular market niche or develop a new idea. The

large companies know that if a new idea turns promising they can buy the entire company after the start-up has borne much of the risk.

The previous figures refer to overall size, or what economists call “aggregate concentration,” but market performance hinges on market concentration—the extent of market power held by leading firms in a well-defined economic market. Market power is what enables a firm to enhance prices to buyers, to extract price reductions from its product suppliers, and to subdue rivals. Although market definition is a complex task, it can be approximated by the Census 4-digit industry group, the 4-digit SIC. The food and tobacco processing sector had 52 such industries in 1992, most of which remain too broadly defined, certainly so on the input side as substitution opportunities are much greater in consumption than production.<sup>27</sup> Consumers can readily switch from chicken to turkey for the evening meal, but chicken processors cannot shift to turkey processing without replacing the specialized equipment in their modern processing plants.

Although there are no monopolies, and several industries are what economists call “workably competitive” (where the four largest firms have a combined market share of 40 percent or less), most have become oligopolies. Oligopolies get some of the advantages of market power without the government regulation that would ensue if they were monopolies.<sup>28</sup> Over time, most of these 4-digit industries have lost companies, averaging a 25.5 percent reduction in company counts, and have increased in concentration as measured by the four-firm concentration ratio, CR4, which increased on average from 43.9 in 1967 to 53.3 in 1992, the last year for which data are available.

The immense size of processors has always concerned farmers, who feared the processors would exploit their bargaining power and pay farmers less than fair market value for their crops. Such fears led to agricultural cooperatives and the Capper-Volstead Act of 1922. Both economic theory and empirical studies<sup>29</sup> conclude that open-membership cooperatives can negate market power imperfections and hence benefit both farmers and consumers. In food processing, the share of an industry's shipments controlled for by the 100 largest cooperatives ranges from a high of 63 percent in the butter industry to several industries without any cooperatives, and it averages 5.4 percent for all of food and tobacco processing.<sup>30</sup>

Food processors have long used branded products and a “pull” marketing strategy, in which they create consumer demand for their products. Hence, retailers are obliged to carry the products or lose sales. New products with strong media advertising support, especially from television, are central to this strategy. Other marketing strategies (e.g., coupons) are often correlated with new products and advertising efforts.<sup>31</sup> New product introductions rose from 4,540 items in 1983 to a high of nearly 17,000 in 1995, then fell back to 12,400 in 1997 (Table 7). Most, by far the majority, do not represent truly new products but variations on existing products. Nevertheless, most new products fail in the marketplace, underscoring both the difficulty of knowing what the consumer wants and the wastefulness of new product launches. Even Coca-Cola, with its huge marketing muscle, misfired with its New Coke. Consumers loudly voiced their preference for the original, and hence we now have Coke Classic *and* New Coke, with the former far outselling the newer product.

Food processors outspend all other stages of the vertical marketing system advertising their products. In 1997, they accounted for over 65 percent of all media advertising in the food system (Table 8). Only restaurants, especially fast-food restaurants, also spend large amounts on advertising, with a 27 percent share of the total. The bulk of the \$55 million spent in farm-related expenditures was for farm chemicals and pest controls that were advertised by the large chemical companies, targeting farmers as their consumers.

Media advertising accounts for somewhere between a fourth and a third of marketing dollars spent by processors. Within the food system, product differentiation created and maintained by advertising provides protection from new entrants and inroads from smaller rivals. Oligopolists often prefer to compete with their rivals in nonprice ways. Advertising and new product rivalry are perfectly suited to this strategy, because it allows competition among the few in a manner that collectively erects barriers to entry to others not involved in the marketing fray. The cola wars are often mentioned as an example of the intense competition in the soft drinks industry, but a former president of Pepsi once commented that such struggles did not involve “some gladiatorial contest where one of us has to leave on a stretcher. We’re both winning.”<sup>32</sup>

Media advertising is not for the cash-starved start-up company but is standard operating procedure among the largest food and tobacco processors. Philip Morris, the number-one food and tobacco advertiser, spent over a billion dollars promoting its brands, which span the supermarket, including Miller beer, Marlboro cigarettes, Kraft cheese, General Foods Post cereals, Oscar Mayer meats, and several other major brands. Of the 16,000 food and tobacco processing firms, the top 100 advertisers accounted for 96.4 percent of media advertising, and the top 8 alone accounted for over 50 percent in 1992. The vast majority of the remaining 15,900 food firms use media advertising minimally or resort to other marketing tactics. Since advertising-created-and-maintained product differentiation is the major advantage in the food system, these firms are at a disadvantage and are left to compete primarily on price and efficiency and the rare, truly new product that captures consumer interest. The concentration of advertising expenditures rose sharply from 1967 to 1992, the last year the data were analyzed, with the four largest advertisers increasing their share from 19.4 percent in 1967 to 36.9 percent in 1992.

### **Food Wholesaling, Retailing, and Service**

Once the production and processing of the inputs are complete—and following the links in the vertical marketing system as shown in Figure 1—distribution in the form of wholesaling, retailing, and food service is the next step.

**Food wholesaling.** Wholesalers distribute the food products from points of production and processing to the retail stores and food service establishments located in every community. Food wholesalers are classified into three general categories: (1) merchant wholesalers who take title of the products they distribute; (2) manufacturers’ sales branches and offices, which are the wholesaling arm of food processors but report their activities as wholesaling as long as the facility is located at a different address than the processor’s location; and (3) agents, brokers, and commission merchants who do not take title of the products they distribute but work on commissions from the manufacturers whose products they represent. Merchant wholesalers account for the largest slice of the wholesaling function, with over 77 percent of the wholesale

establishments and roughly 55 percent of total wholesaling sales in 1992.<sup>33</sup> The other two categories share the remainder, with manufacturers' sales branches and offices being slightly larger than the agents, brokers, and commission merchants.

In general, wholesalers are challenged by processors' own sales forces on one side and by retailers who self-supply on the other. Nearly half of all retail food sales were from retailers who have integrated backward and provide their own wholesaling functions. Major wholesalers have integrated forward and own retail stores, but most remain as merely affiliated with retailers, either in a voluntary or in a cooperative format.

Wholesalers must convince processors that they offer a more profitable method for distributing the processors' products than could be done through their own sales force. In addition, they must convince retailers that self-supply is less profitable than specializing in retailing and using a wholesaler to supply the products. Wholesalers work closely with both processors and retailers to coordinate product flows to benefit both parties while profiting from their activities and market expertise as well. They understand the local retail market and can use their personnel efficiently to represent processors' products and still provide retailers with the supply savings, management, and merchandising services that only the largest retailers would find profitable to provide for themselves. One major service that merchant wholesalers provide retailers is a line of private-label products—products that they arrange for processors to pack and label with the wholesalers' label—which often sell at prices below the national brands' and still offer a higher margin to the retailer (e.g., IGA, President's Choice, and World Classics).

The wholesaling sector continues to consolidate, with larger firms gaining a larger share of the overall business. Retailers continue to explore backward integration, and the larger processors often prefer to have their own sales force manage the distribution of its products in all markets where they have a sufficient volume to justify the expense. By 1992, the four largest wholesalers controlled 11.2 percent of wholesaling sales, up from 6.5 percent in 1982, and the 20 largest held a 25.2 percent share in 1992, up from 16.9 percent in 1982 (Table 9). The two largest wholesalers, Supervalu and Flemming Cos., are nearly equal in size and much larger than the other wholesalers. Both have invested in retail stores, but wholesaling accounted for about three-fourths of their total sales. However, wholesaling has declined and their retailing sales have increased. The five largest wholesalers are listed in Table 10.

**Food retailing.** In 1997, Americans spent over \$700 billion on food, including imports and fish, with food at home accounting for 55 percent of the total and the away-from-home market holding a 45 percent share (Table 11). This 55/45 percentage split of total food expenditures has remained roughly constant since 1988, but it is up substantially from the 75/25 percentage split of the 1950s.<sup>34</sup> Retail food stores have realized that they must compete with the away-from-home firms if they are to continue to grow as food suppliers. They have countered this trend toward away-from-home dining by offering ever more prepared foods—from in-store delis to entire ready-to-serve meals prepared in their stores. No one has solved this marketing puzzle completely, but everyone is trying as they respond to time-pressed but more affluent shoppers seeking a better solution to their food needs and desires.

Food retailing is constantly changing. Store formats come and go as retailers strive to achieve greater efficiencies and a competitive advantage. Store's once featured their meat departments to set themselves apart, but today a well-stocked, attractively displayed produce section is what consumers value most. Prices are always among the leading factors consumers mention when asked why they shop at particular stores, but convenience and quality are also primary considerations. Affluent shoppers are willing and able to pay more for time saved. Home delivery, a retail method long thought dead, has returned; in 1997 consumers spent \$10.3 billion for food home delivery and mail order, up over 300 percent in 10 years.<sup>35</sup> It now accounts for 2.6 percent of food-at-home expenditures and 1.5 percent of total food expenditures. The proliferation of Internet shopping sites adds interest in this format. Even the best-known Internet retailer, Amazon.com, has invested in an Internet grocery venture.<sup>36</sup>

Retail food stores can be arrayed along two dimensions, variety and price, to capture most of the variation found in store formats today. In the middle, at the origin, is the conventional supermarket—with a full line of groceries, meat, produce, service deli, and bakery, and with general merchandise and health and beauty aids accounting for 6 to 8 percent of store sales. Alternative formats move out from the origin by adding or subtracting the number of products carried and by featuring lower or higher prices. The traditional mom-and-pop corner store continues to lose share, but has not been eliminated.

Nontraditional formats, such as wholesale clubs (e.g., Costco and Sams) and Supercenters (e.g., Wal-Mart, Kmart, Fred Myer), have increased their share of grocery volume (defined as items commonly found in a traditional channel) to roughly 10 percent.<sup>37</sup> Newer formats that operate in the traditional channel, such as superstores and food/drug combos, account for about two-thirds of store sales. The conventional supermarket's share of total sales peaked at 70 percent in 1965 and had fallen to just under 25 percent by 1995.

Overall or aggregate concentration in food retailing had not shown as much consolidation as is found in other sectors (Table 9) until recently. By 1992, the four largest grocery retailers held 16.1 percent of total sales, down a point from 1987, and essentially unchanged since 1982. Among the top 20 and 50, concentration did increase, but not dramatically, from 35.6 percent (44.7 percent) in 1982 to 37.6 percent (49.9 percent) in 1992 for the top 20 (50). This stability was sharply broken the 1990s as the 10 largest chains increased their share of sales to 60 percent from 35 percent in 1995.<sup>38</sup> The five leading food retailers are given in Table 12.

Overall concentration is less interesting to economists than market concentration, and in food retailing the geographic size of the market is local, not national. Most economists use the Metropolitan Statistical Area (MSA) as the more appropriate geographic scope, but the government does not publish concentration data at this level unless a special tabulation is commissioned. Such tabulations have been done in past Census years. Alternatively, a trade publication does collect and publish data at the MSA level. When examined at the MSA level, food retailing markets are commonly oligopolies, with a CR4 of 50 percent or more.<sup>39</sup> These data are consistent with a more thorough analysis of concentration in U.S. grocery MSAs done with special tabulations of the Census data.<sup>40</sup> Franklin and Cotterill, in their 1993 report, found average



market concentration did increase in the 1980s, with smaller markets more concentrated than larger markets, on average.

The only challenger to the processor for control of the vertical marketing channel is the modern retailer. Retailers face consumers daily and have begun to harness the power of information generated by their checkout scanners. No longer does the retailer turn to the processor's personnel to explain what consumers are buying, because they now control the most valuable asset in market research—data on consumers and their purchases. With the use of frequent-shopper cards and other incentives, retailers can link demographic data to food sales in ways they only dreamed about a decade ago. They are still learning to exploit this valuable information, which processors now must buy from retailers. No longer are they unsure of what sells and which products generate the highest profits.

In Europe, the food retailer has long been the channel leader, and experts are predicting the same trend to emerge in America. In terms of profitability, food retailers average only a little over 1 percent after-tax profit as percent of sales, while food manufacturers average at least four times that (Table 13). To compare these two vertical stages based on sales is misleading, and a more accurate comparison uses after-tax returns to stockholder equity. By this measure, both manufacturers and retailers have averaged just over a 16 percent rate of return since 1980.

**Food service.** Today's consumer is shopping for complete meals rather than ingredients for meals to be prepared at home, even if such preparation is minimal. Food service outlets have long catered to this demand. Food service includes both commercial (e.g., restaurants) and noncommercial (e.g., school cafeterias, vending machines, hospitals) outlets, with the commercial outlets accounting for about 80 percent of the total sales volume. Consumers feel they have greater choice in selecting their food in the commercial sector, and this is the sector featured here. Currently, many noncommercial food service outlets are being replaced by commercial vendors.

Although food service has not reached an even split of the consumers' food dollar with food at home, it has been the growth segment of the retail food business for at least 40 years. Rising incomes, smaller households, younger consumers, and time-pressed shoppers all lead to greater interest in dining out. Time pressure and younger consumers, along with our affection for the automobile, have driven the fast-food segment from a 4 percent share of the away-from-home market in 1954 to 33 percent in 1996.<sup>41</sup> The rise of McDonald's alone charts the success of this segment.

Overall concentration is not high in food service, but like food retailing, it is a local market rather than a national one. If all restaurants were combined, the largest four held only an 8 percent share and the largest 20 only a 15 percent share in 1992 (Table 9). Within local markets, the shares would be much higher, but no data are available, and most markets have several competing outlets. The overall concentration is highest in the fast-food segment, with fast-food burger restaurants having the greatest concentration. McDonald's alone held a 42 percent national share in 1997 (Table 14), and the top five chains held an 87.6 percent share. The pizza segment is not as highly concentrated, with the largest firm, Pizza Hut, holding a 22.6 percent national share in 1997 (Table 15). The largest chains control a larger share of the advertising expenditures in food service than they do in sales, especially in the pizza segment.

Food retailers have responded to the loss of sales to the away-from-home market, and now offer complete meals, called home replacement meals, or HMRs, in the trade. Consumers show increased interest in these products. There has been some blurring of the lines between supermarkets and food service, as fast-food restaurants now reside within retail stores, offering take-home meals. Fast-food outlets are still the primary source for take-out food, with a 41 percent share in 1997 (Table 16); other restaurants hold a 21 percent share, but supermarkets increased their share to 22 percent, from 12 percent a year earlier. If consumers remain satisfied with these meals and retailers can profit from supplying them, supermarkets will share in the growth of the take-out market. Busy people have less interest in dining out as it adds to, rather than detracts from, daily stress. They are eager to take fully prepared meals home to be eaten in the comfort and privacy of their own homes.

### **Future Forces for Continued Change**

The U.S. food marketing system is a mature sector, but one that is constantly changing. Powerful forces—new technologies, industrialization and consolidation, globalization, and the changing consumer—will continue to alter the food system. The changing U.S. consumer was discussed above, along with the implications for the food marketing system. Forecasting is always uncertain, and it is difficult to project quantitatively the impact these areas of change might have on the food system. It is impossible to predict the yet-to-be discovered information or technology, for example, that might alter the course of events in a monumental fashion. Each individual firm's success, if not survival, and the development of the industry will be shaped by the industry's resilience and willingness to accept and adapt to changes—indeed, to take advantage of them.

**Technological change.** Much of the early development of the U.S. food system was catalyzed by the development and introduction of new technologies, especially in production and processing. The most significant food science innovations from 1939 to 1989 include: (1) aseptic processing and packaging, (2) safe-canning processes for vegetables, (3) the microwave oven, (4) frozen concentrated citrus juices, (5) controlled atmosphere packaging for fruits and vegetables, (6) freeze-drying, (7) frozen meals, (8) the concept of water activity, (9) food fortification, and (10) ultrahigh temperature processing of milk and other products.<sup>42</sup> Entire businesses have been developed on the basis of such technologies.

In the latter half of the twentieth century, food companies, particularly processors, concentrated most of their research efforts on the development and proliferation of new products, rather than on development of technology. Most of these new products do not represent great technological change. In fact, by most measures, the food industry has not positioned itself for significant internal technology development. Research and development investments are low compared to other industries, public investment in food research for post-production industries is low, and food industry employment of engineers and scientists is considerably lower than in other industries.<sup>43</sup> Still, productivity in the food industry has grown at an annual rate of 3 percent since 1963, largely as a result of borrowing technologies from other industries.

A more complicated research effort, still related to new product development, has been the search for fat alternatives and fat-free versions of popular products. Animal and

plant fats have proven difficult to duplicate in the lab, and alternatives have limited success. Procter & Gamble's Olestra has reached commercial use with companies, such as PepsiCo's Frito Lay, who use Olestra in their reduced-fat chips. Consumer acceptance is still unclear, despite heavy promotional spending. Some consumer groups are strongly opposed to products using alternative ingredients and have sought increased labeling of possible harmful effects and even the outright banning of such products. In addition, consumers show signs that their fat-avoidance days are waning.

Not all the technological effort in the last half of the century has been directed to minor tinkering with consumer products. Several new technologies have brought, or promise to bring, developments to rival any in our history. Separation techniques allow basic commodities to be fragmented efficiently into components for restructuring or incorporation into other foods or for removal of undesirable compounds. Corn wet milling, introduced in the United States in the mid-twentieth century, is an example. The new separation technologies include passive membrane filtration (reverse osmosis, ultrafiltration, and microfiltration) and supercritical fluid extraction. These technologies have already achieved commercial success in the food industry.

Information processing and automation have had dramatic impacts on the entire food system, as more efficient methods replace outdated ones. Farmers now match fertilizer and pesticide applications to each acre's needs, guided by onboard computers running advanced geographic information systems. Farm managers can harvest vast amounts of information and use it to improve operations from record keeping to computer-controlled nurseries—for plants or animals. At the processing level, computer-aided measurement devices can efficiently evaluate product quality and pay producers accordingly.

Computer-integrated manufacturing, which integrates order entry, scheduling, operations, inventory control, and other operations management activities, has been implemented in many facilities. At the retail level, information processing, including the development of direct product profitability strategies, has helped shift the balance of power in the food system from processors to retailers. New information-processing hardware and software, coupled with online sensing and control devices, have encouraged increased vertical coordination in the industry and strategic alliances. They link retail activity with distribution, processing and, at times, production. Retailers' scanning information has altered how consumer research is done, giving the retailer control of the best marketing information ever assembled.

The growth of the Internet and consumers' comfort with online shopping has led many visionaries to invest in Internet grocery businesses, some with home delivery. No company has managed to profit from these investments to date, but the appeal brings new investors and firms on a continual basis. Far more impressive results have been with company-to-company Internet sales, estimated to be five times the consumer retail total. Forrester Research, a market research firm, predicts online business-to-business sales will grow from \$43 billion in 1998 to \$1.3 trillion, or 9.4 percent of such sales within four years.<sup>44</sup> The Internet will continue as a major force in altering businesses, especially in retailing.

Biotechnology and the related technologies, often called bioengineering or genetic engineering, have brought controversy and promise but few profits to date. Chemical

companies and other input supply firms view biotechnology as the future and have several products now in wide use. Monsanto has been a pioneer in these developments. Production agriculture has seen the development of crops with unique characteristics, including disease resistance, pest resistance, and improved yield and quality. A gene patented in 1998 and now owned by Monsanto causes genetically engineered crops to produce sterile seeds.<sup>45</sup> Animal agriculture has adopted growth regulators, such as bovine growth hormone. Genetic manipulation of animals, including cloning, seeks commercial application. The lines between food firms and pharmaceutical companies continue to blur as these new products emerge. These new advances have raised both hopes of a better world and concerns that science is out of control and requires regulation before ethical lapses or mistakes result in unforeseen disasters.

The new processing technologies have provided more efficient means of converting commodities into high-quality foods and also have enhanced the consolidation of the entire food system. These larger operations—from biotech firms supplying growth hormones to the mega-hog farms, to the slaughtering firms that transform the animals into value-added products ready for the retailer's meat case—have critics who charge that any benefits from these changes have been at an unacceptable cost in terms of environmental hazards, untold future dangers to health, and a decline in food safety. Massive meat recalls in the late 1990s and food safety problems in salad bars and organic fruit drinks have damaged consumers' confidence in the safety of their food supply. Business and government have responded with programs such as Hazard Analysis Critical Control Points (HACCP), and by allowing greater use of food irradiation to kill harmful bacteria.<sup>46</sup> The use of irradiation in the United States has been limited by consumer resistance over its safety, but given the routine occurrence of listeria, salmonella, and other bacteria outbreaks, consumers may accept this technology, which has been used in other countries.<sup>47</sup> Others argue that the problems were created by technology in the first place and that a return to more traditional agricultural methods will eliminate the problems without resorting to technological fixes that may entail unknown repercussions.

History teaches that attempts to stifle technology are largely unsuccessful. Consumers must recognize that technological change itself will be shaped by the marketplace. Technologies will be developed and successfully introduced only when an economic advantage is afforded. They will succeed when a need in the marketplace is met and when consumers are willing to accept them or become apathetic regarding their use. If consumers refuse to accept certain technologies, then businesses will abandon them, or public officials will ban or regulate them.

Europeans have held firm to their refusal to accept U.S. hormone-enhanced beef, but Americans appear more diverse in their views. Such consumer diversity leads to a variety of market niches from small organic farms to factory farming enhanced by biotechnology. Perhaps, a huge event will grab attention and galvanize consumers against bio-engineered foods. Alternatively, consumers may find their fears fade as the products deliver promised benefits without side effects. The concern over bovine growth hormone in the milk supply did not result in any decline in consumption,<sup>48</sup> but an organic milk market has begun to take hold at the same time.<sup>49</sup>

**Globalization.** The global economy has had a huge impact on countries around the world. Trade has been embraced by even the most protectionist countries, and trading groups continue to form, from NAFTA to the European Union. The United States, with its abundant resources, began its international participation primarily as an exporter of surplus agricultural products. In the 1990s, however, the U.S. trade in high-value products, such as fruit, nuts, breeder livestock, and processed foods, overtook exports of bulk agricultural commodities, exceeding \$30 billion in 1996 (see Figure 6 ). Additionally, Americans became major importers of agricultural products, going well beyond products that cannot be grown profitably in the United States, such as cocoa, coffee, bananas, and palm oil. In 1996, the United States imported \$33.6 billion, up from only \$4 billion in 1959, in agricultural goods. The vast majority was in products grown in the United States, such as meat, dairy, fruits, and vegetables.<sup>50</sup> Some of this growth stems from foreign suppliers catering to U.S. consumer demand for fresh fruits and vegetables, regardless of the season. Other imports represent lower-priced foreign goods competing with domestic supplies. Overall, the United States maintains a trade surplus in agricultural products, some \$22 billion in 1997.<sup>51</sup>

The United States is the world's leading importer and exporter of processed foods. Some of our top domestic brands are also leading brands around the world (Coca-Cola soft drinks, Marlboro cigarettes, Kellogg's cereals). Likewise, many popular brands are imported (Heineken beer, Perrier water). In 1996, the United States exported \$30.1 billion of processed foods and imported \$27.8 billion, leaving a surplus of \$2.3 billion. The United States has had a trade surplus in processed foods since 1991.

Actual international trade data fail to capture the full globalization of U.S. food marketing firms. These U.S. firms often prefer to invest in local facilities, or in licensing agreements, in a host country rather than export finished products from the United States. Foreign direct investment accounts for almost four times the value of sales than from exporting. In 1996, U.S. food processing firms had estimated sales of \$116 billion from their foreign affiliates (Figure 7). In food retailing and food service, traditional exports are not possible, yet foreign direct investment allows transporting a firm's system and reputation to a foreign country. McDonald's golden arches operate in over 110 countries. The estimated sales of foreign affiliates of U.S. food stores and restaurants reached \$27 billion in 1996. Foreign direct investment offers firms several advantages over exporting from lower transportation costs to greater understanding of the consumers and familiarity with local government officials. It also avoids many tariffs and other barriers to trade, while retaining the brand name of the U.S. parent company.

Foreign direct investment also flows from abroad to the United States with several leading firms prominent: Nestlé in food processing, Loblaw in food wholesaling and retailing, Ahold (owner of several food retailers including Stop & Shop and Giant Food Stores), and Diageo PLC (owner of Burger King) in food service. In 1996, the estimated sales of U.S. affiliates of foreign food marketing firms was \$152 billion, with roughly 77 percent of that coming from an even split between food processing (\$59 billion) and food retailing (\$58 billion).

The international flow of products and the mixing of cultures will continue as transportation improves and communication links increase around the globe. Jumbo jets now fly frozen fish from Taiwan to New York and fresh fruits and vegetables from

Chile to the United States during the winter. Increased consumer diversity and rising incomes will encourage these flows. International trade agreements, such as GATT, also reduce the barriers to trade. The World Trade Organization (WTO) seeks to resolve trade disputes before they erupt into trade wars. Nevertheless, strategic moves and countermoves by countries and powerful firms will continue to seek an advantage. The current U.S.-Europe trade dispute over bananas and hormone-treated meat are suggestive of future squabbles, yet pose little threat to reversing the increased flow of goods and services across national borders. Many of the same issues exist in domestic trade, as well, as consumers vary on their acceptance of biotechnology and other practices, such as pesticide residues, that affect the food supply.

**Industrialization and consolidation.** American agriculture continues to industrialize and consolidate, as consumers splinter into more segments and technology allows catering to the diversity of demands. Economic markets can be incredibly efficient in making sense out of the economic chaos involved in moving products from production to consumption, as they summarize the information contained in buyers' demands and sellers' supplies. In the real world, however, traditional agricultural markets are not as perfect as the economist's model suggests, because they miss opportunities to link producers and processors in more profitable arrangements. For example, major chicken processors have been fully integrated by ownership from the hatchery to the processing plant for decades. They merely hire contract growers to raise the birds to market weight without ever transferring ownership, and they even supply the feed and other inputs required for the grow-out operation. Other industries have turned to legal contracts to secure input supplies tailored to their operations (e.g., vegetables for processing), rather than using markets or ownership of the farms.<sup>52</sup> Farmers benefit in lowering their risks, and processors are assured of supplies with appropriate features. Several major processors have entered strategic alliances with growers; they contract for character-specific raw products in a relationship that all parties expect to be ongoing.<sup>53</sup>

Economists understand the benefits—and also the costs—of these nonmarket transactions. As more product volume moves through nonmarket methods, less is known about true product values, because key economic information summarized by price becomes more difficult to discover. To date, most of these nonmarket arrangements involve linking the processing and production stages of the marketing system. However, other stages have established nonmarket coordination in what has been termed "supply chain management." Large retailers now contract for much of the produce they sell rather than buying their produce at the various regional markets. Much of the industrialization has featured improved information, tailored inputs, and reduced cost of production and processing. Consumer concerns arise from whether there will be sufficient competition to force such efficiencies to be passed on as lower prices, and rural communities wrestle with major issues resulting from factory farms that reduce the number of family farms and add to environmental concerns. Even producers who entered these contracts worry whether they will receive fair prices for their products once the marketplace is removed or diminished.

All stages of the vertical system are becoming more concentrated as larger operations increase their size. At the same time, there is increased diversity as the larger firms get larger and the number of smaller firms increases. It is the middle-sized firm that is most endangered by the consolidation movement. Whether in farming or retailing, as

the largest firms increase their share of the sector's output, a growing number of smaller firms emerge in the cracks and eddies left behind by the larger firms.

Food and tobacco processing have seen the most dramatic consolidation in this century, as merger patterns have followed the four great merger movements of the general economy. The first major merger wave occurred around the turn of the century and created some of the famous trusts that antitrust legislation was supposed to prevent.<sup>54</sup> For example, American Tobacco and General Mills were formed during this merger wave. The next wave came during the roaring 1920s, when companies such as General Foods were being formed through mergers. The third merger wave, in the 1960s, was characterized by the formation of conglomerates as unrelated firms sought management synergies (e.g., ITT bought Continental Baking). The fourth merger movement came in the late 1970s and 1980s and was a wild period of leveraged buyouts and hostile takeovers funded with questionable, often illegal, financial instruments. Food companies were at the forefront of these mergers, with record-setting deals, such as the \$25 million leveraged buyout of RJR Nabisco. The largest food and tobacco processor, Philip Morris, is essentially a case history in a merger-built business. Starting from its dominance in cigarettes, Philip Morris purchased huge companies such as Miller Brewing, General Foods (which had already bought Oscar Mayer), and Kraft Foods. Few American shoppers now know the parent company of the branded goods they bring home from the supermarket.

It appears that we are in the midst of a fifth merger wave, and again the food businesses are major players (Figure 8). Most of the food-related mergers involve food processing firms, including some the largest mergers in history, but increasingly mergers in retailing, food service, and wholesaling are commonplace. Wholesalers are increasing their ownership of retailers as they seek to survive in the modern food system. Some of the failures of the previous merger wave are being undone as firms now seek brands from other firms to selectively add to their portfolio of brands. Others merely purchase firms whose brands fit well with their current offerings.

The current merger wave is more horizontal in nature, because processing firms are seeking merger partners among current rivals. Gone are the wild conglomerate mergers; firms now seek to consolidate their leading positions in markets where they currently hold a strong position. Processors cite concerns over consolidation at the retailing level, forcing them to get larger to counter the retailers' increased power. Suiza Foods used the fear of Wal-Mart to undertake a massive restructuring of the fluid milk industry, until recently one of the least concentrated industries in food processing. Some economists have become concerned about the growing concentration and march toward oligopoly in almost every market. There is little evidence of any positive benefits from such mergers outside of the stock market evaluation of these firms. The stock market rewards downsizing as a cost efficiency, and increased market share enhances profitability potential through uncontested price increases. However, the firm defenses of increased efficiencies and productivity gains have been overshadowed by a reduction in research and development and diminished employee morale, as employees fear further uncertainty of possible layoffs.

**The changing consumer.** It is appropriate to end this overview of the U.S. food system where we began, with the consumer, and to examine the changes that will challenge firms and provide opportunities to new businesses. Consumer demand, in

fact, will be the principal source of growth and development in the food industry in the future. Economists do not forecast significant changes in total caloric intake, though it has drifted upward slightly over time. They do, however, anticipate consumer demand to be affected by demographic changes in the U.S. population, shifts in income distribution, and changes in consumer preferences.

Increases in consumer demand can be forecasted fairly accurately, based on Census Bureau projections of the U.S. population. These projections are generally based on the premise that consumers of certain ages and income groups will exhibit the same preference as persons of similar ages and income groups in today's population. This premise is not universally accepted by marketers. In fact, changes in preference are almost certain to occur. Some preference changes will arise from continued immigration and assimilation of new cultural values. Others will arise from changes in household patterns. Most, however, will arise from poorly understood social phenomena. The interplay between technology and consumers will be critical to the future food system.

The workforce experiences the same changes, especially with respect to declining numbers of potential workers in the age groups normally associated with entry-level jobs. Wages in many food-related industries are low (Table 17), and firms have difficulty attracting workers. Some agricultural production will be forced offshore due to shortages of people willing and able to do manual labor for low wages. Another shift has been and will be the increasing assimilation of women, minorities, and immigrants into the workforce, especially in upper-management positions. The changing workforce composition will place special demands on human resource management and development in the coming years, especially in the food industry, where a high percentage of entry-level workers are employed.

The increased diversity of the American consumer, along with the diversity tapped through globalization, provides many opportunities for businesses. Marketers no longer have to use the mass-marketing methods that force viewing all consumers as similar but can target those consumers that they can best serve—from vegetarians who prefer organic foods to cigarette smokers who may prefer red meat to green vegetables.



## **Part Two Food Processing in Massachusetts**

### **An Overview of Agriculture and Food Processing**

There is both encouraging and discouraging information for the Commonwealth's food system in the broad overview of the U.S. food marketing system. Massachusetts is not known as an agricultural state. Indeed, the Bay State ranked 43rd out of the 50 states in overall agricultural production in 1997 (Table 5). Yet agriculture should continue as a top priority for the Commonwealth, for its contribution to both the food supply and to the rural character of much of the state. The current commissioner of the Massachusetts Department of Food and Agriculture, Jonathan Healy, continues a long tradition of department leaders who are energetic advocates for protecting farmland and enhancing agriculture in the state.

Massachusetts consumers reflect national trends of increased incomes, decreased time, and growing awareness and interest in food-related issues—from local impacts to biotechnology and food safety. The advanced biotechnology used by the sector is a well-developed industry in Massachusetts. The consolidation in the food system is evident in every local supermarket. Massachusetts has a long tradition of leadership in the area of information technology, and even the recent use of the Internet to sell groceries, complete with home delivery, is well under way in the Boston area. The state has increased its global reach as well. Thus, Massachusetts is experiencing the same forces of change that exert themselves on the rest of the country's food system.

Despite its small size, Massachusetts has some of the best agricultural land in the nation, and farmers' markets abound in small towns and large cities alike. Farmers in the fertile valleys along the banks of the Connecticut River grow top-quality vegetables, including everything from asparagus to zucchini. The state has several pioneers in the field of aquaculture and maintains some of the oldest dairy farms in the country. In the hills surrounding the valleys, farmers grow excellent apples, which they sell both fresh and processed into cider in the cider houses that dot the rural landscape. In the late winter and early spring, maple syrup is produced in many local sugarhouses. Ocean Spray's headquarters and its growers' cranberry bogs have become tourist attractions in the eastern part of the state.

The state's active efforts have helped agriculture. Those efforts have protected thousands of acres of farmland, increased exports of agricultural and processed foods, encouraged and supported farmers' markets, and reminded consumers that local produce is fresh and of top quality. They have also helped to forge new links and strengthen old ones between farmers, processors, retailers, university researchers, government agencies, and local groups.

However, preserving agriculture in Massachusetts is no easy task. Massachusetts farmers face higher labor and other production costs than farmers in many competing states. The Massachusetts growing season is shorter than in warmer states, and extending the season adds to the already high production costs. The state's strong economy and its proximity to large population centers exert pressure to develop the land for alternative uses. The rural character of the area is inviting to people living in congested areas. With the major expressways that make driving less difficult, many families are leaving the cities and accepting a longer commute in trade for more space.

Even entire companies are choosing to relocate farther from the population centers along the expressway corridors.

The continued consumer interest in fresh produce benefits Massachusetts farmers, since they are located close to large economic markets. Their produce can be picked in the morning and sold to the final consumer by midday. However, not all the agricultural output can be sold fresh, because seasonal supply of fruits and vegetables exceeds seasonal demand. This surplus production will either be wasted or depress prices beneath costs of production, unless it can be sold to processors for transformation into products that can be consumed throughout the year.

For example, less than 5 percent of the cranberry crop is sold fresh, and the dramatic success of the industry has been in processing cranberries into other more value-added products. In addition, livestock products must be processed before today's busy households will purchase meat, poultry, or dairy products made from livestock inputs. Consumers do not have the time, interest, or ability to purchase live animals for the evening meal. Thus, farmers need a healthy, competitive food processing sector to buy their surplus production and other farm products for processing before consumption. Food processing is central to a healthy agricultural economy and provides the key link in the food marketing chain. Nationwide, about two-thirds of the market value of U.S. farm production was bought by U.S. food processors. Only 8 percent was sold as fresh produce or eggs. (The remainder was cotton and other fibers or was exported in unprocessed forms.)

In order to analyze the trends of Massachusetts manufacturers over the past 40 years, information was gathered from the United States Department of Commerce for census years since 1958. The Department of Commerce categorizes various industries in the United States by SIC, or Standard Industry Codes. The Food Processing sector is represented by U.S. Department of Commerce, SIC 20 (Food and Kindred Products), and SIC 24 (Lumber and Wood Products). Two-digit codes represent various manufacturing industry groups at the most general level, with 3-digit codes representing a more detailed level of industry groupings, or "minor groups." Industry information is given at the 4-digit census level, but as the level of detail increases, the available data decreases. Here, we attempt to use these broad measures to capture the major trends occurring in Massachusetts and the region.

The census of manufacturing publishes economic information on the following:

- Total Establishments
- Establishments with 20 or More Employees
- Number of Employees
- Payroll
- Number of Production Hours
- Number of Production Man-Hours
- Production Worker Wages
- Value-Added by Manufacture
- Cost of Materials
- Value of Shipment
- Capital Expenditures

We focus our discussion on a subset of these available data. Each economic measure has its purpose, but given the difficulties in comparing dollar values over time and at various stages of the vertical marketing system, we often resort to using establishment and employment counts. Fortunately, the trends are usually unaffected by the measure used.

### **Food Processing Trends**

Despite its low rank in agricultural production, Massachusetts ranks higher in food processing activity (Table 5). California clearly leads in agricultural production and dramatically dominates the food processing sector as well. Nebraska and Kansas are primarily agricultural states, ranked 4th and 5th, respectively, but rank much lower in food processing. States like Ohio, Pennsylvania, and New York rank much higher in food processing than in agricultural production, reflecting their traditional location advantage to major metropolitan centers.

In time, all major farm states will increase their rank in food processing, because processors now tend to relocate closer to agricultural production centers and rely on modern transportation to get finished products to consumers in population centers quickly and efficiently. Many farm states have already increased their food processing activities and now transport more finished products to population centers on the East Coast. A rural farm state like North Dakota, ranked 41st in food processing in 1996, has increased its investment in food processing. Hence, for many agricultural products, processors now prefer to locate near production rather than near consumers. Such a change both hurts Massachusetts processors and provides a marketing opportunity for local processors to differentiate themselves from the faraway agribusiness factories. The factories, however, will be extremely efficient and have a price advantage; at the same time, they will be vulnerable to an image problem with consumers who question the source and the practices involved in processing their food.

New York and New Jersey had the largest difference between their agricultural production rank (28th and 39th) and their food processing rank (7th and 18th). Massachusetts had a similar divergence—ranking 43rd in production yet 26th in processing. These states attracted food processing firms that chose to locate closer to consumers than to their agricultural inputs. For food products such as bread, the trade-off still favors locating near consumers. This is changing, though, as many local bakeries now merely "finish" baked goods that have been prepared for market elsewhere. Vermont had a much closer correspondence between its agricultural ranking (42nd) and its food processing ranking (46th). The New England states all appear toward the bottom of the agricultural production rankings. Massachusetts is followed by Connecticut (ranked 36<sup>th</sup>), and Maine (40<sup>th</sup>) in food processing.

As a region, New England experienced a loss in food processing activity since 1958, employing 85,000 workers representing 5 percent of all food processing employees in the United States (Figures 9 and 10). By 1996 those numbers had fallen to 44,000 and 3 percent, respectively. The decline in New England food processing was mainly during the first two decades, 1958 to 1977; then the food processing sector stabilized. The region has a larger percentage of establishments than observed for any other measure of food processing activity, which reflects the large number of small food processing firms in the region. The percent of the country's food processing value-added

accounted for by New England states experienced a similar trend to the employment history, with the region accounting for about 2.7 percent of the U.S. total in 1996.

Massachusetts represented just under 3 percent of total U.S. employment in food processing during the 1950s. This declined to around 1.5 percent and then stabilized, especially during the last decade (Figures 11 and 12). The Massachusetts trends in food processing follow the same pattern seen for all of New England, which is not surprising given that, within New England, Massachusetts easily remained the leading state in food processing activity. From 1958 to 1977, employment in Massachusetts food processing fell from 48,000 to 26,800, but from 1977 to 1996 the decline was much more modest, and from 1992 to 1996 the decline reversed itself with a small increase in both employment and value-added. Despite this regional dominance, the state's percent of New England food processing employment declined steadily from 58 percent in 1958 to 48.7 percent in 1977, when the trend stabilized at about 50 percent (Figure 13).

In comparison to two other states in the region, Massachusetts has grown, relative to both New York and New Jersey, though both have larger food processing sectors (Figure 14). In 1958, Massachusetts had 38 percent of New York's total employment in food processing and 78 percent of New Jersey's total. By 1972, this had dropped to 35 percent and 61 percent, respectively. By 1996, Massachusetts had 43 percent of New York's food processing employment and, more dramatically, it was back up to 70 percent of New Jersey's total. New England as a whole has done much better than New York in holding on to its food processing activity. In 1958, New York employed significantly more food processing workers than New England, but by 1996 New England moved closer in the number of food processing employees.

Within New England, Connecticut was a distant second to Massachusetts; with nearly a constant 15 to 16 percent of the region's total employment in food processing from 1958 to 1996, but peaking at 21.43 percent in 1987 (Table 18 and Figure 15). Maine was third, with slightly over 13 percent of the total and, like Connecticut, reached its highest share in the middle years of the period. The three remaining states had a less than a 10 percent share, but experienced greater trends on a percentage basis. Vermont, New Hampshire, and Rhode Island increased their share of New England's employment in food processing, whereas the other three states either declined in their regional share or remained about constant. Vermont's percentage increase was the most dramatic: it went from 2,900 employees or 3.4 percent of all New England food employment in 1958 to 4,000 employees and a 9 percent share of New England food employment in 1996. Nevertheless, Massachusetts still dominated with 22,000 employees and a 49 percent share of all New England food employment in 1996.

Food processing is a very broad economic sector ranging, literally, from canned soup to salted nuts. Food products that require only cleaning and bagging (e.g., fresh carrots) are not included in the food processing sector, yet their processed counterparts are included (e.g., canned or frozen carrots). However, fish processing is included, which is important to states like Massachusetts, Maine, Rhode Island, and Connecticut. Since agriculture does not include offshore fishing, Table 5, which contrasts a state's agricultural production against its food processing activity, fails to adjust for the fishing production in the agricultural figures but does include the fish processing in the food processing figures. Thus, states like Massachusetts—and even

more so, Alaska, last in agricultural production—have larger food processing sectors because of offshore fishing.

**The Role of the Nine Industry Groups in Massachusetts**

The government's reporting system separates the food processing sector into nine industry groups (e.g., SIC 202—Dairy products) and 47 industries (e.g., SIC 2024—Ice cream). The nine groups, along with employment data for 1972 and 1992, follow:

SIC	Description	1972 Employees	Percent of 1972 Total	1992 Employees	Percent of 1992 Total
20	Food & kindred products	32,700	100.00	20,900	100.00
201	Meat products	3,800	11.62	1,900	9.09
202	Dairy products	5,600	17.13	4,300	20.57
203	Preserved fruits & vegetables	1,400	4.28	1,700	8.13
204	Grain mill products	600	1.83	600	2.87
205	Bakery products	6,800	20.80	4,400	21.05
206	Sugar & confectionery products	4,800	14.68	1,700	8.13
207	Fats & oils	500	1.53	200	0.96
208	Beverages	4,000	12.23	1,700	8.13
209	Miscellaneous foods	5,300	16.21	4,400	21.05

Not all of these industry groups are equally important to a healthy local agricultural sector. The grain mill and bakery products involve businesses that buy processed flour from the grain states and then make grain and bakery products closer to the consumer. The same is true for the candy and beverage groups, though in beverages the agricultural sector benefits from the noncarbonated drinks that are increasingly fruit-based. Most of those drinks, however, belong in the preserved fruits and vegetables industry group. The local businesses involved in processing soft drinks are largely local bottlers that purchase the concentrate from out-of-state plants and then bottle and distribute the final product locally. However, industry groups such as meat and dairy products and preserved fruits and vegetables serve a vital role to local farmers who must find a way to market excess supply during the harvest period (e.g., cucumbers to pickles) or to provide consumers with a more convenient product form (e.g, hogs to pork sausage).

Massachusetts had economic activity in all of the nine food industry groups in 1992 (the 1997 census state data were not available for this research, and the 1996 Annual Survey is limited in detail). However, some groups were very minor to the state's overall food processing activity, as can be seen in the above table.

In terms of the share of the state's total employment in food processing, three industry groups—dairy, bakery, and miscellaneous foods—were about equally important, as each held roughly a 20 percent share of the total employment in food processing. Of the other nine industry groups, only two are particularly small—grain mill products and fats and oils—and the remaining three groups are roughly the same size, accounting for 8 to 9 percent of total food processing employment. Before examining

the industries that comprise each industry group, we will examine the trends for each industry group with a significant impact on the region's agriculture.

In terms of the 47 industry subcategories within the nine industry groups that comprise the food processing sector in Massachusetts, the largest was bread, cake, and related products, with 18.7 percent of the state's food processing employment in 1992, and almost unchanged in importance since 1972. Next largest was prepared fresh or frozen fish or seafood, with 10.5 percent in 1992 but down from the 16.2 percent in 1982. The fluid milk industry was next with 12 percent. No other industry reached a 10 percent share of the state's total employment in food processing. The next four largest industries were sausage and prepared meats, confectionery products, soft drinks, and ice cream, each with about a 6 percent share. The four largest industries accounted for 48 percent of the state's 1992 total employment in food processing, and the next three largest industries added another 18 percent, thus just seven of the possible 47 food industries accounted for two-thirds of the state's employment in food processing.

**Meat products.** Employment in the meat products industry group declined from 5,600 employees in 1958 to a low of 1,750 in 1987, then rebounded slightly to 2,300 by 1996 (Figure 16). In terms of the Commonwealth's share of the nation's meat products group, the Bay State fell from 1.8 percent of U.S. employment in 1958 to 0.5 percent in 1996 (Figure 17). A similar pattern occurred in terms of value-added even though the decline was slightly more severe; however, the rebound was slightly stronger (though disclosure problems prevented the census from giving the 1987 value). Recall that as a state, Massachusetts held a 1.3 percent share of the nation's total food processing value-added, so the state's share of the meat products group is less than its overall average.

Livestock producers need a local meat processing sector to survive in the long run. Most of the state's meat products businesses, however, are not in the meat slaughtering business (SIC 2011) but in the manufacture of sausages and other prepared meats (SIC 2013) made from boxed meat that was slaughtered, dressed, and even cut elsewhere. In 1992, the last year for which we have data, only 100 of the 1,900 meat products employees were in meat slaughtering plants in Massachusetts, whereas 1,400 were in SIC 2013. Such establishments do not slaughter animals and do not need to buy local livestock. Instead they buy "boxed meat" from the big meat-packing firms in the Midwest.

The current effort by Western Massachusetts livestock farmers to build a slaughtering facility is an attempt by local farmers to solve a problem. Currently, their plan is to renovate a plant in Connecticut, which won't be included in the Commonwealth's next census numbers, but will be close enough to help local livestock farmers. Also, in 1992, Massachusetts had 400 employees in poultry slaughtering and processing, which probably reflects the state's growing turkey operations. The Census does not report on industries with less than 100 employees, so we can assume that the poultry industry has grown from under 100 employees in both 1972 and 1982 to the 400 employees in 1992. We await the 1997 numbers.

**Dairy products.** Dairy farmers also rely on a healthy dairy processing sector, because no milk is to be sold as raw milk to consumers; hence, milk must go through processing either as fluid milk or as other dairy products such as ice cream or cheese. Employment in the dairy products industry group declined from 9,500 employees to a low of 3,700 in 1996, but most of the decrease occurred from 1958 to 1982 (Figure 18). Relative to the rest of the country, Massachusetts's share in dairy products exceeds its average share of food processing, as it accounted for 2.8 percent of employment and 2.3 percent of value-added in 1996. Also relative to the nation, its employment in dairy products has been much more stable over time, hovering between 2.5 percent and 3 percent of the U.S. total (Figure 19). The state's share of the U.S. value-added has been less than its share of employment, reaching a low of 1.64 percent in 1992, before rising to 2.27 percent in 1996. Two industries—fluid milk and ice cream—accounted for most of the state's dairy products. Fluid milk was largest, with a 12 percent share of 1992 employment in the dairy group (Table 19), and ice cream held nearly 6 percent. The large share held by fluid milk reflects proximity to major consumption markets.

**Preserved fruits and vegetables.** Fruit and vegetable farmers have increased their use of direct marketing, as we showed in our agricultural paper, which returns a higher margin to the growers. Local growers should continue to increase direct sales wherever possible. However, not all fresh produce can be sold as fresh, hence farmers rely on a processing stage to not only preserve the products but also to transform them into more value-added products. Though the preserved fruits and vegetables industry group is not one of the state's largest, it is the only industry group that grew over the 1958 to 1996 period, from 1,400 employees in 1958 to 1,800 in 1996 (Figure 20). Relative to the nation, the Massachusetts share declined from 1958 to 1982 and then increased in the nineties (Figure 21), but remained under 1 percent of the U.S. values. Within the group, three industries—canning, freezing, and pickles, sauces, and salad dressing—accounted for all of the activity (Table 19). All three of these industries grew from 1972 to 1992, with both canning and freezing growing at 50 percent.

**Bakery products.** Bakery products is another large industry group in the Bay State, accounting for around 20 percent of all Massachusetts food processing employment. Employment in this industry group also declined substantially from 11,000 employees in 1958 to 4,700 in 1996, but essentially all of the decline was between 1958 and 1977 (Figure 22). Relative to the nation, bakery products declined from 3.65 percent of employment in 1958 to 2.14 percent in 1996, with similar numbers for value-added (Figure 23). Bakery products do not rely on local agricultural producers; thus large segment is more beneficial to consumers who demand fresh bread than to Massachusetts farmers. One industry—bread, cake, and related products—accounted for nearly all of the employment in this industry group (Table 19).

**Miscellaneous foods, including fish.** The last industry group we discuss in detail is the catchall group "miscellaneous foods," which represents a diverse set of industries, such as potato chips, coffee, pasta, and fish. Overall, employment in this group has hovered around 5,000 to 6,000 employees over the four decades (Figure 24). Relative to the nation, this group accounted for 5 percent of the national employment in 1958, but decreased to 2.93 percent in 1996 (Figure 25). In terms of value-added the state's share varied from the high of 3.86 percent in 1958 to a low of 1.71 percent in 1967, then rose to 2.69 percent in 1996. Although this industry group is comprised of a

diverse set of industries, the most important one to Massachusetts is the fresh and frozen packaged fish industry, which accounted for half of the sector's employment in 1992 (Table 19).

Of these seven largest food processing industries in Massachusetts, the processed fish industry is the only one that has obvious production-related incentives for firms to locate in Massachusetts, because of the fisheries on the Atlantic coast. Although the large processed fish industry is critical to Massachusetts fisherman and to the state's economy, farmers do not benefit directly. Aquaculture is developing in the state, and this new endeavor blurs the line between fisherman and farmer. However, the vast majority of the processed fish industry is seafood related.

### **Impact on Farming**

The fishing industry aside, firms in the other leading, but nondairy industries are driven more by consumption considerations in their location preferences. Those industries have economic incentives to locate close to final consumers and transport their needed inputs from elsewhere. In other industries, firms have a financial incentive to stay close to their farm inputs and transport the finished product to final consumers. For example, Massachusetts has only a small presence in canned vegetables, whereas California and Florida are major vegetable processors and canners. While Massachusetts is well located in terms of population—and hence consumption—centers, it does not have a leadership position in agricultural crops, with the notable exception of cranberries. Thus firms in food processing industries that have an economic incentive to be close to their farm inputs will likely choose to locate in another state. Nevertheless, niche markets remain, and farmers in the Connecticut River valley have consistently shown an ability to produce products such as cucumbers for pickles and relish that keep processors interested in the state's growers.

Traditional farmers do not benefit much from the sausage, soft drinks, and candy processing industries. The dairy processing industries represent an opportunity to combine local production and processing to serve the state's large population centers. Fluid milk has been a regional market, with farmers transporting their milk to local processing plants. The distances that farmers ship their milk has increased over time, and this trend has led to a reduction in the number of milk processing plants in the country. Consumers, however, now seem interested in where their food comes from and have responded to efforts to market a more local product. The state of Vermont has had great success with dairy processors tying their product to the state's dairy image (e.g., Ben and Jerry's), and Massachusetts farmers are experimenting with selling their own brands (e.g., Our Family Farms).

### **Economic Impact**

Overall, the data describe the food processing activity in Massachusetts relative to the region and the nation, but they do not show the importance of food processing to the state's general economic activity. In 1958, food processing accounted for 7 percent of total employment in all manufacturing industries in Massachusetts and 8 percent of the state's manufacturing value-added (Table 20). These shares declined slowly until 1982, then increased modestly (Figure 26). Corresponding figures show that food processing accounted for 11 percent of the nation's total employment in manufacturing and 12.4 percent of value-added (Figure 27). The national shares of



food processing employment to total manufacturing employment have declined in a similar fashion to the Commonwealth's experience, but the nation has maintained roughly a 4-point higher percentage than the state's ratio in any given year. Similar trends occur with value-added, where the national share of food processing to total manufacturing stayed about 5 percentage points higher.

All in all, the data reveal that Massachusetts lost much of its traditional food processing businesses, but most of the losses came between 1958 and 1977 period or the early 1980s.. The last decade has seen several reversals for Massachusetts food processing industries. Local farmers should continue to rely more on fresh markets, including food service, and even to do some processing themselves, provided that small-scale processing is competitive to processed products from major producing states (e.g., Florida and California). Massachusetts farmers may have to avoid direct competition with such states and market other products and services that yield them the advantage, including appealing to consumer concerns about local food supplies, food safety, and preservation of local agriculture.

Despite the extent of the data presented, numbers fail to reveal the true breadth of food processing activity under way in Massachusetts. Many food processing businesses have fewer than 20 employees. The employment figures given in the earlier tables exclude proprietors and partners of unincorporated firms. Several food processing operations in Massachusetts have no hired employees; therefore, unless incorporated, they are not included in the figures.

Even for the food companies included in the above figures, many are producing niche products that are lost in the government's broad industry categories. For example, both tofu-based products and maple syrup are buried in industry SIC 2099, miscellaneous food products. In 1982, the value of production for maple syrup accounted for only 0.6 percent of the state's value of shipments in SIC 2099. This activity is a small part of the state's food processing activity, but it is of vital importance to many people in Western Massachusetts. It adds much to the character of the area and, in turn, influences other industries as well (e.g., tourism).

Much more detailed information is required before we can access the promising areas of food marketing in Massachusetts. Just such a study is now under way in another collaborative effort between the State Department of Food and Agriculture and the Department of Resource Economics at the University of Massachusetts. In that study we hope to better understand the alternative marketing activities that have assisted our farmers and food processors to survive and profit from these changing times.

## **Part Three**

### **The Forest Products Industry**

#### **The Lumber and Wood Products System**

Analogous to the vertical marketing system shown in Figure 1, the wood products industry in Massachusetts has the following:

Inputs—from a healthy and growing forest resource base

Production—from a relatively small, but active, logging and sawmill industry

Assembly and Processing/Manufacturing—in the broad areas of lumber, furniture, and pulp and paper

Distribution—Both at the wholesale and retail levels prior to delivery to the end consumer

Massachusetts ranks as a minor state in the primary processing end of the wood products distribution system. The state's logging statistics were small enough to be omitted from the 1997 logging industry report of the census. In 1997, sawmill establishments (37), employment (415), payroll (\$6,931,000), and value-added by manufacture (\$21,487,000) all ranked well under 1 percent of the U.S. totals for the sawmill industry.

Massachusetts, with a current estimated population of 6,175,000 residents, ranks as the 13<sup>th</sup> most populous among all states. Like the majority of U.S. states, the lumber and other forest products consumed are largely imported. In the residential construction market, for example, structural framing lumber comes primarily from three broad geographic areas. Sources of lumber are almost equally divided in thirds among Canada, the Pacific Northwest, and the Southeast. In Massachusetts and New England, there is a significant proportion of local forest products consumption, but sources from outside state boundaries still make up the highest proportion.

The role of wholesaling and retailing of lumber, wood products, furniture, and pulp and paper is much more significant than their primary production levels. There are no good data on the portion of production or sales that are derived from the Massachusetts resource base, but it is expected to be small. Fabrication, distribution, and consumption of forest products are tracked in three broad areas: lumber and wood products; furniture; and pulp and paper. The 1996 Census of Manufactures data for these three categories are listed in Table 21.

Moving up the vertical marketing system to the wholesaling and retailing functions, Massachusetts is a significant “consumer” of forest products, even if the current inputs are coming largely from out of state. Again, we cannot accurately estimate the percentage of input from Massachusetts lumber and sawmill manufacturers, but we can expect that the percentages are small. Table 22 shows 1997 wholesale trade statistics for lumber and wood products wholesaling. Retail trade of wood-based products is even more significant, as seen in Table 23.

The retail sector is the largest for wood-based products, closely followed by the wholesale sector. Each of these sectors has close to \$7 billion in annual sales. The primary and secondary manufacturing sectors, including sawmill, furniture, and pulp and paper production, account for just under \$2.5 billion in value-added. The primary

input of logs and wood fiber grown in Massachusetts is by comparison quite small. Annual stumpage fees to Massachusetts forest landowners are only estimated to be in the \$15 million range.

### **Analysis of the Lumber and Wood Products Industry—Statewide Trends**

In order to analyze the trends of Massachusetts forest products manufacturers over the past 30 years, census information was gathered from The United States Department of Commerce. The Lumber and Wood Products major group is represented by U.S. Department of Commerce, SIC 24, with 3-digit codes representing industry groups.

The present study focuses on the industry groups within the Lumber and Wood Products major group. Data were collected for the census years 1972, 1977, 1982, 1987, 1992, and where possible for 1997. Specific 3-digit industry groups are as follows:

- 241 - Logging
- 242 - Sawmills and Planing Mills
- 243 - Millwork, Veneer, Plywood, and Structural Wood Members
- 244 - Wood Containers
- 245 - Wood Buildings & Mobile Homes
- 249 - Miscellaneous Wood Products

Data were also gathered for SIC 2421, Sawmills and Planing Mills—General, in order to reach a finer level of detail for this industry.

**Licensed loggers.** The Department of Environmental Management has instituted a harvest licensing program to register loggers in the Commonwealth. A measure of the level of primarily logging activity is given by this listing of 504 loggers statewide. In 1999, Worcester County was home to the most registrations—132, or 26 percent of the total (Figure 28). Hampshire, Franklin, Berkshire, and Hampden counties followed in order of the number of loggers.

This information should be contrasted with the most recent census data for logging, SIC 241, which accounted for only 20 establishments in the 1992 census of manufactures. This discrepancy is a clear indication that the census data should be taken as an indicator of minimum activity in this sector and in the lumber and wood products sector as a whole.

**Sawmills.** The Massachusetts Department of Environmental Management publishes a listing of the state's sawmills. Between 1971 and 1997, the number of sawmills appearing in the most recent report fell by 35 percent, from 130 to 85. The greatest numbers of sawmills are located in the counties with the greatest wood resource base, including Worcester, Franklin, Hampshire, Berkshire, and Hampden counties. While Worcester County increased its sawmill count over the period from 15 to 18 mills, other counties have experienced mill closings. Plymouth County has 63 percent fewer sawmills than in 1971, Berkshire 55 percent fewer, and Franklin 48 percent fewer (Figure 29).

Most of the loss in sawmill count has occurred with the smaller sawmills. This trend is consistent with nationwide forest industry trends toward mill consolidation, with

increased average mill throughput of the remaining mills. In 1971, only 24 percent, or 31 out of 130, of the mills reported production of more than 1 million board-feet per year. In 1997, that percentage had grown to 35 percent. The number of “large” mills fell by one to 30 mills over that time period. The number of smaller mills, producing less than 1 million board-feet production, had dropped by 44 percent, from 99 in 1971 to 55 in 1997. Figure 30 shows the trend in number of sawmills statewide.

**Number of establishments.** The number of lumber and wood products businesses maintained a narrow range over the period 1972 to 1997, hovering around 400. The number grew slightly over the period 1972 to 1987, rising from 399 to a peak of 443. The number fell by 21 percent to just 348 businesses in 1997.

Of those counties for which data were reported, Worcester and Middlesex typically ranked as having the most businesses. Worcester County reported 65 lumber and wood products concerns in 1997, down from a peak of 82 in 1987. Middlesex reported 54 businesses, down from 63 in 1987. Bristol, Essex, Hampden, Norfolk, and Plymouth counties also showed reportable numbers of lumber and wood products establishments, but roughly half those reported in Worcester and Middlesex. Plymouth showed the largest decline in number, falling from a peak of 47 in 1987 to only 22 establishments reported in 1997. The remaining counties did not have sufficient numbers of lumber and wood products businesses to enable reporting.

Most Massachusetts wood products businesses are small. Only 14 percent of the total establishments in Massachusetts had 20 or more employees in 1997. The number of these larger businesses dropped by 43 percent between 1987 and 1997, falling from 84 to 48. Trends among the counties follow those for total establishments, with Worcester and Middlesex counties being home to concentrations of the larger businesses.

Census of Manufacturing data are the basis for the trends and figures reported here. However, it should be noted that these data do not capture all of the business activity in the forest and wood products sectors. For example, we can compare the sawmill count from the Department of Environmental Management listings with the number of establishments reported from the census SIC category 242 for sawmills and planing mills. The census reported 94 establishments in 1972, and the DEM listing reported 130 sawmills for 1973. Similarly, the census reported 63 establishments in 1992 with the DEM sawmill report listing 92.

Given this cautionary note, the census reports 43 percent of the total number of establishments were in the millwork and structural wood category in 1992. This percentage and the total count of 153 businesses has risen significantly since 1972 when only 104 businesses were reported, which was 26 percent of the total. The other category showing an increase over the period was wood containers, with 33 businesses in 1972, rising to 39 in 1992. Wood containers are largely used for shipping and might be expected to follow the general level of economic activity as a whole.

Other 3-digit SIC categories show a declining trend in numbers over the study period. Miscellaneous wood products has fallen from 131 businesses to 78 in 1992, sawmills and planing mills from 94 to 63, and wood building and mobile home manufacturers from 10 to 7.

**Employment.** State employment was highest in 1987, with about 6,200 employees in the lumber and wood products industry falling steadily over the last 10 years to 3,500 in 1997. Middlesex County had the highest employment in this sector, followed closely by Worcester County. Hampden County was third in terms of number of employees in the forest products sector. Norfolk County was the third largest employer based on payroll dollars. Figure 31 shows the statewide trend in employment over the period 1972 to 1997.

Millwork and structural wood products, along with miscellaneous wood products, were the largest employment sectors for lumber and wood products. Nominal payroll dollars have not fallen as fast as employment figures. Payroll rose rapidly from \$45 million in 1972 to a peak of \$125 million in 1987. Over the past 10 years, payroll in lumber and wood products has fallen to \$100 million. Payroll in the largest sector, millwork and structural wood products, rose 251 percent between 1972 and 1992. The 1992 figure reported was \$46 million, 49 percent of the total reported payroll for all lumber and wood products. The second and third categories, ranked by total payroll, were miscellaneous wood products and sawmills and planing mills.

**Value-added, costs, and shipments.** Value-added rose steadily between 1972 and 1987, then dropped. However, inflation must be considered. The most recent reported figures for 1992 amounted to \$206 million compared with \$81 million in 1972. The larger counties reporting value-added are Middlesex, Worcester, and Plymouth.

The millwork and structural wood category showed good growth from 1972 to 1992, rising from \$21 million value-added to \$103 million, or an increase of 390 percent. The value-added for wood buildings and mobile homes was the only category to decline, from \$12 million to \$9 million.

Cost of materials follows the trends indicated for value-added by manufacture. Cost of materials reported rose from \$88 million in 1972 to a peak of \$287 million in 1987, falling off to \$255 million in 1992.

Cost of materials for the millwork and structural wood category is highest, followed by miscellaneous wood products and sawmills. All categories, with the exception of wood buildings and mobile homes, showed increasing cost of materials. Cost of materials rose from \$27 million to \$108 million for the millwork and structural wood category, which almost matched the increases in value-added for this category. The material cost increases for the miscellaneous wood products category far outstripped increases in value-added. In 1977, the ratio of value-added to cost of materials for this category was 108 percent. In 1992, that ratio had fallen to 61 percent, indicating rapidly rising material costs.

The corresponding total value of shipments for the lumber and wood products sector was \$168 million in 1972, rising 210 percent to \$521 million in 1987. The 1992 figures were slightly lower, at \$481 million. The millwork and structural wood category accounted for 44 percent of the total, followed by miscellaneous wood products with 31 percent, and sawmills with 9 percent. The mix of shipment value changed significantly from 1977, when millwork accounted for only 28 percent of the total

value. Sawmills and wood buildings and mobile homes each ranked 16 percent of total value of shipments in 1977, which were much higher than their percentages in 1992.

**Outlook for the Massachusetts Lumber and Wood Products Industry**

The primary processing sector of the Massachusetts forest products industry shrunk from 1971 to 1997. The number of sawmills declined from 130 to 85, but the loss was mainly in the smaller-capacity mills. Those that remain have made investments in more efficient sawmill technologies. The number of employees in the lumber and wood products sector also declined, from 6,000 in 1972 to 3,500 in 1997.

With a growing natural resource base, Massachusetts could significantly increase its harvest, processing, and manufacture of native wood. There are market opportunities that can help entrepreneurs better utilize our wood resources. Local consumer demand for lumber, wood products, furniture, and paper far exceed current production within the state.

## **Part Four**

### **The Food System**

We close this paper by attempting to pull together data that span most of the food system in Massachusetts for the year 1997. Following the vertical flow depicted in Figure 1, we trace the number of establishments, employees, and sales across the major stages of the Massachusetts agriculture and food system. We separate the forest products industries (see Part Three) and focus on a more traditional definition of agriculture and the food system. We also feature establishment and employee counts for comparisons since sales data are doubled-counted as you move through the vertical system (e.g., processors sell to wholesalers, who then sell to retailers). Since we cannot control for out-of-state sales by wholesalers, or any other firm for that matter, we cannot calculate in-state value-added for each vertical stage.

Massachusetts had at least 29,000 establishments involved in the vertical agricultural and food system and employed at least 394,000 people (Table 24). Of that total, primary agricultural represented over 20 percent of the establishments but just under 3 percent of the employees. By far the largest employers in the food system are food service operations; as a group, they represented half of the establishments and 55.5 percent of the employees. Within food service, restaurants, both full-service and limited-service, dominated all others. Although some might exclude places where primarily alcoholic beverages are consumed from the food system, food processing does include them and so they are included here as well.

The next largest vertical stage was retailing, accounting for nearly 22 percent of the establishments and 27 percent of the employees. Within this stage, supermarkets and grocery stores dramatically dominate in terms of sales and employees, but are similar in establishment counts to convenience stores and liquor stores. The much larger size of a typical supermarket and its large volume of sales explain the difference.

Wholesaling is the next largest stage, with 5 percent of the establishments and 7.5 percent of the employees. Within wholesaling, grocery and related establishments account for the vast majority of both—4.2 percent of the establishments and 6.0 percent of the employees. Massachusetts is well located to serve as wholesalers to all of New England, New York, and even beyond. C&S Wholesalers, headquartered in Brattleboro, Vermont, is the nation's 5th largest food wholesaler and has operations in Western Massachusetts. Many food brokers operate in the greater Boston area. This locational advantage is reflected by the state's large sales for food wholesalers, \$28.6 billion, which far exceeds sales at the retail and food service stages combined. Clearly, Massachusetts food wholesalers sell to out-of-state accounts.

Food processing in Massachusetts accounts for only 1.6 percent of the establishments but 6 percent of the employees, and had sales of \$5.6 billion in 1997. These figures are consistent with the national figures given in Tables 3 and 4, but are even smaller, which reflects the fact that Massachusetts food processing is not as large on a relative basis in the Massachusetts food system as it is for the nation. Indeed, few of the largest food processors locate in Massachusetts, with Ocean Spray being the largest; it ranks 49th among the nation's food processors.

Agriculture is the smallest of the state's vertical stages, ignoring the smaller agricultural trucking category, in terms of sales and employees, but it is as large as the retailing stage in terms of establishments. Our paper on self-sufficiency will explore the implications of this in greater detail.

### **Conclusions**

Though it is a difficult task to summarize and draw together all the information from the state's vertical food and forest products marketing system, we attempt a sketch as to what we consider the most important points.

Four major trends affecting the nation's food system are at work in Massachusetts:

1. Changing consumers
2. New technologies
3. Consolidation
4. Globalization

Each of these exerts forces that will shape our food system. Those who position themselves to benefit rather than be hurt by these changes will survive and profit.

- Massachusetts and New England lost food processing businesses over time, but the loss mostly occurred in the 1958 to 1980 period. Subsequently, some growth has occurred.
- Massachusetts has a cost disadvantage in several industries compared to other states, but there are offsetting advantages that allow price premiums.
- Dairy processing is still a large industry and has encouraging possibilities, but dairy farm numbers continue to decline.
- Massachusetts livestock farmers are disadvantaged, given the small number of in-state meat processors that slaughter animals. Prepared meat processors are more abundant but obtain meat from out of state.
- Fruit and vegetable processing has increased in the state since 1982.
- Massachusetts is a densely populated state, yet retains a significant agricultural sector that can benefit from some of the consumer trends.
- Food service is of great importance to Massachusetts, and farmers and food processors should cater to this sector.
- Retailing is a population-driven business, and Massachusetts farmers need to find ways to benefit from rather than be hurt by population pressures.
- The state plays an important role as food wholesaler to the region.
- The Massachusetts lumber industry has potential with increased value-added activities done in state.



## **APPENDIX: TABLES AND FIGURES**

- Table 1 - Major Foods: U.S. Per Capita Food Supply  
Table 2 - Food Expenditures as a Share of Disposable Personal Income, 1967-1997  
Table 3 - Food System Employment, 1950-1997 (thousands)  
Table 4 - Number of Food-System Business Establishments, 1972-1997  
Table 5 - Ranking of States by Value of Agricultural Products Sold, 1997, and Value-Added in Food Manufacturing  
Table 6 - Value-Added by Industry Sector, Selected Years (in billions of dollars)  
Table 7 - New Food Product Introductions, 1983-1997  
Table 8 - Total Measured Media U.S. Advertising Spending by Category, 1997 and 1996  
Table 9 - Aggregate Concentration of Largest Wholesale Firms, Grocery Stores, and Restaurants, 1982-1992  
Table 10 - Top Five Food Wholesalers, 1998  
Table 11 - Expenditures for Food, 1997-1997  
Table 12 - Top Five Food Retailers, 1998  
Table 13 - Profit Margins of Food Manufacturers and Retail Food Chains, Industry Averages, 1981-1997  
Table 14 - Top Ten Fast-Food Burger Restaurants, 1997  
Table 15 - Top Five Pizza Chains, 1997  
Table 16 - Shoppers' Primary Source of Takeout Food  
Table 17 - Average Hourly Earnings of Production and Nonsupervisory Employees of Food Industries, 1977-1997  
Table 18 - New England States Employment in Food Processing as a Percent of New England's Total, 1958-1996  
Table 19 - Massachusetts Food Processing Employment by Industry Groups, 1972-1992  
Table 20 - Food Processing's Share of Total Manufacturing in Massachusetts and the U.S.  
Table 21 - Massachusetts Agriculture and Food System, 1997  
Table 22 - Massachusetts Lumber and Wood Products, Manufacturing, 1996  
Table 23 - Massachusetts Lumber and Wood Products, Wholesale Trade, 1997  
Table 24 - Massachusetts Lumber and Wood Products, Retail Trade, 1997
- Figure 1 - The Vertical Food Marketing System  
Figure 2 - The Distribution of Food Expenditures between Farming and Marketing, 1970-1997  
Figure 3 - What a Dollar Spent for Food Paid in 1997  
Figure 4 - Changes in U.S. Per Capita Food Consumption, 1970-1997  
Figure 5 - Largest 100 Food Manufacturing Companies, Census Years 1954-1995  
Figure 6 - U.S. High-Value and Bulk Agricultural Exports, 1980-1996  
Figure 7 - U.S. Processed Food Exports and Sales of U.S.-Owned Foreign Affiliates, 1982-1994  
Figure 8 - Food Mergers and Acquisitions, Food Businesses, 1973-1998  
Figure 9 - New England Employment in Food Processing  
Figure 10 - New England Employment and Value-Added in Food Processing, as Percent of U.S. Total  
Figure 11 - Massachusetts Employment in Food Processing  
Figure 12 - Massachusetts Employment and Value-Added in Food Processing, as Percent of U.S. Total  
Figure 13 - Massachusetts Employment and Value-Added in Food Processing, as Percent of New England Total  
Figure 14 - Employment in Food Processing, Selected Eastern States  
Figure 15 - Employment in Food Processing, Five New England States  
Figure 16 - Massachusetts Employment in Meat Processing, SIC 201  
Figure 17 - Massachusetts Employment and Value-Added in Meat Processing, as Percent of U.S. Total  
Figure 18 - Massachusetts Employment in Dairy Processing, SIC 202  
Figure 19 - Massachusetts Employment and Value-Added in Dairy Processing, as Percent of

***Food Marketing and Lumber Processing in Massachusetts, 1958 to 1997***

U.S. Total

Figure 20 - Massachusetts Employment in Fruit and Vegetable Processing, SIC 203

Figure 21 - Massachusetts Employment and Value-Added in Fruit and Vegetable Processing, as Percent of U.S.

Figure 22 - Massachusetts Employment in Bakery Products, SIC 205

Figure 23 - Massachusetts Employment and Value-added in Bakery Products as Percent of U.S. Total

Figure 24 - Massachusetts Employment in Miscellaneous Food Processing, SIC 209

Figure 25 - Massachusetts Employment and Value-added in Miscellaneous Food Processing, as Percent of U.S. Total

Figure 26 - Massachusetts Employment and Value-added in Food Processing, as Percent of Total Manufacturing in the State

Figure 27 - U.S. Employment and Value-Added in Food Processing, as Percent of Total Manufacturing

Figure 28 - Registered Loggers in Massachusetts by County, 1999

Figure 29 - Massachusetts Sawmills by County, 1997

Figure 30 - Massachusetts Sawmills, 1971-1997

Figure 31 - Massachusetts Employment in Lumber and Wood Products, SIC 24

Inside Back Cover:

### SPECIAL THANKS

The authors gratefully acknowledge the financial support and general encouragement of the Massachusetts Department of Food and Agriculture.

This paper is funded in part by a grant from the DFA to the University of Massachusetts Donahue Institute, the College of Food and Natural Resources, and the Department of Resource Economics at the University of Massachusetts in Amherst.

---

<sup>1</sup> This section draws heavily from R. T. Rogers, "U.S. Food Marketing System," in *Wiley Encyclopedia of Food Science and Technology*, 2nd Edition, edited by Frederick J. Francis, John Wiley & Sons, New York, NY, 2000, pp. 2701–2724.

<sup>2</sup> R. T. Rogers, "Broilers—Differentiating a Commodity," in *Industry Studies*, 2nd Edition, edited by Larry L. Duetsch, M. E. Sharpe, Armonk, New York, 1998, p. 67.

<sup>3</sup> L. S. Kantor, "A Dietary Assessment of the U.S. Food Supply: Comparing Per Capita Food Consumption with Food Guide Pyramid Serving Recommendations," Agricultural Economic Report No. 772, Food and Rural Economics Division, Economic Research Service, U.S. Department of Agriculture, 1998.

<sup>4</sup> B.H. Lin, E. Frazao, and J. Guthrie, "Away-From-Home Foods Increasingly Important to Quality of American Diet," Agriculture Information Bulletin No. 749, January 1999.

<sup>5</sup> J. Kinsey, "Changes in Food Consumption from Mass Market to Niche Markets," in *Food and Agricultural Markets: The Quiet Revolution*, edited by Lyle P. Schertz and Lynn M. Daft, NPA Report No. 270, Economic Research Service, U.S. Department of Agriculture, 1994.

<sup>6</sup> *Population Trends 1996–2050*, The Food Institute, Fair Lawn, N.J., April 1996.

<sup>7</sup> Food Institute Report, "Publisher Categorizes Shoppers Six Ways," The Food Institute, Fair Lawn, N.J., February 15, 1999, p. 3.

<sup>8</sup> J. Kinsey, "Changes in Food Consumption from Mass Market to Niche Markets," in *Food and Agricultural Markets: The Quiet Revolution*, edited by Lyle P. Schertz and Lynn M. Daft, NPA Report No. 270, Economic Research Service, U.S. Department of Agriculture, 1994, p. 29.

<sup>9</sup> M. Beck, "Next Population Bulge Shows Its Muscle," *The Wall Street Journal*, February 3, 1997, p. b1.

<sup>10</sup> "Labor Force, Employment, and Earnings," *Statistical Abstract of the United States: 1998*, September 25, 1998, Section 13.

<sup>11</sup> M. Beck, "Next Population Bulge Shows Its Muscle," *The Wall Street Journal*, February 3, 1997, p. b1.

- <sup>12</sup> J. J. Putnam and J. E. Allshouse, "Food Consumption, Prices, and Expenditures, 1970–97," Food and Rural Economics Division, Economic Research Service, U.S. Department of Agriculture, Statistical Bulletin No. 965, Table 100, 1999.
- <sup>13</sup> Food Institute Report, "Publisher Categorizes Shoppers Six Ways," February 15, 1999, p. 3.
- <sup>14</sup> "These Grocery-Delivery Services Might Even Do Windows," *Wall Street Journal*, February 12, 1998, p. a1.
- <sup>15</sup> J. Kinsey, "Changes in Food Consumption from Mass Market to Niche Markets," in *Food and Agricultural Markets: The Quiet Revolution*, edited by Lyle P. Schertz and Lynn M. Daft, NPA Report No. 270, Economic Research Service, U.S. Department of Agriculture, 1994, p. 32.
- <sup>16</sup> Food Institute Report, "What's For Dinner? Ask Me Later," The Food Institute, Fair Lawn, N.J., March 9, 1998, p. 1.
- <sup>17</sup> "Nabisco Dumping Grey Poupon 'Pardon Me' Ads," *Wall Street Journal*, April 6, 1998, p. a23.
- <sup>18</sup> Food Institute Report, "Americans Do Cook," The Food Institute, Fair Lawn, N.J., February 15, 1999, p. 2.
- <sup>19</sup> J. Krasner, "Pilgrim Dessert Returns, but Who Will Give Thanks?," *Wall Street Journal*, March 17, 1999, p. ne2.
- <sup>20</sup> J. Friedland and S. Kilman, "As Geneticists Develop an Appetite for Greens, Mr. Romo Flourishes," *Wall Street Journal*, January 28, 1999, p. A1.
- <sup>21</sup> "Greed is Good," *The Economist*, January 17, 1998, p. 26.
- <sup>22</sup> J. S. Royer and R. T. Rogers, editors, *The Industrialization of Agriculture: Vertical Coordination in the U.S. Food System*, Ashgate Publishing Ltd., Aldershot, United Kingdom, 1998.
- <sup>23</sup> S. Warren and S. Kilman, "DuPont Co. Lands Huge Biotech Prize," *Wall Street Journal*, March 16, 1999, p. a2.
- <sup>24</sup> J. Friedland and S. Kilman, "As Geneticists Develop an Appetite for Greens, Mr. Romo Flourishes," *Wall Street Journal*, January 28, 1999, p. A1.
- <sup>25</sup> J. M. Connor, R. T. Rogers, B. W. Marion, and W. F. Mueller, *The Food Manufacturing Industries*, Lexington Books, Lexington, MA, 1985.
- <sup>26</sup> R. T. Rogers, "Broilers—Differentiating a Commodity," in *Industry Studies*, 2nd Edition, edited by Larry L. Duetsch, M. E. Sharpe, Armonk, New York, 1998, p. 71.
- <sup>27</sup> R. T. Rogers and R. J. Sexton, "Assessing the Importance of Oligopsony Power in Agricultural Markets," *American Journal of Agricultural Economics* 76, December 1994, pp. 1143–1150.
- <sup>28</sup> G. P. Zachary, "Many Industries Are Congealing into Lineup of Few Dominant Giants," *Wall Street Journal*, March 8, 1999, p. B1.
- <sup>29</sup> R. T. Rogers and L. M. Petraglia, "Agricultural Cooperatives in Food Manufacturing: Implications for Market Performance," *Journal of Agricultural Cooperation*, Vol. 9, 1994, pp. 1–12.
- <sup>30</sup> R. J. Sexton, "The Role of Cooperatives in Increasingly Concentrated Agricultural Markets," in *Cooperatives: Their Importance in the Future Food and Agricultural System*, edited by Michael Cook, Randall Torgerson, Tom Sporleder, and Dan Padberg, National Council of Farmer Cooperatives, Washington, D.C., 1997.

- 
- <sup>31</sup> J. M. Connor, R. T. Rogers, B. W. Marion, and W. F. Mueller, *The Food Manufacturing Industries*, Lexington Books, Lexington, MA 1985.
- <sup>32</sup> John Sculey, former President of Pepsi-Cola, cited on page 112 of J. M. Connor, R. T. Rogers, B. W. Marion, and W. F. Mueller, *The Food Manufacturing Industries*, Lexington Books, Lexington, MA, 1985.
- <sup>33</sup> J. J. Belonax, Jr., *Food Marketing*, Simon and Schuster Custom Publishing, Needham Heights, MA, 1999.
- <sup>34</sup> K. L. Lipton, W. Edmondson, and A. Manchester, "The Food and Fiber System: Contributing to the U.S. and World Economies," Agriculture Information Bulletin No. 742, Economic Research Service, U.S. Department of Agriculture, Washington, D.C., 1998, p. 12.
- <sup>35</sup> Food Institute Report, "Food Sales Top \$10 Billion Mark," The Food Institute, Fair Lawn, N.J., February 8, 1999, p. 1.
- <sup>36</sup> G. Anders, "Amazon.com Buys 35 percent Stake of Seattle Online Grocery Firm," *Wall Street Journal*, May 18, 1999, p. B10.
- <sup>37</sup> J. J. Belonax, Jr., *Food Marketing*, Simon and Schuster Custom Publishing, Needham Heights, MA, 1999, Table 8-20, p. 317.
- <sup>38</sup> Food Institute Report, "Nash Finch Does More Than Gnash Its Teeth," The Food Institute, Fair Lawn, N.J., April, 5, 1999, p. 2.
- <sup>39</sup> J. J. Belonax, Jr., *Food Marketing*, Simon and Schuster Custom Publishing, Needham Heights, MA, 1999, p. 312.
- <sup>40</sup> A. W. Franklin and R. W. Cotterill, "An Analysis of Local Market Concentration Levels and Trends in the U.S. Grocery Retailing Industry," Food Marketing Policy Center, Research Report No. 19, May 1993.
- <sup>41</sup> K. L. Lipton, W. Edmondson, and A. Manchester, "The Food and Fiber System: Contributing to the U.S. and World Economies," Agriculture Information Bulletin No. 742, Economic Research Service, U.S. Department of Agriculture, Washington, D.C., 1998.
- <sup>42</sup> Institute of Food Technologists, "Top Ten Food Science Innovations, 1939–1989," *Food Technology* 43(9), 1989, p. 308.
- <sup>43</sup> Research Committee, Institute of Food Technologists, "The Growth and Impact of the Food Processing Industry: A Summary Report," *Food Technology* 42(5), 1988, pp. 95–110.
- <sup>44</sup> Food Institute Report, "B-to-B On-Line Sales Dwarf Retail," The Food Institute, Fair Lawn, N.J., April 26, 1999, page 1.
- <sup>45</sup> *Food Regulation Weekly*, April 26, 1999, p. 16.
- <sup>46</sup> F. M. Biddle, "Titan Adapts Defense Technology to Food Irradiation," *Wall Street Journal*, May 13, 1999, p. B4.
- <sup>47</sup> C. M. Bruhn and H. G. Shultz, "Consumer Awareness and Outlook for Acceptance of Food Irradiation," *Food Technology* 43(7), 1988, pp. 93–94.
- <sup>48</sup> L. Aldrich and N. Blisard, "Consumer Acceptance of Biotechnology: Lessons from the rbST Experience," Agriculture Information Bulletin No. 747-01, USDA, Economic Research Service, Current Issues in Economics of Food Markets, December 1998.

<sup>49</sup> Food Institute Report, "Organic Milk Making a Splash," The Food Institute, Fair Lawn, N.J., March 22, 1999, p. 2.

<sup>50</sup> K. L. Lipton, W. Edmondson, and A. Manchester, "The Food and Fiber System: Contributing to the U.S. and World Economies," Agriculture Information Bulletin No. 742, Economic Research Service, U.S. Department of Agriculture, Washington, D.C., p. 8.

<sup>51</sup> *Statistical Abstract*, U.S. Department of Commerce, Bureau of the Census, Washington, D.C., 1998, Table 1318.

<sup>52</sup> M. Drabenstott, "Industrialization: Steady Current of Tidal Wave?," *Choices*, Fourth Quarter, 1994, pp. 4–8.

<sup>53</sup> E. van Duren, W. Howard, and H. McKay, "Forging Vertical Strategic Alliances," *Choices*, Second Quarter, 1995, pp. 81–83.

<sup>54</sup> J. M. Connor and F. E. Geithman, "Mergers in the Food Industries," *Choices*, Second Quarter, 1988, pp. 14–17.