Value Added in Food Manufacturing and Retailing: A Ratio Analysis of Major U.S. States

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Raising the value added in food and fiber products has been an appealing goal to a variety of interests. Farm groups want value added to enhance the demand for the commodities they grow, and have viewed value-added processing ventures as an investment opportunity to capture more of the consumers' food dollar. Rural leaders and state and national policymakers interested in rural America perceive value-added food processing firms as contributors to employment and economic development. Consumers demand high-value products to satisfy their specific tastes for food variety or convenience.

The commitment of some groups to value added has sparked many specific product-development activities and investment projects, some of them funded by public-sector sources. For example, Iowa State University's Extension Service assists in new product development and feasibility studies. A growing number of cooperatively owned value-added enterprises have emerged in grain and livestock processing, including Value Added Products, Inc. in Oklahoma (Holcomb) and the 21st Century Alliance in Kansas and surrounding states (Boland et al.).

The various new ventures in value added demonstrate the recent interest in firm-level value added, but it is important to retain a broader perspective on the aggregate contribution of agricultural and food industries to U.S. economic activity. The analysis in this paper provides a statistical foundation by which to assess the progress and needs of particular areas in terms of value-added output. This research also provides measures to assess the value-added contribution of retail food sectors, which are an important complement to the value added offered by food processing. The objectives are to:

1. Develop performance indicators for value-added food manufacturing and retailing.
2. Use those performance indicators to compare major agricultural and food processing states in terms of their relative success at enhancing value added.
3. Report trends in the contributions of the food manufacturing and retailing sectors to value added in the food and fiber system.

Definitions

Before proceeding to the statistics it is necessary to clarify what is meant by value added. Most generally, value added "represents what a business adds to raw materials it purchases" (Nichols and Goodwin). Thus value-added food manufacturing takes place when a company buys a raw commodity and by processing and adding ingredients, converts it into a good that is ready for consumption. A company may add value through several methods, including "changes in genetics, processing, or diversification" and "increasing the consumer appeal of an agricultural commodity" (Nayga, Nichols, and Jones). For example, the Kellogg's Company adds value to the corn commodity it buys by processing the corn to make cereal, packaging it into bags and then boxes, and transporting it to supermarkets across the nation.

Another component of value added is demand-driven. Thus value added exists if the consumer wants the product and is willing to make the purchase. "To add value one needs to ask if the product has a significant market, if it does not and nobody likes the product, there is no added value" (Otto and Williams). Hence, to be profitable and successful the company has to know what the target market really wants and needs. The firm may also increase a good's appeal to consumers by branding it and establishing a marketing strategy. This will increase the presence of the product in the market and highlight its specific characteris-

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tics (good quality, convenience, health, etc.).

Finally, the term value added describes a statistic used by the United States Census Bureau to measure the manufacturing activity within geographic regions. This measure avoids duplication of the figures by adjusting for changes in work in process. "Value added is considered to be the best value measure available for comparing the relative economic importance of manufacturing among industries and geographic areas" (U.S. Census Bureau 2001a). The following equation explains the Census definition of value added: *Value added by firm = Value of shipments - cost of purchased inputs and services.*

To calculate the total value added by a firm one must subtract the value of the purchased inputs. Value added in the Census definition is the total contribution of labor, capital, and management to the value of shipments, in dollars. This definition will clearly encompass the contributions to final product value made by physical transformation. Cost of purchased inputs and labor services will be measured in accounting records and can be gathered in Census questionnaires. The full contribution to value added that originates with demand may be more difficult to measure. Advertising and similar marketing expenses are measurable but the intangible value of brand or image is less likely to be captured in the Census data. Nevertheless, the Census data on value added is the best indicator available.

Three Types of Food Industries

Three types of food processing industries, derived by location preference, exist in the United States (Connor). All three types engage in value-added manufacturing but their differences are important in attempting to understand their decisions. The first type of food industry is demand driven. Companies of this type locate their facilities near their customers. For example, bakeries, such as Mrs. Baird's, are located in highly populated areas where their product is close to grocery stores and their customers. Similarly, soft drink bottling companies locate in metropolitan areas.

The second type of food industry is "agriculturally related." In this type, "[firms] must locate in major agricultural production zones, either because their principal food ingredients are bulky or perishable or because farmers are their customers" (Connor). For example, IBP, Inc. has plants in beef production areas such as Amarillo, where it slaughters and packs cattle to be shipped to other United States locations.

The last type of food manufacturing industry is the "footloose" industry. Firms in this industry can usually satisfy demand from a wide geographic area with one plant, regardless of where it is located. "These industries typically make foods with high values relative to distribution costs, products like prepared flour mixes, confectionery, frozen foods, canned specialties" (Connor). Footloose industries are the ones that have the highest contribution to value added when compared to demand-driven and agriculturally related industries. For example, Hershey Foods produces most of their products in their Pennsylvania factory and then distributes to millions of locations around the United States.

Regional and state governments must take these three types of food manufacturing companies into account when trying to attract them. Demand-driven companies will tend to locate near customers. This means that these firms have to locate in or near large metro areas where the most customers are located. The importance of this issue is apparent in the next section. It would be unwise for a demand-driven company to locate in non-metro areas unless its main customers are in rural areas (i.e. feed mills selling at feedlots). Large agricultural production regions will attract agriculturally related companies. These companies will rarely locate in metro areas.

Food Manufacturing in Major States

In this section we discuss the levels of value-added food and beverage manufacturing in California, Illinois, Pennsylvania, Ohio, Texas, and the Texas border states of Arkansas, Louisiana, New Mexico and Oklahoma. The states examined include the large agricultural states (California, Texas, and Illinois) and major food manufacturing states (Ohio and Pennsylvania). The three measurements used are number of establishments, value of shipments, and value added.

Data

The data are from the United States Economic Census of 1997, which has recently been released. Census uses the North American Industry Classification System (NAICS), which "provides common industry definitions for Canada, Mexico, and the United States. It replaces the country's separate classifications systems with a uniform system for classifying industries" (U.S. Census Bureau 2001c). In the United States, the NAICS has replaced the SIC (Standard Industrial Classification) code system. Because of the change in classification systems, there may be some differences in data coverage. The major difference is that SIC 20, Food and Kindred Products, included beverages whereas the NAICS classifies food (NAICS 311) separately from beverages (NAICS 3121). The separation of beverages from food led to some limitations on data disclosure, which will be discussed later.

Number of Establishments

Texas, which had 1,694 food and beverage manufacturing establishments in 1997, ranks second behind the 4,087 establishments in California (See Table 1) (U.S. Census Bureau 2001b). Pennsylvania, Illinois, and Ohio follow Texas with 1,491, 1,378, and 996, respectively. The number of establishments in Texas is much larger than in the bordering states; Louisiana has 448, Arkansas has 307, Oklahoma has 242, and New Mexico has 156.

Value of Shipments

When ranked by the value of processed food shipments, California ranks first with about $40 billion dollars of shipments in 1997, followed by Illinois with $29.3 billion, Texas with $26.3 billion, Pennsylvania with $20.4 billion, and Ohio with about $17.9 billion (See Table 1). The bordering states, Arkansas, Louisiana, Oklahoma and New Mexico, lag behind Texas in value of shipments (U.S. Census Bureau 2001b).

It should be noted that the value of shipments in 1997 for beverage industries is not included in these rankings. The reason for omitting beverage value of shipments is that the data for four of the nine states examined was undisclosed in the Economic Census of 1997. The Census does not disclose values when there are only a few firms in the industry.

Value Added

California, with $16.8 billion, ranks first in food-value added for 1997, followed by Illinois ($12.4 billion), Texas ($10 billion), Pennsylvania ($9.1

Table 1. Number of Food and Beverage Manufacturing Establishments, Shipments, and Value Added for Selected States and U.S., 1997.

State	Number of Establishments	Value of Shipments ($1,000)	Value Added ($1,000)
Top Five			
California	4,087	39,975,134	16,831,145
Texas	1,694	26,313,112	10,023,561
Pennsylvania	1,491	20,374,271	9,130,026
Illinois	1,378	29,266,966	12,352,764
Ohio	996	17,869,313	8,873,516
Texas Border States			
Louisiana	448	4,938,462	1,589,837
Arkansas	307	10,656,622	3,604,598
Oklahoma	242	3,714,245	1,187,821
New Mexico	156	977,047	383,234
United States	28,924	423,978,723	165,056,502

Source: U.S. Census Bureau (2001b)

billion), and Ohio ($8.9 billion) (See Table 1). Texas' value added outperforms its border states. Arkansas, Louisiana, Oklahoma, and New Mexico have $3.6 billion, $1.6 billion, $1.2 billion, and $.38 billion dollars in value added, respectively (U.S. Census Bureau 2001b). Again, the beverage industry's value added was ignored because of the disclosure problems talked about earlier.

Food Retailing in Major States

Another important section of value added is the food retail sector, which adds value through shipping, marketing, and preparing foods. In this section we discuss the number of establishments and the level of sales for food and beverage places, NAICS 722, and food and beverage stores, NAICS 445. Food and beverage places include restaurants, bars, and fast-food services, while food and beverage stores are grocery and convenience stores. The states studied are the top five value-added states: Ohio, Illinois, California, Pennsylvania, and Texas; and the Texas border states of Oklahoma, Arkansas, Louisiana, and New Mexico. We are unable to report the value-added figures, since these are not provided by the United States Census.

Food and Beverage Places

California has the most sales occurring at food and beverage places, $31.2 billion. Texas, Illinois, Ohio, and Pennsylvania follow with $18.2 billion, $11.8 billion, $10.7 billion, and $9.9 billion, respectively. Texas' food-and-beverage-places sales are considerably higher than those of its border states: Louisiana, $3.7 billion; Oklahoma, $2.7 billion; Arkansas, $1.8 billion; and New Mexico, $1.6 billion. Population is one reason for the difference in sales between states (See Table 2).

The number of establishments of food and beverage places helps measure the value added by retailers in a particular state. California is the leading state in this category, with 56,330 establishments. Texas, Pennsylvania, Illinois, and Ohio trail California with 30,790, 22,601, 22,445, and 21,061 establishments, respectively. The Texas border states lag behind the top five value-added states. The ranking for these states is Louisiana with 6,487, Oklahoma with 5,869 Arkansas with 3,985, and New Mexico with 3,060 establishments. States with a higher population—California and Texas—tend to have higher food-away-from-home sales and a higher number of establishments than states with lower population.

Table 2. Retail Food and Beverage Sales and Establishments for Selected States and U.S., 1997.

State	Food and Beverage Stores		Food Services and Drinking Places		Population
Top Five	**Establishments**	**Sales**	**Establishments**	**Sales**	
Ohio	6,371	$15,806,582	21,060	$10,745,173	11,212,498
Illinois	6,026	$16,487,682	22,445	$11,769,073	12,011,509
California	15,494	$48,767,273	56,330	$31,245,843	32,317,708
Pennsylvania	7,201	$19,096,558	22,601	$9,893,512	12,015,888
Texas	8,906	$28,399,240	30,790	$18,192,429	19,355,427
Texas Border States					
Oklahoma	1,586	$3,777,594	5,869	$2,731,689	3,314,259
Arkansas	1,492	$2,942,513	3,985	$1,785,689	2,524,007
Louisiana	2,495	$5,732,533	6,487	$3,650,288	4,351,390
New Mexico	697	$2,183,701	3,060	$1,568,110	1,722,939
United States	148,528	$400,970,661	486,906	$251,934,204	267,783,607

Source: U.S. Census Bureau (1999a) and (2001b)

Food and Beverage Stores

California leads all states with sales of $48.8 billion. Texas ($28.4 billion), Pennsylvania ($19.1 billion), Illinois ($16.5 billion), and Ohio ($15.8 billion) follow. Texas compares favorably with its border states. The number of establishments of food and beverage stores for these states is a measure that helps explain the amount of added value a state produces. The ranking for the number of establishments of the top five value-added states is as follows: California, 15,494; Texas, 8,906; Pennsylvania, 7,201; Ohio, 6,371; and Illinois, 6,026. Louisiana, Oklahoma, Arkansas, and New Mexico trail Texas by a substantial number of establishments. Again, the number of establishments and sales of food and beverage stores seems to be positively correlated with the population of the state. Thus California and Texas have more establishments and higher sales than less-populous states such as New Mexico (See Table 2).

Ratio Analysis of Agriculture and Food Manufacturing

In order to investigate value-added food industries in more depth, we develop some statistical ratios that can be used as benchmarks. Observers often find it useful to compare value-added manufacturing to the value of agricultural production. It is a concern to policy makers in states that depend on agriculture that the state share in the potential of the products' total value. Thus agriculturally based ratios were developed.[1] It is also of interest to focus on the value-added component exclusively within food manufacturing industries. To that end a margin-type ratio was developed to compare the value-added contribution to the total value of shipments of processed food. This ratio will indicate something about the stage of processing of the manufactured foods, with higher value added indicating foods that are more nearly consumer-ready, with advanced preparation, or other highly desired qualities. The third ratio compares the value added produced in each state with their relative size based on population.

[1] Some of the ratios presented here rely on prior work by Siebert and Nichols.

Value Added Compared to Agriculture

The agricultural ratio compares value added in food manufacturing to farm receipts from foodstuffs. Farm-receipts data (from USDA) were adjusted to include only the receipts for commodities that will be used as food. Items such as cotton, wool, mohair, tobacco, seed crops, etc. were excluded from the total farm receipts. Due to the disclosure problems in beverage value added in the United States Economic Census for 1997 we excluded the beverage manufacturing industry. This is a reasonable comparison, since many beverages have relatively little agricultural content. Hence, the ratio was computed as follows:

$$\text{Value-Added Contribution} = \frac{\text{Food Value Added}}{\text{Adjusted Farm Receipts}}$$

Pennsylvania is the leader in food value added relative to agricultural production in 1997, followed by Ohio, Illinois, Texas, and California (See Table 3). To some extent the large agricultural sector of a state will decrease its ranking in this ratio. Some of the farm production contributes directly to the economy of the state because of its freshness and high demand among consumers in U.S. and domestic markets. These are higher-value agricultural products. Yet there is no processed value added recorded in the statistics, thus reducing the states' ranking. The citrus industry, for example, ships much of its product as higher-value fresh commodities. Another important factor underlying these rankings is the strong manufacturing tradition in the Northeast and Midwestern states.

The 1992 and 1997 value-added contribution for the top five value-added states and the Texas border states were compared. Two of the top five states, Illinois and California, experienced a decline in value-added contribution. California experienced a decline of 16.31 percent from .95 in 1992 to .79 in 1997, and Illinois' ratio decreased by 2.05 percent from 1.46 in 1992 to 1.43 in 1997. However, the United States' ratio experienced an increase of 7.75 percent from .87 in 1992 to .94 in 1997. A possible explanation for the decrease in California, Illinois, and Louisiana is new agricultural technologies, such as precision agriculture, that have led to an increase in productivity in the agricultural sector. The increase in the other states—Penn-

sylvania, Ohio, Texas, Arkansas, Oklahoma, and New Mexico—can be attributed to a renewed focus on value-added food-manufacturing initiatives in these states. Louisiana was the only Texas border state that experienced a decrease, falling by 20.26 percent from 1992 to 1997; the others increased their ratios (See Table 3).

Manufacturing Value-Added Margin

This ratio indicates how many dollars of value added are produced for each dollar of food processed in a state. This measure focuses directly on the manufacturing component of food. Thus, the ratio is computed as follows:

$$\text{Value-Added Margin} = \frac{\text{Food Value Added}}{\text{Value of Processed Food Shipments}}$$

The United States national average for value-added margin was .39 in 1997. This has increased from.37 in 1992 because of more value-added food-manufacturing initiatives, triggered by consumer preferences for convenience and health foods. The ranking of value-added margin for the top five value-added states is: Ohio, Pennsylvania, Illinois, California, and Texas. This means that the three Midwestern states produce more value added per dollar of processed food shipments than Texas and California. Ohio, Pennsylvania, and Illinois are traditionally manufacturing states, producing high-value-added products from raw commodities. For example, Pennsylvania's Hershey Foods creates high-value chocolate products from cocoa beans and sugar, which are not produced in the state, thereby increasing the value added compared to the total shipments. In addition, Ohio and Illinois have large amounts of grain processing and meat-packing operations that increase value added. On the other hand, Texas produces an array of food products such as beef and fresh produce that do not require much processing and therefore do not contribute much value added to this measure (Table 3).

The value-added margin for the selected states, the Texas border states, and the United States was evaluated through time. The United States' value-added margin showed an increase of 6.15 percent

Table 3. Performance Ratios for Food Manufacturing Industry for Selected States and the U.S., 1992 and 1997.

States	Adjusted Value-Added Contribution			Value-Added Margin			Value Added Per Capita		
Top Five	**1992**	**1997**	**% Change**	**1992**	**1997**	**% Change**	**1992**	**1997**	**% Change**
Pennsylvania	2.46	2.58	4.75%	0.44	0.45	0.91%	665.52	759.83	14.17%
Ohio	1.86	1.89	1.87%	0.46	0.50	7.02%	588.97	791.40	34.37%
Illinois	1.46	1.43	-2.05%	0.42	0.42	0%	893.01	1028.41	15.16%
Texas	0.65	0.96	46.39%	0.31	0.38	21.33%	359.75	517.87	43.95%
California	.95	0.79	-16.31%	0.42	0.42	0%	472.68	520.80	10.18%
Texas Border States									
Louisiana	1.14	0.91	-20.26%	0.40	0.32	-19.91%	378.54	365.36	-3.48%
Arkansas	0.56	0.71	27.22%	0.27	0.34	24.46%	959.99	1428.13	48.77%
Oklahoma	0.30	0.34	14.88%	0.36	0.32	-11.76%	301.33	358.40	18.94%
New Mexico	0.15	0.23	55.70%	0.34	0.39	15.48%	123.30	222.43	80.40%
United States	0.87	0.94	7.75%	0.37	0.39	6.15%	501.90	616.38	22.81%

Note: Sorted by 1997 Adj. Value-Added Contribution
Adjusted Value Contribution = Food Value Added / Adjusted Farm Receipts
Value-Added Margin = Food Value Added / Food Value of Shipments
Value Added per Capita = Food Value Added / Population
Source: U.S. Census Bureau (2001b) and Economic Research Service.

from .37 in 1992 to .39 in 1997. Similarly, all of the leading value-added states' margins increased or stayed the same from 1992 to 1997. Texas experienced the greatest change of the top five states, a change of 21.33 percent from .31 in 1992 to .38 in 1997. However, in terms of percentage change of value-added margin only Arkansas was greater than Texas, increasing 24.46 percent from .27 in 1992 to .34 in 1997. The only states that experienced a decrease in this margin were Louisiana (a decrease of 19.91 percent) and Oklahoma (a decrease of 11.76 percent). One possible reason for the increase in value-added margin is that food-manufacturing companies are increasing their production of convenient and health-food items, products that carry higher value added per dollar of shipment (See Table 3).

Value Added Per Capita

The third ratio, value added per capita, compares the value added that food manufacturers produce in a given state with that state's population. This is an effective measure since it standardizes all states based on population. Hence, populous states such as California may be compared more effectively to less-populous states such as Wyoming. The ratio is computed as

$$\text{Value Added Per Capita} = \frac{\text{Food-Manufacturing Value Added}}{\text{Population}}$$

In 1997 Illinois ranked the highest of the top five value-added states in value added per capita, with a measure of $1,028.41 per person. Ohio ($791.40), Pennsylvania ($759.83), California ($520.80), and Texas ($517.87) follow. Arkansas leads all selected states in value added per capita, with $1,428.13. A possible reason is that Arkansas has a fairly low population compared to other states. Furthermore, this state is the leader in chicken processing in the United States and supplies a majority of the country. Louisiana, Oklahoma, and New Mexico trail all of the selected states (Table 3).

All of the selected states except for Louisiana experienced an increase in value added per capita from 1992 to 1997. The United States increased its value added per capita by 22.81 percent from $501.9 in 1992 to $616.38 in 1997. The greatest percentage changes were observed in New Mexico (80.40 percent), Arkansas 48.77 percent), and Texas (43.95 percent). This is encouraging for these three states, as they see that their efforts in improving value added have been successful. A potential reason for the increase in this ratio is that customer preferences have switched to convenient, healthy, and high-value-added products (See Table 3).

Food-Retail Ratios

Food retail is an important sector that adds value to food products through the preparation of meals and services that it provides. For example, the Outback Steakhouse adds value by preparing and cooking steaks and serving them to its customers. Little attention has been placed on this sector of value added in the past, as most analysis of Census data focused on the manufacturing businesses. However, the value added at retail is as important as adding value through manufacturing. The new NAICS classification system enables us to examine dollar value of sales through retail outlets but it is limited to 1997 due to the complexities of coordinating the SIC system with NAICS codes. Three ratios were used to analyze the contribution of food retail to the food system in major states. It should be noted that these ratios are calculated using dollar values of sales, not value added.

Retail Sales Compared to Agriculture

The first ratio used—"retail contribution"—compares total sales of grocery stores and restaurants (i.e. food and beverage stores and places) to total agricultural output (Siebert). While there is little intuitive basis for expecting agricultural locations to be associated with significant retail sales, this ratio indicates that the contribution of the retail food sector should be considered when evaluating the entire foods system. The formula is

$$\text{Retail Contribution} = \frac{\text{Food and Beverage Stores and Places}}{\text{Total Ag Output}}$$

Food and beverage drinking stores is the sales for NAICS 445 and *sales for food services and drinking places* is NAICS 722.

While evaluating the retail contribution ratio we find that the United States average is 3.15. In other words, for each dollar of agricultural produc-

tion, there is $3.15 spent by customers in grocery stores, convenience stores, and food away from home. Regarding the leading states, Pennsylvania ranks first with 7.01, followed by Ohio (5.06), Texas (3.53), Illinois (3.14), and California (3.10). Compared to its border states, Texas ranks second behind Louisiana with 4.29. Following Texas are New Mexico with 1.95 and Oklahoma with 1.73 (See Table 4).

Food Consumption Away from Home

The second ratio relating to retail food value tells how much people eat away from home compared to how much food they purchase in total. The data are sales in food places (restaurants and drinking places) and are not from expenditure surveys. The ratio is computed as

$$\text{Food Away From Home} = \frac{\text{Sales of Food and Beverage Places}}{\text{Sales of Food and Beverage Places and Stores}}$$

Or

NAICS 722 / (NAICS 445+ NAICS 722)

The food-away-from-home ratio was compared to the leading states and its bordering states. Illinois leads this category with a ratio of .42, followed by Ohio (.40), Texas (.39), California (.39), and Pennsylvania (.34). Comparing Texas to its border states, Texas is tied for third with Louisiana; Oklahoma and New Mexico are the leaders with a food-away-from-home ratio of .42. Arkansas lags behind the other states with a food-away-from-home ratio of .38 (See Table 4).

Notable growth occurred in sales of food away from home between the Census years 1992 and 1997. The average United States sales on food away from home was 35 percent of total food retail sales in 1992. In 1997 the national average increased to 39 percent, a 12.7-percent increase. Iin 1992 Texans spent $0.34 of their food dollar eating away from home. This increased by 15.4 percent to 39 percent of Texas' total retail food and beverage sales in 1997. Texans spend the same share of food away from home as the U.S. average; however, the ratio for Texas has increased at a higher rate than the ratio for the United States (See Table 5).

The location of food and beverage retail stores is directly related to the population of a region. Thus

Table 4. Performance Ratios for Retail Food Industry for Selected States and U.S., 1997.

State	Retail Sales Contribution	Food Away From Home	Retail Sales per Capita
Leading States			
Illinois	3.14	0.42	2,352
Ohio	5.06	0.40	2,368
California	3.10	0.39	2,476
Texas	3.53	0.39	2,407
Pennsylvania	7.01	0.34	2,413
Texas Border States			
Oklahoma	1.73	0.42	1,964
New Mexico	1.95	0.42	2,178
Louisiana	4.29	0.39	2,156
Arkansas	0.82	0.38	1,873
United States	3.15	0.39	2,438

Note: Sorted by Food Away From Home
Retail Sales Contribution = (Sales for NAICS 445 + Sales for NAICS 722) / Farm ReceiptsFood Away From Home = Sales for NAICS 722 / (Sales for NAICS 445+ Sales for NAICS 722)
Retail Sales per Capita = (Sales for NAICS 445 + Sales for NAICS 722) / Population
NAICS 445 = Food and Beverage Stores
NAICS 722 = Food Services and Drinking Places
Source: U.S. Census Bureau (1999a) and (2001b)

Table 5. Retail Ratios Comparison for Texas and the U.S., 1992 and 1997.

	Texas 1992	U.S 1997	% Change	1992	1997	% Change
Food Away From Home	0.34	0.39	15.40%	0.35	0.39	12.70%
Retail Sales per Capita	$2,256	$2,407	6.69%	$2,214	$2,438	10.11%

Source: U.S. Census Bureau (1999a) and (2001b)

retailers are more abundant in densely populated areas such as Dallas-Fort Worth, Houston, San Antonio, and Austin than in smaller cities and towns. Retailers, in turn, have more potential for sales when locating in a highly populated region. Furthermore, the increasing migration into big cities has led to the increase in grocery stores and restaurants.

Retail Sales Per Capita

The last ratio shows food expenditures per capita in the United States and in Texas. In other words, it tells how much the average consumer spends on food. It is computed as

Food and Beverage Stores and places / Population

Or

(NAICS 722 + 445) / Population

In 1997 California was the leader in retail sales per capita with $2,476 being spent on food per person. Pennsylvania ($2,413), Texas ($2,407), Ohio ($2,368), and Illinois ($2,352) follow California in this category. Texas ranks favorably in retail sales compared to its border states and is followed by New Mexico, Louisiana, Oklahoma, and Arkansas (See Table 4).

In 1992 food and beverage retail sales per capita in Texas totaled $2,256. This figure increased 6.69 percent to $2,407.16 by 1997. United States consumers spent $2214 in 1992, which increased 10.17 percent to $2,438 by1997. However, part of this increase can be attributed to inflation during this period. We conclude that the average United States consumer spends about $20 more in food and beverages than the Texas consumer (See Table 5). This difference may suggest that the cost of living and the cost of food are lower in Texas than in other U.S. states. In other words, consumers in other states pay more for similar goods and services than consumers in Texas. For example, in Texas a consumer may spend $13 on a meal, while in New York the same meal sells for $17. Relative wage rates, energy expenses, and many other factors are possible contributors to the regional differences.

Urban or Rural Location of Texas Food Manufacturing

When policy makers raise concerns about the future of rural America, it is often suggested that value-added food processing be located in rural communities to take advantage of agricultural inputs produced in the region and to supplement employment opportunities for rural and farm residents. The Census data already discussed in this report indicates the general level of value-added manufacturing and food retail sectors in 1999 and emphasize some key differences in performance among states. The remainder of this research addresses the location of food manufacturing in rural or urban areas and is focused on Texas.

Information provided by a commercial source (Industrial Development and Site Selection Handbook) was used to provide an indication of the trends in investment locations for the food and beverage industries in Texas (Conway). [2] Texas has shown an increasing pattern of food manufacturing investments in both metropolitan and non-metropolitan areas. From 1988 to 1995 there was a 350-percent increase in the number of projects in metro areas but an increasee of only 20 percent in non-metro areas (Table 6). Most of these new investments were located in the Houston and Dallas/Fort-

[2] Conway Data, Inc., publishes a variety of site selection media for businesses, and is involved with research, consulting, and other services in the development arena. The data for Texas for 1988 and 1995 were readily available; information for additional years was not gathered due to cost considerations.

Worth metro areas (See Table 6).

The combined number of metro and non-metro food and beverage investments increased by 236 percent from 1988 to 1995. Beverage-related investments doubled in number during the same period, and other agriculturally related investments decreased by 14 percent (Figures 1 and 2). This large increase in food and beverage investments can be attributed to several factors. First, the significant increase in population in metro areas during this period lured demand-driven investments into these cities. In 1988 five of the eight investments (63 percent) in metro areas were demand driven. Similarly, demand-driven investments in 1995 accounted for 60 percent of the total investments in Texas' four largest cities, Austin, Dallas, San Antonio, and Houston (Table 7). A second reason for the increase in investments was that the economy was much better in 1995 than in the late 1980s. Thus the recession in the 1980s slowed the investments of private companies.

In Table 8 we identify the non-metro investments undertaken by Texas food-manufacturing companies. In 1995 there were two "footloose" investments in Texas, Blue Bell Creameries' expansion of their ice cream manufacturing plant in Brenham and Russell Stover Candies' new plant in Corsicana. The companies are able to meet the demand for their product from these rural locations. The other investments fit into the "agriculturally related" category of the Connor classification. They locate their plants where their inputs are produced.

Table 6. Number of Agribusiness Investments in Texas by Metro Area.

	1988	1995
Houston	4	8
Dallas/Fort Worth	4	27
San Antonio	1	4
Austin	0	2
Non-metro	5	6
Total	14	47

Source: Conway Data, Inc.

Table 7. Number of Investments in Metro Areas by Category, 1988 and 1995.

Metro Areas	Demand Driven		Footloose		Agriculture Related	
	1988	1995	1988	1995	1988	1995
Dallas	3	15	1	3	0	6
Houston	2	3	1	1	0	1
San Antonio	0	1	0	2	1	1
Austin	0	2	0	0	0	0
Total	5	21	2	6	1	8

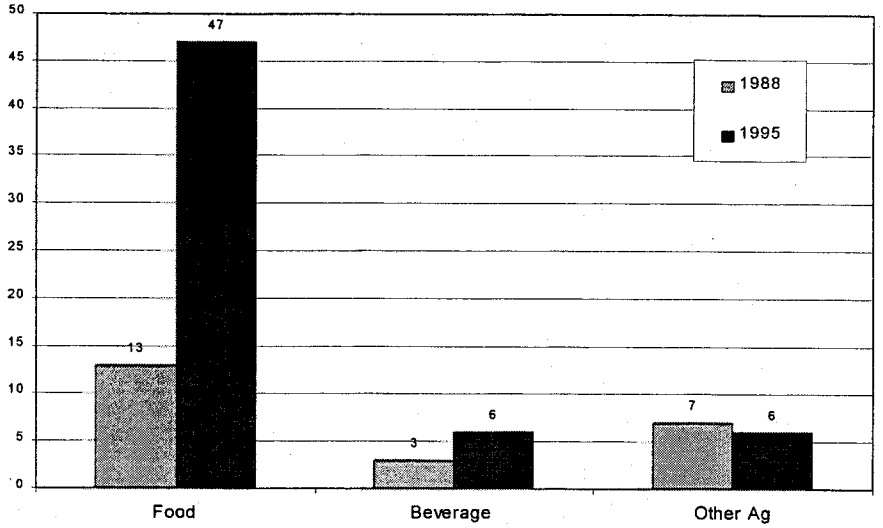
Source: Conway Data, Inc.

Table 8. Non-metro Agribusiness Investments: 1995.

Location	Company	Industry	$ Value (million)	Type
Brenham	Blue Bell Creameries	Ice Cream Products	5.7	Expansion
Clayton	Premium Standard Farms	Pork Processing	n.a	New plant
Corsicana	Russell Stover Candies	Candy	25	New plant
Hughes	Great American Foods	Catfish Processing	n.a.	New plant
Nacogdoches	Green Acre Foods	Chicken Processing	1.2	Expansion
Uvalde	Dean Foods Vegetable	Carrots	3	Expansion

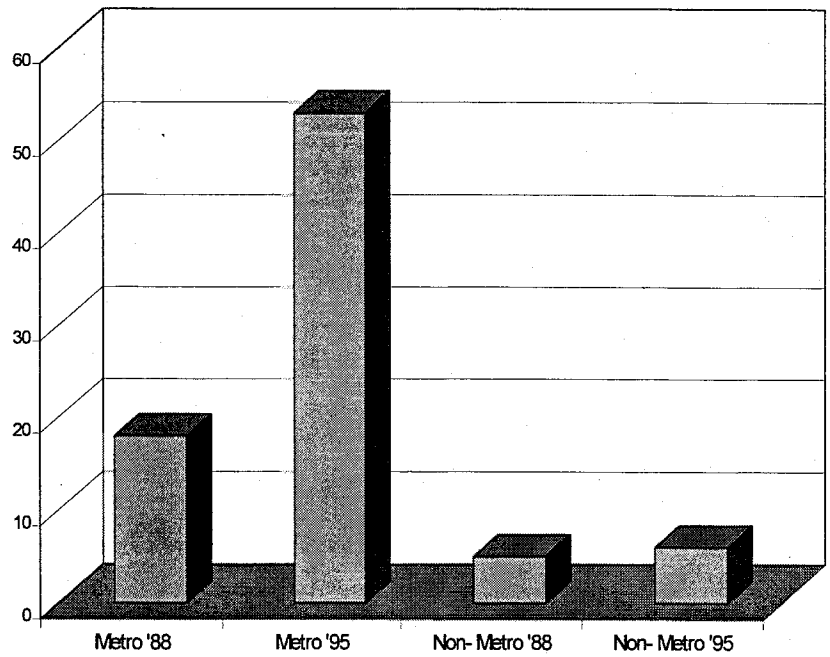
Source: Conway Data, Inc.
n.a. = Not Available

Figure 1: Number of Agribusiness Investments in Texas by Product Type



Source: Conway Data, Inc.

Figure 2: Number of Agribusiness Investments in Texas by Location



Source: Conway Data, Inc.

Table 9. Number of Food Manufacturing Establishments in Texas by County, 1997.

County	No. of Establishments	Value Added ($1000)	Value of Shipments ($1000)	Value-Added Margin
Angelina	7	94,954	322,736	0.29
Bexar	127	512,928	1,178,816	0.44
Cameron	47	90,745	271,252	0.33
Collin	11	D	D	D
Cooke	7	D	D	D
Dallas	179	2,184,181	4,027,797	0.54
Deaf Smith	13	114,021	355,175	0.32
El Paso	62	110,301	272,862	0.40
Fort Bend	14	174,230	512,645	0.34
Gonzales	8	37,165	160,365	0.23
Grayson	17	888,838	1,492,563	0.60
Guadalupe	9	D	D	D
Hale	10	D	D	D
Harris	222	1,007,620	2,305,037	0.44
Hidalgo	50	107,244	264,763	0.41
Lamar	7	D	D	D
Lubbock	32	144,765	424,057	0.34
McLennan	19	716,731	1,128,705	0.64
Moore	3	D	D	D
Nacogdoches	7	48,541	279,893	0.17
Nueces	20	D	D	D
Panola	2	D	D	D
Parmer	5	D	D	D
Potter	14	D	D	D
Reeves	2	D	D	D
Shelby	5	D	D	D
Smith	12	69,437	155,432	0.45
Tarrant	91	654,788	1,736,977	0.38
Titus	8	D	D	D
Tom Green	17	46,021	212,576	0.22
Travis	55	D	D	D
Washington	7	D	D	D
Wilbarger	3	D	D	D

Source: U.S. Census Bureau (2001b)
D: not available due to disclosure of proprietary information
Note: Italicized counties are metropolitan areas

Table 11. Number of Establishments by Metro Area, 1997.

Metro Area	No. of Food Mfg. Establishments	No. BeverageEstablishments	Total
Austin-San Marcos	55	0	55
Houston	236	14	250
Dallas/Fort Worth	281	18	299
San Antonio	136	14	150

Source: U.S. Census Bureau (2001b)

Table 10. Number of Beverage Establishments in Texas by County, 1997.

County	No. of Establishments
Bexar	14
Dallas	13
Harris	14
Tarrant	5

Source: U.S. Census Bureau (2001b)

For example, Dean Food Vegetables' expansion was located in Uvalde, a region in South Texas known for its vegetable production.

The number of investments is an important measure of value-added initiatives but it is incomplete. It would be useful to know the size in terms of employment and the value of output from these new investments, but detail is not available.

The Conway data suggests the dominance of demand-driven types of food companies in Texas. Census information corroborates this finding. Using the Economic Census data, we observed the number of establishments, value added, and value of shipments of the Texas counties that have food and beverage manufacturing enterprises (Tables 9 and 10). Due to the Census restrictions on disclosure, value added and value of shipments for each metro area could not be aggregated. Table 11 summarizes the number of food and beverage establishments by metropolitan area. The Dallas-Ft. Worth metroplex has the largest number of establishments, followed by Houston, San Antonio, and Austin-San Marcos (Table 11). One of the reasons may be that Dallas-Ft. Worth has the largest population in the state. Its location near major interstate highways such as Interstate 35, Interstate 30, and Interstate 20 is ideal for distributing its products all over Texas and other states. More importantly, Interstate 35 is known as the "NAFTA" (North American Free Trade Agreement) corridor and crosses Austin, San Antonio, and Dallas-Ft. Worth. Interstate 35 is very important since it is a highly used trade route between Mexico, the United States, and Canada.

Two data sources confirm that, in terms of number of firms, metropolitan locations are the primary beneficiaries of value-added food industries. Further analysis was conducted to determine if the value-added margin is also stronger in rural areas. If so, then not only are there more firms involved in food manufacturing in metro areas than in rural areas, but those in the metro areas have a higher share of value added in their shipments than do the rural food manufacturing firms. Census data were utilized to investigate this issue.

The counties were grouped into metropolitan and non-metropolitan areas through the use of a dummy variable; a 'one' represented a metropolitan county and 'zero' a rural. It should be noted that not all counties in Texas that have value-added food businesses were included in the analysis, because some data were undisclosed due to confidentiality concerns (data are shown in Table 9). A linear regression was run, with the dummy variable as the independent variable and the value-added margin for the county as the dependent variable. The value-added share of total shipments was 72 percent higher in metropolitan counties.[3] [[3] The estimated coefficient on the dummy variable was statistically significant at the .95 level (p-value 0.013). R^2 was 0.346, and sample size was 17, of which 4 took the value of zero for the dummy variable.] Metropolitan counties yield an average value-added margin of 0.43, while rural counties have a margin of 0.25. Thus from this limited analysis it appears that the food processing firms in rural areas add relatively less value to their agricultural inputs than do their metropolitan counterparts.

Conclusions

While many statistical benchmarks can be useful for industry or policy decisions, we recommend two ratios for evaluating the value-added food-processing industries.[4] [[4] Other ratios considered for this research but not published here are available from the authors upon request.] First, the "adjusted value-added contribution" ratio is preferable as a comparison of value-added output to farm output because it correctly limits the agricultural measure to food products. This ratio will help identify locations that have been successful in increasing value-added processing.

We showed estimates of the value added for major agricultural producing states. Nationwide the value added contribution of U.S. food processing is, on average, very close to the value of agricultural production, with a ratio of .94. The highest

value added relative to farm production occurred in Ohio and Pennsylvania, yielding adjusted value-added contribution ratios of 1.9 and 2.6 times agricultural production, respectively. California and Texas, two states that lead in agricultural production, have substantial value-added processing in whole numbers, but their ratios are not as great as Ohio's and Pennsylvania's when compared to their substantial agricultural output.

The second useful indicator developed is the "value-added margin." This ratio is recommended for analysis of food processing industries. It measures the value-added portion compared with the total value of shipments of processed foods and therefore measures further processing. It will help to distinguish high-value-added consumer-ready food products from these sectors that perform only initial processing. U.S. food-value added averages 39 percent of the total value of processed food shipments. Pennsylvania, Ohio, Illinois, and California exceed this margin, with a margin of 42 percent or greater for each state. Texas is below the national average, as might be expected from a state with a food industry in which over one-fourth of the value added is in meat packing and processing.

These statistical measures provide the data needed for a broad perspective on food industries in leading states. Another primary concern with respect to value added is more microeconomic in nature, namely the location of food processing in metro and rural areas. Connor's theory about location decisions was supported by our analysis of food-industry investments in Texas. The largest number of new investments in 1988 and 1995 occurred in metro areas, primarily Dallas. Examples of food businesses that invested in rural areas were of the "footloose" category and vertically integrated operations that encompass processing and contract farm production. These data indicate that rural areas are attractive to certain special types of firms but not to the vast majority of food processing businesses. Hence, transportation links will be critical for rural areas to remain efficient suppliers to metropolitan processors. In areas experiencing aging rural infrastructure and restructuring of railroads, this challenge is especially difficult.

As a complement to the statistical benchmarks for the food processing industry, we presented ratios for the value of food output at retail and food service establishments. The "retail contribution" ratio shows that the value of U.S. output in food and beverage retail firms is over three times the value of agricultural production.

The value of output of the restaurant industry (including beverage establishments) is about 39% of the total food retail sales, and has grown rapidly since 1997. These statistics support the general trend of increasing consumption of food away from home and suggest that agricultural producers will have an increasing opportunity to meet specific demand for products destined for restaurant and food service use.

While the value added in food manufacturing and retailing presents opportunities for farm producers, the pattern of location of value added industries suggests that rural areas face difficulties in attracting manufacturing. Rural areas may have a competitive advantage in attracting agriculturally related businesses, yet the dominant portion of value added as a share of food shipments continues to be from food manufacturers located in metropolitan areas.

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