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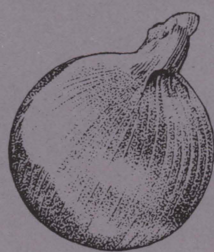
Expanded Marketing Opportunities for Dry Onion Production in Texas: An Interregional Analysis of the Spring and Summer Seasons



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Expanded Marketing Opportunities for Dry Onion Production in Texas:

An Interregional Analysis of the Spring and Summer Seasons

Stephen Fuller, H. L. Goodwin, Carl Shafer, and John Schmitz[1]

[1]Professor, associate professor, professor, and research assistant in the Texas A&M University Department of Agricultural Economics.

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Introduction

For over a decade, dry onions have been the most valuable vegetable crop produced in Texas, typically comprising 16 to 20 percent of the state's vegetable revenues (Texas Department of Agriculture 1976-1986). Texas is an important national supplier of fresh onions. During the 1985-87 period, the share of onions supplied by Texas to the national market averaged nearly 14 percent. This figure compares with a market share which averaged about 21 percent during the 1977-79 period. The decline in market share is the result of a modest decline in Texas shipments and a substantial increase in shipments by competing production regions. The purpose of this study is to analyze the declining share of the dry onion market held by Texas producers and evaluate opportunities to expand the marketing of Texas-produced onions.

Background

United States

The United States Department of Agriculture segregates dry onions by maturity period or harvest period. These include (1) the Spring onion, (2) the Summer non-storage onion, and (3) Summer storage onion crops. The Spring onion crop comprises about 15-18 percent of national onion production and is produced primarily in south Texas, Arizona, and California. Spring onions are the first-harvested of the calendar year, and typically they move directly to the fresh market. Texas, New Mexico, and Washington are the primary producers of Summer non-storage onions which, on the average, account for about 10 percent of national production. The Summer storage onion constitutes about 70-75 percent of total onion production in the United States. This crop is harvested during the August through October period with subsequent shipment continuing through the fall and early spring (April). The storage onion receives no competition from new onion production in the United States until Spring onion harvest commences in March. Imported new onions from Mexico during the winter and spring, however, offer some competition for the storage onions. There are about twelve states involved in the production of storage onions. Leading states include Oregon, New York, Colorado, Idaho, Michigan, and Washington (USDA 1976-1987).

During the 1975-77 period, per capita consumption of onions averaged about 14 pounds (USDA, Vegetable Situation and Outlook Yearbook, 1978). The increase in per capita consumption of fresh onions and other salad-vegetables (broccoli, cauliflower, tomatoes, and lettuce) is often attributed to health-conscious consumers who are increasing their consumption of fresh vegetables and away-from-home consumption that often includes both fresh and processed onion products. Per capita consumption of onions has also benefited from the increased consumption of ethnic foods, in particular Mexican foods, which often include liberal quantities of onions. An estimated trend line, based on 1970-85 per capita onion consumption, and expected population growth were used to project mid-1990 onion consumption. The trend line showed per capita consumption to increase by .29 pounds per year and population to increase 19 million over the 1985-95 period. With this scenario, onion consumption could increase about 10,500 cwts over this period, or approximately 25 percent.

Texas

About three-fourths of the harvested dry onion acreage in Texas is located in south Texas, in particular, in the Rio Grande Valley (62%), San Antonio-Winter Garden (10%), and Laredo (3%) regions. The remaining onion acreage in Texas is located in the High Plains (16%) and Trans-Pecos (9%) regions (Texas Department of Agriculture 1976-1986). The south Texas area is the primary source of the state's Spring onion production, while the Plains and Trans-Pecos areas are producers of Summer onions (nonstorage). During the past decade, about 94 percent of the south Texas onions have been shippped to the fresh market with the remainder merchandized as ringers or chopped, frozen, and sold to food processors (South Texas Onion Committee Report 1975-1985).

The shipment of Spring onions from south Texas commences in March and peaks in April and May. On the average, about 63 percent of the dry onion shipments from Texas are in three months: March (4%), April (29%), and May (30%). The remaining shipments are concentrated in June (10%), July (16%), and August (10%). The March-May shipments are Spring onions that originate in south Texas while the June-August shipments tend to be Summer onions that originate in the remainder of the state's production regions. As shown by the information in Table 1, the portion of annual shipments from Texas during April is trending upwards. The share of annual shipments in April has increased from about 20-25 percent (late 1970s) to nearly one-third in recent years. Conversely, the share of annual shipments made by Texas producers in June has edged downward from 14 percent to 9 percent. No discernable trends were observed for other shipping months.

Dry Onion Market Shares and Competing Regions

The 1977-87 annual dry onion shipments for the major producing states are shown in Table 2. This information illustrates the dramatic increase in fresh shipments from an average of 1.97 billion pounds in the 1977-78 seasons to 2.88 billion pounds in the 1986-87 seasons, a 46 percent increase.

To gain information on the changing market shares of the various producing states, annual market shares were calculated for the 1977-78 and 1986-87 seasons and then contrasted. In the 1977-78 seasons, Michigan, New York and Texas had a cumulative market share of 44 percent; this contrasts with their 1986-87 share of 29 percent. Dry onion shipments from New York tended to remain relatively constant over this period while total shipments increased. As a result, the New York market share declined. In Michigan and Texas, actual shipments declined; in particular, Texas shipments declined about 10 percent. As a result, Texas' share of the national market declined from 23.7 percent in 1977-78 to 14.6 percent in 1986-87, the largest decline of any state. In contrast, the cumulative market share of California, Colorado, Idaho, Georgia, Oregon, Utah, and Washington increased from about 48 to 64 percent during the 1977-78 to 1986-87 period. The most substantial gains in market share were made by California, Colorado, Oregon, and Washington, plus new entrants, Georgia and Utah.

More complete information on the declining market share claimed by Texas producers, during their March-September market window, is developed by examining market share by month. During March and September, the Summer storage onion producing regions (Pacific Northwest, Colorado, Michigan, and New York) dominate. By April, however, Spring non-storage onions from Texas, California, and Arizona claim important market shares. In May, these states and New Mexico are preeminent. Summer non-storage onions from Texas, Washington, California, and New Mexico vie for the July market window, while these states, in conjunction with storage onion producing states, compete for the August market (USDA 1977-1987).

Monthly market share for April, May, June, July, and August was calculated for Texas and competing regions during the 1977-87 period. This exercise showed monthly market share in Texas to be trending downward in all months except April. During April, Texas shippers consistently claimed 60-80 percent of the national market. This finding is, in part, corroborated by the information in Table 1, which shows an increasing share of Texas onions to be shipped in April, a period when competing regions face climatological constraints.

Further analysis showed that much of Texas' declining market share in May, June, July, and August had been claimed by California producers. During May, California's 1977-79 average share was 22 percent, while the 1985-87 share was 41 percent. Conversely, the market share held by Texas in May declined from 69 to 41 percent. The changing role of California and Texas in the fresh onion market over the 1977-87 period is shown in Figure 1. Other competing regions showed no definite trend; however, Georgia's increased role since 1983 has typically claimed 4 to 8 percent of the May window.

Historically, Mexico has originated about 80 percent of the dry onions imported into the United States. These imports represent about 3-5 percent of total dry onion shipments in the United States. On the average, about 60-70 percent of the imports from Mexico are received in the March-June window and most enter via Texas crossing locations (USDA 1977-1987). There is no conclusive evidence that the imports from Mexico have played a significant role in the decline of dry onions shipped by Texas producers.

Table 1. Dry onions: percent of Texas' annual shipments per each March, April, May, June, July, and August shipping period, 1977-1987.[1]

Year	%					
	March	April	May	June	July	August
1977	0.0	21.7	33.6	14.4	19.2	10.4
1978	4.8	24.7	31.0	12.5	18.0	8.6
1979	0.4	23.3	39.9	7.6	11.1	15.1
1980	5.4	29.3	25.9	11.3	19.3	8.1
1981	2.1	29.2	28.5	10.9	18.9	10.3
1982	12.7	34.1	20.6	10.1	14.2	8.2
1983	5.6	29.5	27.4	9.9	12.4	12.7
1984	0.4	31.5	31.7	7.9	17.3	10.5
1985	3.0	31.2	36.1	7.0	12.5	9.9
1986	5.4	35.4	23.6	9.6	19.0	6.8
1987	2.2	35.6	35.1	9.0	12.3	5.8

[1]Yearly shipments may not total 100 percent because of September and October shipments. In 1979 and 1983 these months included about 2.5 percent of annual shipments.

Source: U. S. Department of Agriculture, Agricultural Marketing Service, Fruit and Vegetable Division, Fresh Fruit and Vegetable Shipments by Commodity, States and Months, FVUS-7, 1977-87.

Table 2. Dry onions: estimated U.S. domestic shipments, exports, imports, 1977-87, by calendar year (1000 cwt).

Origin	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
Arizona	437	377	333	496	482	665	638	802	554	538	530
California	3,044	2,616	3,534	3,189	3,682	4,879	4,065	4,226	4,714	4,892	5,343
Colorado	1,532	1,994	1,694	1,616	2,244	2,126	2,573	2,817	3,404	3,178	3,312
Georgia	---	---	---	---	---	150	407	170	165	280	369
Idaho	1,559	1,806	1,563	2,041	2,178	1,944	2,188	2,431	2,597	2,776	2,910
Michigan	1,513	1,404	1,749	1,410	1,500	1,533	1,455	1,723	1,910	1,287	1,160
New Mexico	1,038	1,119	948	1,165	1,210	1,631	1,225	1,331	1,318	1,609	1,656
New York	2,462	2,732	3,545	3,616	3,499	3,808	2,999	2,908	3,156	3,144	2,617
Oregon	2,418	2,774	2,587	3,638	3,029	2,672	3,054	3,066	3,773	4.106	4,710
Texas	4,252	5,104	3,522	5,071	4,168	4,382	5,254	4,116	3,321	4,803	3,565
Utah	13	4	12	24	15	13	4	323	578	473	655
Washington	86	1,019	985	1,350	1,006	857	1,477	1,300	1,307	1,619	2,013
Other	30	20	17	6	7	5	4	1	4	0	9
U.S. Domestic Shipments	18,384	20,969	20,489	23,622	23,020	24,665	25,343	25,214	26,801	28,705	28,849
U.S. Exports	1	2	191	421	1,977	343	724	1,870	634	1,104	898
Texas Exports	1	2	8	28	0	0	0	141	77	105	0
Total U.S Shipments	18,385	20,971	20,680	24,043	24,997	25,008	26,067	27,084	27,435	29,809	29,747
Total U.S. Imports	1,438	1,365	1,548	862	917	1,246	1,431	1,839	1,768	1,577	2,434

Source: USDA, AMS, Fruit and Vegetable Division. Fresh Fruit and Vegetable Shipments By Commodities, States and Months. FVUS-7. 1977-1987.

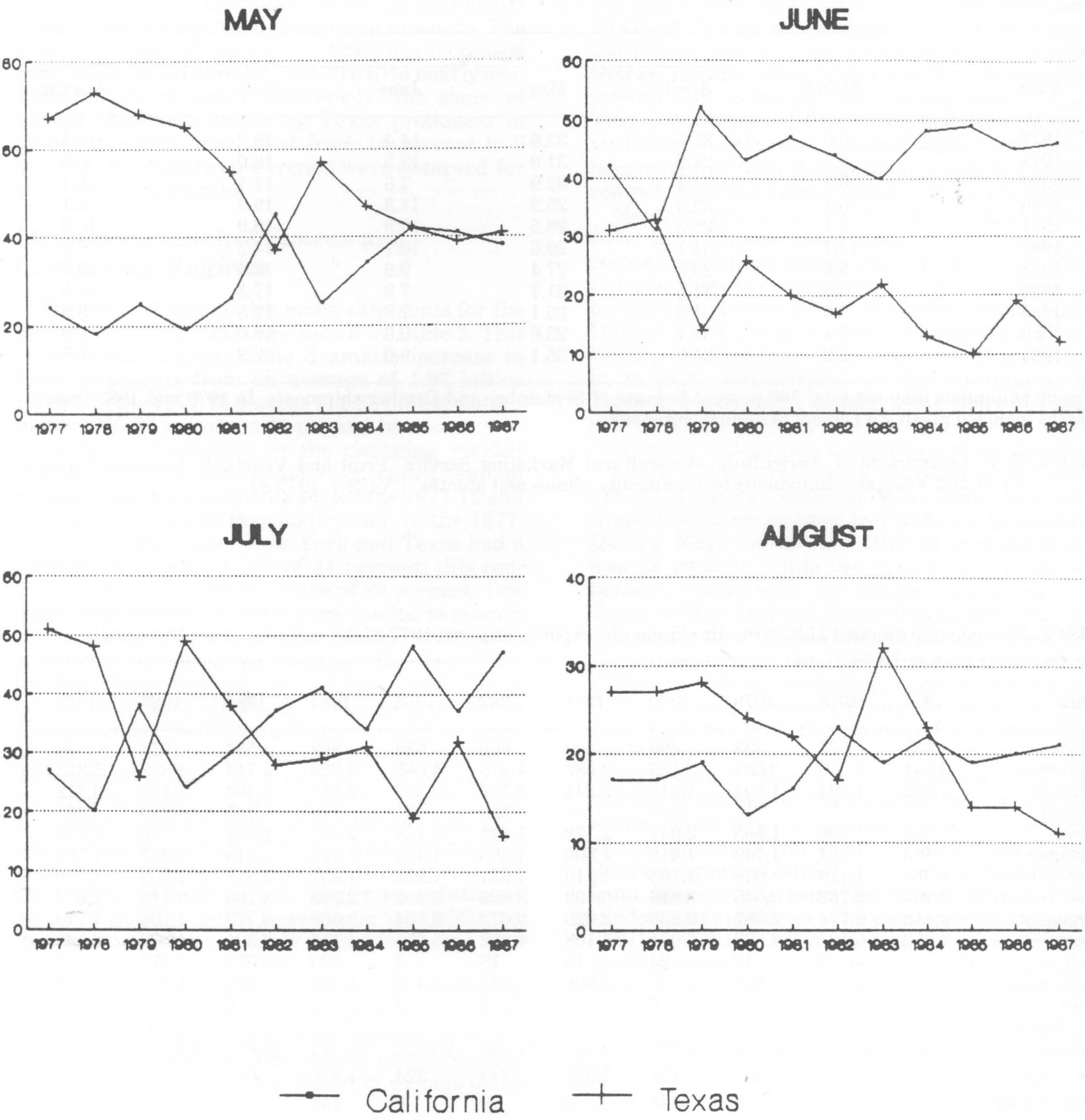

Figure 1. Trends in California and Texas market share, 1977-87.

Purpose

Shifts in the relative importance of Texas as a national supplier of dry onions has generated a need to learn more about its competitive position. To study this issue requires a complex of economic information on competing regions and associated production costs, regional demands, and transfer costs. The objective is to determine the cost-competitiveness of Texas onions in the national dry onion market and identify windows where Texas shipments may be increased. Although the analysis is accomplished with a national model, the focus of the research is on Texas and its competitors.

Framework for Analysis

Theoretical

In a competitive environment, the type and quantity of commodities produced in a region reflect an efficient utilization of resources. Efficient resource use implies a geographical distribution of production that satisfies market requirements at the lowest possible cost of production and transfer. Often the observed changes in location and volume of production may be considered an adjustment toward a long-run equilibrium (Bressier and King 1970).

Analytical

The study uses a spatial equilibrium model to address the competitiveness issue, in particular, a transportation model. The model includes each surplus region's monthly producer price, which is used as a proxy for cost, and monthly transportation charges, which link surplus producing regions and consumption regions. Based on this information, the model determines the most efficient regional trade patterns, i.e., the producing regions which can serve demand regions at lowest cost as well as the flow between regions. To the extent these flows approximate historic flows, a tool is available to measure changes in shipping patterns that result from an induced stimuli (e.g., transportation rates or producer costs).

The model can be expressed in mathematical notation as follows:

Let:

i = onion producing region ($i = 1,.....n$)

j = onion consuming region ($j = 1,.....m$)

k = months of year ($k = 1, 2, 3,.....,12$)

Q^s_{ik} = quantity of onions produced in region i in time period k

Q^c_{jk} = quantity of onions consumed in region j in time period k

S_{ijk} = quantity of onions shipped from region i to region j in time period k

TC_{ijk} = transfer cost linking region i to region j in time period k

P_{ik} = shipper price (cost) in region i in time period k

The objective is to determine the S_{ijk}'s which minimize,

$$\sum_{i=1}^{n} \sum_{j=1}^{m} \sum_{k=1}^{12} P_{ik} + S_{ijk}TC_{ijk}$$

Subject to,

$$S_{ijk} \geq 0$$

$$Q^s_{ik} \sum_{J=1}^{m} S_{ijk}$$

$$Q^c_{jk} \sum_{i=1}^{n} S_{ijk}$$

$$\sum_{i=1}^{n} Q^s_{ik} = \sum_{i=1}^{m} Q^c_{jk}$$

Data Components of Model

Substantial data and background information are required to construct the transportation model. There is a need to (1) delineate production and consumption regions; (2) estimate available supplies in each producing region; (3) estimate consumption in each consumption or demand region; (4) estimate regional production costs or prices; and (5) estimate transportation charges that link production and consumption regions.

Demand and Supply Regions

The developed trade model includes 34 regions: fourteen supply regions and 20 consumption or demand regions. Monthly onion supply for each of the regions was based on an average of 1983-85 shipments. The estimated monthly supplies for each producing region are included in the model and are identified in Table 3. These data originate with the Agricultural Marketing Service (AMS). The AMS report provides information on monthly domestic shipments by truck, rail, and piggyback (trailer on flat car) from each major producing state (USDA 1977-87).

The consumption of fresh onions was estimated with data from the Nationwide Food Consumption Survey (NFCS) and the Census of Housing. The Food Consumption Survey contains comprehensive and detailed data on food consumption patterns. The survey data indicates the frequency and quantity of fresh onion consumption (lbs/week/household) in four regions of the United States (West, South, Northeast, Northcentral) in each season of the year. It was assumed that any regional differences in onion consumption at the time of the survey (1977-78) were also applicable during the study period. This seemed a reasonable assumption in view of the relatively small differences in regional consumption patterns. The per household estimate for a state within a region was multiplied by the number of households in that state for purposes of estimating statewide fresh onion demand. States were aggregated to form the 20 demand regions identified in Figure 2. Estimated annual consumption of dry onions for each region is exhibited in Table 4. For purposes of model construction, it was necessary to estimate regional consumption per month.

Regional Production Costs

Monthly average prices received by farmers at the point of first sale, for all grades and qualities of dry onions, were used as a proxy for costs. It was assumed that prices were determined in a competitive environment, in which case, the monthly average price for each supply region approximates production costs. The 1983-85 monthly average producer prices for each supplying state is shown in Table 5. These values are included in the trade model.

Texas producer prices for 1983-85 are highest in the March, April, and July period (Table 5). Lowest average prices in Texas during the 1983-85 period are in May, June, August, and September. California, one of Texas' principal competitors, exhibits a similar price level and pattern. Prices in Texas during March, April, and July were substantially above the estimated costs, which range between \$10 and \$11 per cwt. This situation is due to the relatively high prices which occurred in the spring of 1984 when the March and April prices averaged \$25.80 per cwt. Although this is a relatively high price, it seems that similar prices have historically occurred. In 1981, as an example, average monthly prices in Texas ranged up to \$27.20/cwt. (April). When the unusually high prices are removed from the data, average prices tend to approximate costs. For example, the average March price for 1982, 1983, and 1984 is \$11.50 (range \$10.10 to \$12.30), a value which approximates costs. Regardless of the divergence between prices and costs, it seems that relative prices of competing regions approximated their relative costs (Table 5) (Fuller, Goodwin, and Shafer 1989).

The relative costs of producing regions that compete for a market window partially determine their advantage or disadvantage in that window. Because relative prices seem to parallel costs, it was judged appropriate to use producer prices rather than costs. Accordingly, the monthly average prices for 1983-85 were included in the spatial analyses.

Transportation Costs

The charge for transporting onions between supply and demand regions may have an important bearing on the ability of a supply region to compete in a national market. Transportation rate information was collected from Fruit and Vegetable Truck Rate and Cost Summary, a publication prepared by the Agricultural Marketing Service, Fruit and Vegetable Division, of the USDA (1982-1985). Based on this data source, six linear regression equations were estimated to calculate the expected charge for transporting dry onions among the designated supply and consumption areas.

The estimated equations used to calculate rates linking Texas with the 20 consumption regions included in the transportation model are shown in Table 6. Both equations show distance of haul (miles) to be the most important factor determining rates, and, to a lesser extent, the month of shipment. The coefficient on the distance variable is similar in both equations, with an estimated value of $.002/cwt/mile. The estimated equations explain 87 and 99 percent of the variation in rates. The estimated rates linking Texas with the 20 demand regions during the state's dry onion shipping seasons are shown in Table 7.

Table 3. Estimated supplies of fresh dry onions, 1983-85 averages (1000 cwts).

Origin	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Yearly Total
Arizona	-	-	-	-	306	359	-	-	-	-	-	-	665
California	104	56	39	74	910	1088	910	421	199	195	186	153	4335
Colorado	302	284	193	50	-	-	-	287	583	440	431	361	2931
Georgia	-	-	-	-	157	89	-	-	-	-	-	-	246
Idaho	366	289	166	11	1	-	-	103	264	423	390	392	2405
Michigan	263	208	178	37	-	-	-	20	217	259	270	244	1696
New Mexico	-	-	-	-	-	473	435	325	58	-	-	-	1291
New York	432	353	359	239	-	-	-	84	390	408	390	366	3021
Oregon	488	416	356	86	16	-	7	155	359	511	449	455	3298
Texas	-	-	127	1307	1341	351	596	465	43	-	-	-	4230
Utah	43	-	-	-	-	-	-	-	42	78	81	57	301
Washington	122	116	117	49	1	-	280	127	120	144	143	142	1361
Total U.S.	2120	1722	1535	1853	2732	2360	2228	1987	2275	2458	2340	2170	25780
%	8.3	6.7	6.0	7.3	10.1	8.9	8.7	7.8	8.9	9.6	9.2	8.5	100
Mexico	136	148	484	274	84	34	-	-	-	-	16	75	1251
Total	2256	1870	2019	2127	2816	2394	2228	1987	2275	2458	2356	2245	27031

Source: USDA, AMS, Fruit and Vegetable Division. Fresh Fruit and Vegetable Shipments by Commodity, States and Months. FVUS-7. 1977-86.

Table 4. Dry onion demand regions and the associated annual consumption.

Demand Regions[1]	Estimated Annual Consumption (1000 cwt.)
1. Maine, New Hampshire, Vermont, Massachusetts, Connecticut and Rhode Island	1765
2. New York	2774
3. Pennsylvania, Maryland, Delaware and New Jersey	3273
4. Ohio and West Virginia	1384
5. Virginia, North Carolina and South Carolina	1560
6. Kentucky and Tennessee	914
7. Alabama and Georgia	997
8. Florida	1372
9. Wisconsin, Illinois and Indiana	2125
10. Arkansas, Louisiana and Mississippi	914
11. Minnesota, North Dakota and South Dakota	492
12. Nebraska, Kansas, Iowa and Missouri	1110
13. Oklahoma and Texas	2249
14. Montana and Idaho	167
15. Colorado and Wyoming	338
16. Arizona and New Mexico	448
17. Washington and Oregon	813
18. Nevada and Utah	233
19. California	2887
20. Michigan	926

[1]See Figure 2 to identify geographic areas included in the respective demand regions.

Table 5. Monthly average onion prices by state, 1983-85 ($/cwt).

State	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Average
Arizona[3]	-	-	-	-	8.82	8.29	-	-	-	-	-	-	8.61
California	15.62[1]	14.86[1]	16.39[1]	15.00[1,3]	12.47[3]	10.80[2,3]	14.40[1,2]	13.23[1]	12.47[1]	11.62[1]	12.13[1]	16.97[1]	13.83
Colorado[1]	13.56	12.63	13.75	13.34	-	-	-	12.66	10.07	10.48	11.60	14.83	12.55
Idaho[1]	11.80	12.20	14.97	14.52	15.87	-	-	9.10	7.63	7.67	9.63	13.93	11.73
Michigan[1]	8.73	9.37	10.77	11.23	-	-	-	13.67	9.90	8.33	8.37	8.80	9.91
New Mexico[2]	-	-	-	-	-	9.20	14.80	10.43	8.77	-	-	-	10.80
New York[1]	13.07	13.12	14.30	13.85	-	-	-	16.67	14.30	12.53	13.27	13.53	13.84
Oregon[1]	9.63	9.00	11.00	11.00	11.66	-	9.50	8.17	6.38	7.97	9.00	11.00	10.73
Texas	-	-	16.03[3]	15.83[3]	13.30[3]	13.60[2,3]	15.23[2]	12.00[2]	11.23[2]	-	-	-	13.89
Utah[1]	9.04	9.07	8.91	-	-	-	-	-	6.13	6.30	6.50	9.70	7.95
Washington	11.05[1]	10.67[1]	12.87[1]	3.73[1]	15.02[1]	-	12.32[2]	10.59[2]	8.27[1]	7.07[1]	7.93[1]	10.88[1]	10.96

[1]Summer storage
[2]Summer non-storage
[3]Spring

Source: U.S. Department of Agriculture, Agricultural Statistics Board, Annual Price Summary, National Agricultural Statistical Service, June 1986.

Table 6. Estimated linear regression coefficients on equations used to calculate motor carrier transportation rates linking Texas with onion demand regions ($/cwt).[1]

	Origin of Haul			
	McAllen, Texas		Hereford, Texas	
Variable	Coefficients	t-ratio	Coefficients	t-ratio
Intercept ($/cwt)	$0.34795	4.640	$0.30298	2.508
Distance ($/cwt/mile)	$0.00195	45.724	$0.00206	24.312
April ($/cwt)	$0.01130	2.005	NA	NA
May ($/cwt)	-$0.00640	-0.127	NA	NA
July ($/cwt)	NA	NA	$0.11555	1.569
August ($/cwt)	NA	NA	-$0.01820	-0.873
September ($/cwt)	NA	NA	-$0.28100	-0.924
R-squared	0.9528		.8783	

[1]The months of March and June are excluded from the respective McAllen and Hereford, Texas equations because they were considered base months. As such, their estimated parameters are included in the intercept.

NA=Not applicable shipment periods.

Table 7. Estimated transportation rates linking Texas with the transportation model's twenty demand regions during Texas' dry onion shipping season, 1983 ($/cwt).

Texas Shipping Month	Demand Regions[1] 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
March	4.68	4.29	3.91	3.36	3.42	2.63	2.69	3.04	3.23	1.93	3.51	2.38	1.43	4.25	2.75	2.53	4.98	3.44	4.22	3.61
April	4.56	4.17	3.79	3.24	3.30	2.51	2.57	2.92	3.11	1.81	3.39	2.27	1.31	4.14	2.63	2.41	4.86	3.32	4.10	3.49
May	4.57	4.18	3.79	3.25	3.30	2.52	2.58	2.93	3.12	1.82	3.39	2.27	1.32	4.14	2.64	2.42	4.87	3.32	4.11	3.49
June	4.51	4.12	3.81	2.99	3.47	2.40	2.70	3.29	2.76	1.91	2.77	1.79	1.08	3.12	1.54	1.71	3.89	2.31	3.37	2.80
July	4.51	4.12	3.81	2.99	3.47	2.40	2.71	3.30	2.76	1.92	2.77	1.79	1.08	3.12	1.54	1.71	3.90	2.32	3.37	2.81
August	4.40	4.01	3.69	2.88	3.36	2.29	2.59	3.18	2.64	1.80	2.65	1.67	0.96	3.01	1.42	1.59	3.78	2.20	3.25	2.69
September	4.55	4.16	3.84	3.03	3.51	2.44	2.74	3.33	2.79	1.95	2.81	1.83	1.12	3.16	1.57	1.75	3.93	2.35	3.41	2.84

[1]See Figure 2 for geographic location of demand regions.

Validation of Model

To develop confidence in the transportation model's ability to project actual flows, an effort was made to compare model-generated flows with historical flows (Phillips et al. 1976). Unfortunately, there is little onion trade flow data; therefore, validation could not be directly accomplished. An effort was made, however, to compare city terminal market share data with projected flows (shares). Assuming that Texas' share of a city terminal market is analogous to the region where the city is located, then some intuitive evidence is offered by a comparison.

The projected flows reflect the earlier finding that Texas' principal markets are in the east, in particular, the southeast, and in the midwest and south central regions (Fuller, Goodwin, and Shafer 1989). In addition, Texas' projected market share often approximates the historical information. The historical unload data shows Columbia, South Carolina to receive about one-third of its onion unloads from Texas, a market share which closely corresponds to the estimated share (38 percent). In general, the model-projected share in the northeast U.S. closely parallels the historical share. For example, in the cities New York, Philadelphia, and Pittsburgh, Texas' market share historically ranged between 7-19 percent, 13-22 percent, and 16-23 percent, respectively. These compare with projected shares of 13 percent, 18 percent and 18 percent for these respective cities. In general, the model underestimated flows to midwest regions and showed no flows to the west. Historical shares at midwest locations ranged from 19 percent to 30 percent while Texas' projected flows generally represented less than 20 percent of a terminal market. Even though Texas' market share in the western U.S. is small (e.g., Los Angeles is 3 percent), the model underestimated this flow by projecting no movement to this area.

There are numerous factors which contribute to the descrepancy between projected and historical trade patterns. Clearly, fresh onions are a heterogeneous product which go to satisfy a variety of different demands. Because the model fails to recognize product qualities and associated demands, discrepancies exist. Further, it is difficult to estimate representative transportation charges because of the unregulated nature of these hauls. Because the transcontinental flow of commodities and products from west to east exceeds the east to west flow, very low transportation charges often exist for hauls to West Coast locations. This situation may partially account for the observed small flow of onions from Texas to western U.S. locations. In spite of descrepancies, the model seemed to correctly project the major flows and accordingly, was judged appropriate to determine the competitiveness of Texas in the national fresh onion market.

Results

Three scenarios are developed and analyzed with the validated trade model for purposes of evaluating Texas' ability to compete in the national dry onion market. First, an effort is made to determine Texas' ability to displace competing regions and expand its market share, i.e., to be cost-competitive in the national market. Then, Texas' costs are increased to identify the sensitivity of Texas' expanded market share to these unfavorable cost adjustments. The second scenario focuses on competing regions and their ability to reduce Texas' market share through incremental cost reductions. Finally, the trade model is used to identify those regions which would produce if total production and transportation costs were minimized.

Ability of Texas to Expand Its Market Share

The purpose of this scenario is to measure Texas' ability to displace competing dry onion producing regions based on possible cost advantages that Texas may possess during its market window (March through September). The validated trade model determines those flow patterns which minimize total producer and transportation costs given producer costs (prices), transportation charges, fixed regional damands, and fixed regional supplies (1983-85 average). By relaxing Texas' historic monthly supply constraints, the least-cost model simultaneously determines whether the additional Texas supplies would be shipped and which regions may lose as a result of Texas expanded market share. Next, the model is used to determine whether Texas can hold this expanded market share as its costs are incrementally increased.

The analyses show Texas' cost advantage to be substantial during its market window. When Texas' historic supply constraints (1983-85) are relaxed, the trade flow model projects shipments to increase from 4230 to 7833 million pounds, an 85 percent increase.[1] Because the model fails to consider

[1]The methodology (network flow) does not allow for the incorporation of upward-sloping supply functions and, as such, the solution overstates the production potential. Regardless, it offers some measure as to the competitiveness of Texas production.

biological constraints, however, some of the expanded production is not attainable. For example, in March it is projected that shipments from Texas could be increased from 12.7 to 61.2 million pounds -- an unrealistic projection in view of the difficulty associated with producing a high quality product in large volume during this early period. Regardless, the projected volume is a substantial increase over the average 1983-85 shipments, and this implies that Texas producers are not at a cost disadvantage during their market window.

A closer examination of the solution to the trade model offered two additional findings regarding the competitiveness issue. First, most of the projected increase in onion shipments by Texas was at the expense of California; i.e., California shipments were reduced to relatively low levels when Texas supplies were unconstrained. This implies that Texas producers have an unexploited cost advantage relative to California. Second, the projected increase in shipments differs by month. The model projects that Texas' cost advantage yields modest increases in shipments during April and June (10 percent) but more substantial increases in May (41 percent), July (112 percent), August (106 percent), and September (105 percent).

To determine the sensitivity of Texas' expanded market share to unfavorable cost movements (increases in production and transportation costs), the trade model was used to project monthly shipments from Texas as costs were increased 5, 10, 15, and 20 percent, or an average of about $.85, $1.70, $2.55, and $3.40 per cwt, respectively. If the unfavorable cost adjustments have little effect on Texas shipments, then it is appealing that the cost advantage is meaningful; conversely, if shipments are substantially reduced, then the cost advantage is modest and possibly insignificant. The analyses show a 5, 10, 15, and 20 percent increase in Texas costs to reduce the expanded shipment volume (7833 million pounds) to 7071, 5000, 4579, and 4523 million pounds, respectively. Shipments in the March, April, May, and June window are reduced to historic 1983-85 levels with a 10 percent increase in production and transportation costs in Texas. July shipments decline to the historic level with a 15 percent increase in costs. Only projected August and September shipments exceed the historic level when costs are increased to 20 percent. Thus, the analysis shows Texas monthly shares to be sensitive to adverse cost movements except in August and September. During August it is projected that Texas could increase shipments from 465 to 614 million pounds and in September from 43 to 231 millions pounds, a projected increase in total shipments of about 8 percent. The expanded shipments are to Arkansas, Louisiana, Mississippi, Oklahoma, and Texas markets and are at the expense of California.

Vulnerability of Texas' Market Share

California and Arizona are important dry onion shippers during Texas' market window. To test the sensitivity of Texas' market share, California's

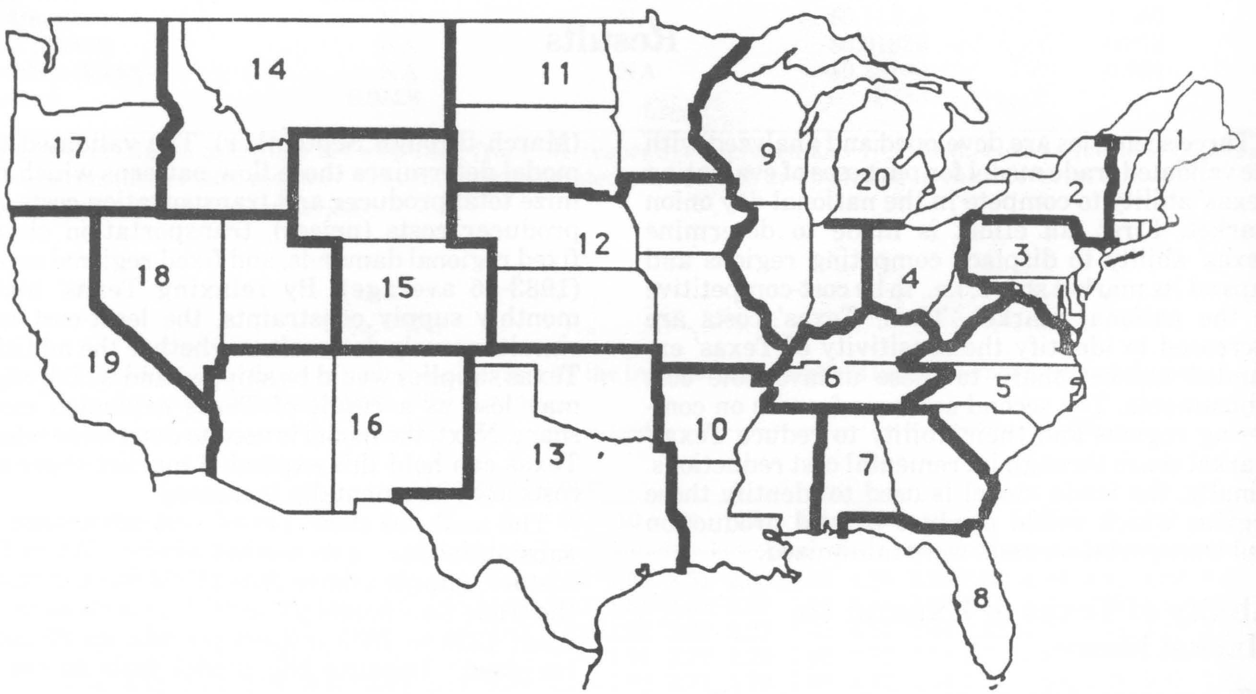

Figure 2. Demand regions included in spatial model.

historic supply constraints were relaxed and their costs subsequently reduced. The trade model shows the removal of California's historic supply constraint to have little effect on California or Texas. This finding is in contrast to the earlier scenario which showed shipments from Texas to dramatically expand when its supply constraints were removed and California's shipments to decline as a result of Texas' market expansion. This analysis shows the market share held by Texas to dramatically decline only if California's costs are reduced (Figure 3). When California costs are reduced by 10 percent, Texas share of the market is reduced to 60 percent of its historic level. Texas shipments in June, April, and May are most vulnerable to California's cost reductions while March, August, and September shipments are little affected. These findings reinforce earlier results regarding the opportunity to expand Texas shipments in August and September.

Arizona is an important dry onion shipper in May and June. Based on the trade flow model. Arizona has the ability to displace nearly all competing regions during this period. The exception is New Mexico which retains its historical shipments in June.

Location of Production Based on Least-Cost Criteria

To gain more insight into regional cost advantages and/or disadvantages, historical supply constraints for all producing regions were relaxed. Based on this modification, the trade model projects least-cost dry onion production in the United States. This analysis shows onion production to be concentrated in six states (Michigan, Oregon, Utah, Washington, Arizona, and New Mexico). Summer onion producers (Michigan, Oregon, Utah, and Washington) supply 81 percent of the onion output while Arizona and New Mexico generate the remaining supply. Storage onion stocks are the source of supply in March and April while during May, June, July, and August onion supplies originate in Arizona, New Mexico, and Oregon. Even though the unconstrained trade model includes simplifying assumptions, it shows there would be a dramatic relocation of dry onion production if cost were the only factor determining the national production pattern. Clearly, other variables such as quality have an important role in explaining the geographic location of production.

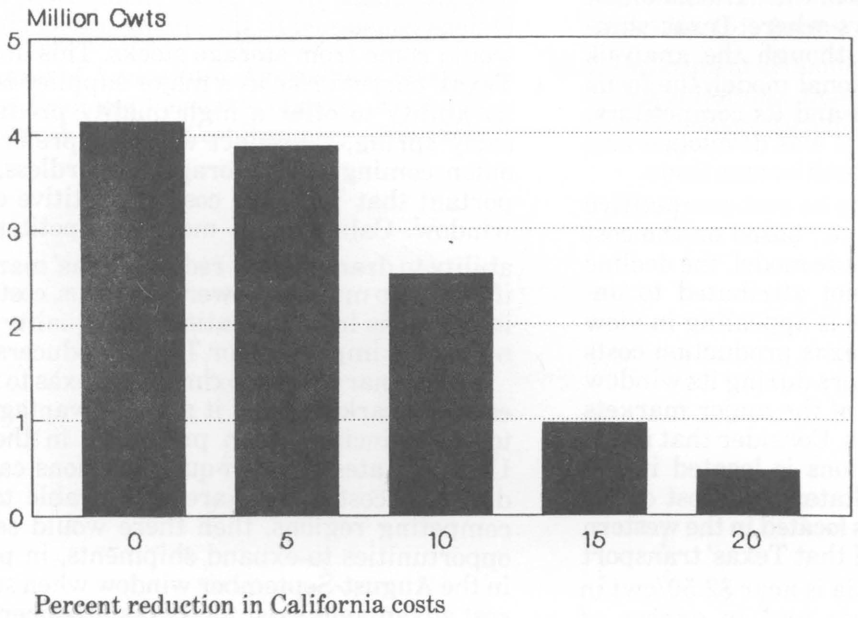

Figure 3. Annual shipments from Texas in view of reduced costs in California.

Summary and Conclusions

Historically, Texas producers supplied about 20 percent of the national onion market. In recent years, however, their market share has declined to about 14 percent. Total shipment of fresh onions by all U.S. producers has trended upward over time while shipments from Texas edged downward; consequently, a declining market share for Texas producers.

Texas'market window extends from March through September but is concentrated in the April-May window when about sixty percent of the state's fresh onion production is marketed. Texas' April onion production is the nation's first new crop shipments, and, as such its competition is primarily limited to carryover stocks and imports from Mexico. In May-August, new crop production in California, Arizona, New Mexico, and other Summer producing states offer competition. Historical data shows Texas' share of the fresh market in each shipping month to be trending downward except in April. Much of Texas' declining market share in May, June, July, and August has been claimed by California producers.

The objective of this study was to determine the cost-competitiveness of Texas in the national onion market and identify windows where Texas shipments may be increased. Although the analysis was accomplished with a national model, the focus of the research was on Texas and its competitors. An inter-regional trade model was developed and validated to address the competitiveness issue.

The analysis shows Texas to be cost-competitive during the market window, i.e., based on the cost parameters included in the trade model, the decline in Texas' market share is not attributed to unfavorable costs. This outcome is appealing in view of the earlier finding that Texas production costs are similar to major competitors during its window and Texas is closer to many of the major markets than its principal competitors. Consider that much of the market for Texas onions is located in the eastern half of the United States and most of the competing onion production is located in the western United States. It is estimated that Texas' transport cost advantage over California is near $2.50/cwt in the northeast U.S. markets and in excess of $3.00/cwt in southeastern markets.

It was reasoned that Texas' greatest opportunity for increasing shipments and market share would be in periods when its greatest cost advantage existed. This was determined with the trade model by removing Texas' historic supply constraints, incrementally increasing Texas' costs, then solving the associated models and identifying flows. This analysis shows little opportunity for Texas to expand its market share during its peak shipment period (April-May), and a modest ability to increase July shipments with any increase in Texas shipments coming at the expense of California. The most promising window for expansion would appear to be in August and September, a period when Texas' cost advantage is substantial. Although the absolute increase would be relatively small (4000 cwts), it does represent a 70 percent increase in shipments for Texas during the August-September window.

Although Texas is a cost-competitive producer during its window, it generally has higher costs than many of the regions which harvest storage onions in the late summer. Consequently, if the location of the nation's onion production were based on cost, Texas would be an insignificant supplier. Onions consumed in the spring and early summer would come from storage stocks. This implies that Texas' current role as a major supplier is based on its ability to offer a high quality product in the early spring, a product which is preferred to an onion coming from storage. Regardless, it is important that Texas be cost competitive during its window. California, a major competitor, has the ability to dramatically reduce Texas' market share if it were to modestly lower cost. Thus, cost-reducing innovations in combination with quality improvements are important for Texas producers.

In summary, the proximity of Texas to the major eastern markets gives it a cost advantage relative to the principal onion producers in the western United States. If high-quality onions can be produced at costs which are comparable to those of competing regions, then there would seem to be opportunities to expand shipments, in particular, in the August-September window when substantial cost advantages exist for Texas producers.

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