CHANGES IN MARITIME TRAFFIC OF THE PORT OF JACKSONVILLE

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This paper falls within the subfield of port geography. Its purpose is to measure relative and absolute change in Jacksonville's maritime traffic from 1974 through 1980. Changes are described in the context of the Northeast Florida/Georgia region, which includes the ports of Jacksonville in Florida and Savannah and Brunswick in Georgia. Interport competition among these regional ports has been increasing, and information concerning throughput trends will become essential for port planning decisions.

According to Oram (1965, p. 1), the main function of a modern port is to serve as a gateway to an industrial hinterland to provide an outlet for its products and an inlet for the raw materials it needs. Weigend (1958, p. 185) defines a port as the place of contact between land and maritime space providing service to both hinterland and maritime organization. A hinterland can be described as organized and developed land space which is connected with a port by means of transport lines and which receives or ships goods through that port. Hinterland areal overlap occurs where there is competition between ports of comparable size for cargo of the same type to and from the same area (Bird 1971, pp. 124-25). It is assumed that hinterland areal overlap existed among the three study ports. Jacksonville's cargo data were examined in this light.

Data

All United States ports compile cargo statistics. However for comparative analyses suspicion arises because a uniform methodology of data collection and reporting does not exist and individual ports emphasize particular types of data.

The data analyzed here were taken from the records of the U.S. Army Corps and Engineers' Waterborne Commerce of the United States (1974 and 1980), and the U.S. Department of Commerce, Maritime Administration's MARAD Containerized Foreign Trade Data (1974 and 1980). The first data source provides traffic information by Standard Industrial Classification (SIC) for all U.S. ports, and the second reports international containerized movements originating or terminating in domestic ports.

Methodology

This investigation of the Northeast Florida/Georgia region is in two parts. First, the import cargo and export cargo by two-digit SIC codes were examined. Second, containerized cargo to and from the region were surveyed. Two indicies, an index of concentration and a location quotient, were applied to both types of cargo flows.

Index of Concentration

An index of concentration has been suggested as a valid method of translating relative time series data to absolute terms (Lowe and Moryadas 1975, p. 167). It defines the cargo which should have been handled at an

individual port assuming the port's growth rate was the same as the region's. Differences between the actual and hypothetical tonnage were calculated as follows:

$$H_j = X_j * Y_{nfg} / X_{nfg}$$

Where

H_j = hypothetical tonnage of Jacksonville

X_j = tonnage of Jacksonville in initial year

X_{nfg} = tonnage of Northeast Florida/Georgia in initial year

Y_{nfg} = tonnage of Northeast Florida/Georgia in terminal year

Y_j = tonnage of Jacksonville in terminal year.

$Y_j - H_j$ = comparative gain or loss

The index of concentration makes more meaningful the progression of the commodity tonnage throughput of a single port over time.

TABLE 1

STUDY AREA FOREIGN WATERBORNE COMMERCE
(WEIGHT IN SHORT TONS)

PORT	1974	1980
Jacksonville		
Imports	5,328,990	3,039,929
Exports	1,707,452	3,137,260
Total	7,036,442	6,177,189
Savannah		
Imports	4,251,970	4,202,760
Exports	1,981,240	4,863,722
Total	6,233,210	9,066,482
Brunswick		
Imports	1,155,445	950,295
Exports	38,123	139,973
Total	1,193,568	1,090,268
Regional Total		
Imports	10,736,405	8,192,984
Exports	3,726,815	8,140,955
Total	14,463,220	16,333,939

Source: Waterborne Commerce of the United States, U.S. Corps of Engineers, Part 1, 1974 and 1980.

Location Quotient

The location quotient, referred to as a ratio of ratios, is a measurement of the relative importance of one phenomenon when compared to a larger entity. This statistic, applied to port traffic, may be regarded as an index of the characteristics of an individual port compared to a larger region (Rimmer 1965, pp. 65-66).

The formula for calculating the location quotient is:

$$LQ_c = \frac{\frac{T_{cj}}{TT_j}}{\frac{T_{cnfg}}{TT_{nfg}}} * 100$$

where

LQ_c = location quotent for commodity c

T_{cj} = tonnage of commodity c in Jacksonville

TT_j = total tonnage in Jacksonville

T_{cnfg} = tonnage of commodity c in Northeast Florida/Georgia

TT_{nfg} = total tonnage in Northeast Florida/Geogria

Location quotients permit the researcher to distinguish commodities which are under-represented (location quotients less than 100) or over represented (location quotients greater than 100). Thus traffic specialization can be recognized.

A word of caution should be mentioned, however. When interpreting the results of the location quotient analyses, the researcher should exercise caution because statistics will be in relative numbers. Herein lies the major weakness of the analyses, since equal weight may be apportioned to both large and small movements in different sectors.

Commodity Analysis

Jacksonville's tonnage over the study period grew at a slower rate than that of the Northeast Florida/Georgia region. In 1974, Jacksonville handled 7,036,442 total short tons, or almost 49 percent of the region's tonnage; while by 1980 tonnage decreased to 6,177,189 short tons, or approximately 38 percent of the region's handle (Table 1).

The port's decline, however, did not occur in all commodity sectors. An analysis of the indicies of concentration (ICs), for both imports and exports by commodity revealed respective strengths and weaknesses. Commodity sector codes for use with subsequent tables may be found in Table 2.

TABLE 2

COMMODITY SECTORS

Sector	Commodity Type
1	Agricultural Products - Crops
8	Forest Products
9	Fishing, Hunting, and Trapping Products
10	Metallic Ores
11	Coal and Lignite
13	Crude Oil and Gas
14	Nonmetallic Minerals
19	Ordnance and Accessories
20	Food and Kindred Products
21	Tobacco Products
22	Textile Mill Products
23	Apparel and Other Finished Products Made From Fabrics and Similar Materials
24	Lumber and Wood Products, Except Furniture
25	Furniture and Fixtures
26	Paper and Allied Products
27	Printed Products
28	Chemicals and Allied Products
29	Refined Petroleum and Related Products
30	Rubber and Miscellaneous Plastics Products
31	Leather and Leather Products
32	Stone, Clay, Glass, and Concrete Products
33	Primary Metal Products
34	Fabricated Metal Products, Except Ordnance, Machinery, and Transportation Equipment
35	Machinery, Except Electrical
36	Electrical Machinery, Equipment, and Supplies
37	Transportation Equipment
38	Professional, Scientific, and Controlling Instruments, Photographic, and Optical Goods, Watches, and Clocks
39	Miscellaneous Manufacturers
40	Scrap and Wastes
41	Other
99	Defense and SCI

Index of Concentrations

An examination of Table 3 reveals that nine imported commodities experienced a comparative gain or losss greater than 10,000 short tons when hypothetical tonnage was compared to actual tonnage for 1980. Greatest gains were in transportation equipment (36,890) and nonmetallic minerals (14,707). The principal commodity classification contributing to high actual yields in transport receipts was motor vehicles, parts, and equipment. Increases in motor vehicles reflected the fact that Jacksonville was the major import center for foreign built automobiles in the South Atlantic port range. Unworked building stone was the key item included in the category of nonmetallic minerals.

Large inbound losses were in refined petroleum and related products (-535,348), chemicals and allied products (-97,092), primary metal products (-77,043), lumber and wood products (-38,041), metallic ores (-17,801), crude oil and gas (-12,531), and stone, clay, glass and concrete products (-10,420). Declines in refined petroleum, crude oil, and gas were probably stimulated by national trends encouraging energy conservation and self-sufficiency. Other consequential aberations incurred as a result of the international economic recession which inhibited trade.

Exports originating at Jacksonville fared slightly better than did imports (Table 4). Nine SICs acquired a comparative gain or loss exceeding 10,000 short tons. Gains were achieved in chemicals and allied products (405,790), food and kindred products (32,466), paper and allied products (197,361), transportation equipment (22,082), and fabricated metal products (13,225). The primary chemical product shipped included potassic chemicals and other fertilizers. Although many food products were handled, prepared fruit and vegetable juice dominated exports, while in the category of paper an allied products, paper and paperboard were the primary commodity moved. Similar to

TABLE 3

INDEX OF CONCENTRATION FOR JACKSONVILLE'S IMPORTS
(WEIGHT IN SHORT TONS)

SIC	ACTUAL TONNAGE 1974	ACTUAL TONNAGE 1980	HYPOTHETICAL TONNAGE	COMPARATIVE GAIN OR LOSS
1	100,962	91,890	97,777	-5,887
8	58	3,135	101	3,034
9	628	544	2,846	-2,302
10	39,136	329	18,130	-17,801
11	0	13	---	---
13	20,351	0	12,531	-12,531
14	662,213	656,280	641,573	14,707
19	0	13	0	13
20	20,649	58,366	55,004	3,362
21	42	2	32	-30
22	4,849	2,298	3,358	-1,060
23	128	369	218	151
24	311,844	33,605	71,646	-38,041
25	751	1,225	3,263	-2,038
26	0	519	0	519
27	10,295	288	795	-507
28	57,230	24,707	121,799	-97,092
29	3,329,771	1,600,401	2,135,749	-535,348
30	1,711	7,865	2,739	5,126
31	707	298	1,250	-952
32	267,012	45,914	56,334	-10,420
33	265,469	43,204	120,247	-77,043
34	8,085	6,310	10,757	-4,447
35	12,891	18,589	16,610	1,979
36	1,058	3,379	3,231	148
37	209,522	436,570	399,590	36,890
38	37	347	113	234
39	946	1,576	2,809	-1,233
40	113	0	260	-260
41	2,532	1,893	2,049	-156
99	0	0	---	---

Source: Waterborne Commerce of the United States, U.S. Corps of Engineers, Part 1, 1974 and 1980, and Author's calculations.

TABLE 4

INDEX OF CONCENTRATION FOR JACKSONVILLE'S EXPORTS
(WEIGHT IN SHORT TONS)

SIC	ACTUAL TONNAGE 1974	ACTUAL TONNAGE 1980	HYPOTHETICAL TONNAGE	COMPARATIVE GAIN OR LOSS
1	15,833	74,979	132,207	-57,228
8	19	403	93	310
9	74	40	673	-633
10	4,364	77	228	-151
11	0	0	---	---
13	0	0	---	---
14	1,162,065	1,328,303	1,639,505	-311,202
19	0	2	---	---
20	24,709	60,550	28,084	32,466
21	59	686	288	398
22	1,193	6,177	4,029	2,148
23	68	1,250	246	1,004
24	8,728	15,798	172,205	-158,407
25	312	539	2,136	-1,597
26	28,962	253,516	56,155	197,361
27	227,814	148	620	-472
28	153,405	1,251,494	845,704	405,790
29	1,755	283	2,828	-2,545
30	194	2,732	1,129	1,603
31	23	70	353	-283
32	1,718	4,269	3,947	322
33	5,253	37,650	30,678	6,972
34	1,053	15,429	2,204	13,225
35	2,316	8,035	1,630	6,405
36	311	6,205	3,398	2,807
37	800	23,886	1,804	22,082
38	181	207	347	-140
39	47	510	205	305
40	66,109	43,696	84,299	-40,603
41	3	212	267	-55
99	84	114	280	-166

Source: Waterborne Commerce of the United States, U.S. Corps of Engineers, Part 1, 1974 and 1980 and Author's calculations.

gains in imports, exports of transport equipment relied heavily on motor vehicles, parts and equipment. However, the data for fabricated metal products were not disaggregated into specific types. Gains in exports, therefore, mostly represented regional or localized products.

The four export SICs that displayed the largest losses were nonmetallic minerals (-311,202), lumber and wood products (-158,407), agricultural products (-57,228), and scrap and wastes (-40,603). Losses were attributable to a combination of two factors--the general slowdown of the world economy and competition from other regional port facilities.

The preceeding comparative gain or loss information highlighted commodity sectors which grew at a faster or slower rate in Jacksonville compared to the region as a whole. Major gains or losses predominantly fell into the bulk or neobulk class of cargo. Bulk cargoes are those usually carried in homogenous shiploads. While neobulk cargoes are comparable, they are usually hauled on purpose-built tonnage owned or chartered by industrial corporations.

Location Quotients

It is imperative to draw distinctions between the location quotient technique and the previously employed index of concentration procedure. While the earlier methodology could measure change over time and reported statistics in absolute numbers, it also possessed inherent weaknesses. A principal shortcoming was that the researcher had to define the initial and terminal study years. The choice of the time span could bias the investigation. Moreover, there was no assurance that the period covered was indicative of long-term trends, thus, assertions about change at the port were, at best, time specific. Some of these potential partialities were ameliorated by utilizing the location quotient, since this approach measured change only after the computation of location quotients for each respective year.

An examination of Table 5 shows that Jacksonville fared better than the North Florida/Georgia region by 50 percent or more (LQs greater than, or equal

TABLE 5

LOCATION QUOTIENTS FOR JACKSONVILLE'S INTERNATIONAL TRADE

	IMPORTS			EXPORTS		
SIC	1974	1980	CHANGE	1974	1980	CHANGE
1	197.945	248.852	50.907	37.413	25.225	-12.188
8	0.359	14.918	14.559	11.520	59.665	48.145
9	60.567	15.487	-45.080	159.919	11.295	-148.624
10	46.025	1.117	-44.908	87.155	34.993	52.162
11	---	269.512	---	---	0.000	---
13	4.392	0.000	-4.392	---	---	---
14	69.218	94.716	25.498	138.906	133.795	-5.111
19	0.000	23.998	23.998	---	2.085	---
20	40.959	58.140	17.181	26.054	66.784	40.730
21	104.467	8.694	-95.773	73.169	206.991	133.822
22	5.357	4.904	-0.453	9.434	17.195	7.761
23	3.188	7.203	4.015	23.862	144.163	120.301
24	150.611	94.500	-56.111	44.083	4.753	-39.330
25	47.625	23.919	-23.706	194.570	58.375	-136.195
26	0.000	2.879	2.879	9.133	49.018	39.885
27	200.285	97.024	-103.261	218.225	61.943	-156.282
28	49.351	13.392	-35.959	103.326	181.784	78.458
29	134.703	135.027	0.324	155.085	18.451	-136.634
30	23.061	88.569	65.508	25.280	72.756	47.476
31	28.284	9.020	-19.264	83.669	19.701	-63.968
32	161.001	175.536	14.535	32.171	41.364	9.193
33	62.574	30.075	-32.499	66.413	96.904	30.491
34	26.164	20.530	-5.634	15.594	129.784	114.190
35	52.209	78.163	25.954	8.002	47.007	39.005
36	27.282	38.165	10.883	32.730	71.057	38.327
37	169.748	248.090	78.342	11.387	179.259	167.972
38	14.999	61.486	46.487	64.238	45.560	-18.678
39	31.487	23.633	-7.854	28.029	83.025	54.996
40	0.616	0.000	-0.616	99.863	61.541	-38.322
41	104.022	128.575	24.553	43.654	41.146	-2.508
99	0.000	---	---	76.077	36.840	-39.237

Source: Waterborne Commerce of the United States, U.S. Corps of Engineers, Part 1, 1974 and 1980, and Author's calculations.

to 150) for imports in five categories in 1974 and in four categories in 1980. During the initial year, printed products, agricultural products, transportation equipment, stone, glass, clay, and concrete products, and lumber and wood products were highly overrepresented. However, by 1980, coal and lignite was over-represented, and printed products dropped out of the premier designation. The greatest positive change for import LQs occurred in transportation equipment, rubber and plastic products, and agricultural products. Large negative change was recorded in printed products, tobacco products, and lumber and wood products.

Export location quotients greater than 150 in 1974 existed in four SIC categories--printed products, furniture and fixtures, fishing, hunting, and trapping products, and refined petroleum and related products. By 1980, only three commodity sectors registered LQs greater than 150--tobacco products, chemicals and allied products, and transportation equipment. With the exception of transport equipment, all sectors recording a LQ greater than 150 in 1980 did not occupy a similar status in 1974. In addition to transport equipment, the greatest gains (in decreasing order of importance), were in tobacco products, apparel, fabricated metal products, chemicals and allied products, miscellaneous manufacturers, and metallic ores.

Container Analyses

The international container information utilized in this research recorded only movements of boxes with cargo, therefore, no discussion of empties was included. Statistics for both years examined reported tonnage in long tons (2,240 lbs.). To provide compatability with the commodity analyses all tonnage figures were converted to short tons (2,000 lbs.) by multiplying by a 1.12 factor.

In addition, the Maritime Administration updated its data reporting scheme over the study period. During the initial period, MARAD's container figures were in number of units without regard to size. Thus, equal weighting was given both to twenty-foot boxes and forty-foot boxes. This disparity was later remedied by reporting units in twenty-foot equivalent units (TEUs). TEUs for the earlier year were calculated based upon an assumption that the average container held 10.91 long tons. This 10.91 conversion factor was the mean tonnage of all United States container movements in 1980.

Regional growth in containerized movements from 1974 to 1980 increased by almost 161 percent in TEUs and 134 percent in tonnage. Table 6 gives the data for TEUs and short tons for the three ports comprising the Northeast Florida/Georgia region.

TABLE 6

INTERNATIONAL CONTAINER MOVEMENTS
NORTHEAST FLORIDA/GEORGIA REGION
(WEIGHT IN SHORT TONS)

	1974		1980		CHANGE 1974-1980	
	TEUs	TONS	TEUs	TONS	TEUs	TONS
Jacksonville						
Imports	4,267	41,567	10,466	92,082	6,199	50,515
Exports	7,381	71,899	25,675	188,682	18,294	116,783
Total	11,648	113,466	36,141	280,764	24,493	167,298
Savannah						
Imports	11,982	116,674	33,639	271,906	21,657	155,232
Exports	24,232	235,993	55,038	536,839	30,806	300,846
Total	36,214	352,667	88,677	808,745	52,463	456,078
Brunswick						
Imports	0	0	1	25	1	25
Exports	4	30	0	0	-4	-30
Total	4	30	1	25	-3	-5
N. Florida/Georgia						
Imports	16,249	158,241	44,106	364,013	27,857	205,772
Exports	31,617	307,922	80,713	725,521	49,096	417,599
Total	47,866	466,163	124,819	1,089,534	76,953	623,371

Source: MARAD Containerized Foreign Trade Data, U.S. Department of Commerce, Maritime Administration, 1974 and 1980, (unpublished reports).

Jacksonville recorded approximately 25 percent of the containers and tonnage moved through the region in 1974. By 1980, it handled nearly 29 percent of the regional TEUs and 26 percent of the tonnage. The principal reason why the port's relative growth was only moderate was that it achieved a slower than average growth in imports which was not completely compensated for by exports. Although Brunswick moved only minor amounts of containers, its handle was included to maintain continuity with the commodity analyses.

Index of Concentration

Data in Table 7 reveal that when Jacksonville's hypothetical TEUs and tonnage were compared to actual movements for 1980, the port's total

TABLE 7

ACTUAL AND HYPOTHETICAL MOVEMENTS
OF THE PORT OF JACKSONVILLE'S CONTAINERS
COMPARED TO THE NORTHEAST FLORIDA/GEORGIA REGION
(WEIGHT IN SHORT TONS)

	1980					
	TEUs			TONS		
	ACTUAL	HYPOTHETICAL	DIFFERENCE	ACTUAL	HYPOTHETICAL	DIFFERENCE
Imports	10,466	11,582	-1,116	92,082	95,620	-3,538
Exports	25,675	18,842	6,833	188,682	169,407	19,275
Total	36,141	30,424	5,717	280,764	265,027	15,737

Source: MARAD Containerized Foreign Trade Data, U.S. Department of Commerce, Maritime Administration, 1974 and 1980, (unpublished reports) and author's calculations.

performance was positive. However, imports did not grow as quickly as the regional average, in fact they showed a decline. Despite an absolute positive import growth, Jacksonville lagged behind its major competitor, Savannah, which experienced higher growth rates. Nevertheless, Jacksonville's container traffic grew at a rate of 121 percent for imports and 162 percent for exports. This trend of exports exceeding imports was the general case for most Southeastern United States ports.

TABLE 8

LOCATION QUOTIENTS FOR JACKSONVILLE'S
CONTAINERIZED CARGO MOVEMENTS

	1974		1980		COMPARATIVE GAIN OR LOSS	
	TEUs	TONS	TEUs	TONS	TEUs	TONS
Imports	107.913	47.286	81.953	98.165	-25.960	26.879
Exports	95.934	101.305	109.862	100.921	13.928	-0.384

Source: MARAD Containerized Foreign Trade Data, U.S. Department of Commerce, Maritime Administration, 1974 and 1980, (unpublished reports) and Author's calculations.

Location Quotients

Derived location quotients for both TEUs and tonnage for 1974 and 1980 are found in Table 8. Jacksonville's import LQ for TEUs slightly exceeded that for exports in 1974, however, the reverse was true by 1980. The LQ relationship for tonnage revealed a different pattern. Although the statistic for exports was greater than that for imports for both years, it decreased slightly over time, while it more than doubled for imports. The observed deviation occurred despite a high absolute growth in TEUs, therefore one can conclude that heavier cargo was being carried in inbound boxes.

Summary and Conclusions

This paper has applied the two techniques--an index of concentration and a location quotient--to a relatively small region composed of three domestic ports. It has demonstrated the value of such tools in attempting to describe interport competition. The strength of the index of concentration was that it accounted for magnitudes of flows in real numbers, while the strength of the location quotient was that it reflected change based upon each year's commerce. By applying both techniques, apparent weaknesses of each can be minimized.

Jacksonville apparently had fared well over the study period even though it did not achieve the gains recorded by its major competitor, Savannah, Georgia. However, Jacksonville, both in commodity commerce and container traffic, showed robustness particularly in outbound movements. Chemicals and allied products and transportation equipment show positive potentials for future exports, while transport equipment (automobiles and parts) and nonmetallic minerals should enjoy continued import growth. Unfortunately, these cargoes are not generally carried in containers. However, the prognosis still is for continued increases in unitized handling of a large admixture of consumer oriented cargoes.

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