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The Dynamics of West Coast Container Port Competition

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ABSTRACT

Competition among U.S. container ports has broadened and intensified in the last decade. New port service offerings have expanded the scope of competition. At the same time, changes within the container trades have made the port choice decision more critical to ocean carrier business strategies, and raised the stakes in port competition. The dynamics of this competition, and the shifting priorities of ocean carriers, are illustrated by changes in coastal and port area shares of U.S. foreign trade. The paper uses a ten-year time series of containerizable foreign trade to demonstrate the impact of intermodal services, ocean carriers' increasing concern with land transportation, and other maritime industry developments. Carrier and shipper port selection criteria (from recent interviews) are discussed.

I. BACKGROUND

Maritime trade has been a vital part of West Coast economic activity for over a century. Superb natural harbors, abundant resources, and a position on the Pacific guarantee important roles for West Coast ports. As Pacific liner trade has grown, it has also been containerized. The emergence of intermodal transportation has allowed the West Coast ports to serve the growing Pacific trade for the entire nation.

West Coast ports compete vigorously for containerized traffic. The economics of containerization favor large ships, mechanized terminals, and few port calls. The decision of a major ocean carrier to call at one port rather than another, or to direct discretionary cargo through one port rather than another, affects port cargo volumes, employment, and revenues. This paper addresses the competition among three West Coast port regions:

- *San Francisco Bay,* including San Francisco and Oakland.
- *Pacific Northwest,* including Seattle, Tacoma, and Portland.
- *Southern California,* including Los Angeles and Long Beach.

Other West Coast ports, some of which handle small volumes of containerized cargo, were grouped with Alaska and Hawaii as "Other West Coast." We also compared the West Coast with other U.S. port regions, including the East Coast, the Gulf Coast, and the Great Lakes.

We began by documenting the international containerizable cargo flows through West Coast and U.S. port regions for the last ten years (1976-1985). The results of port competition are apparent: the data show substantial cargo shifts between Southern California, the Bay Area, and the Pacific Northwest. To obtain an understanding of the factors affecting port choice, the ranking of those factors, and the degree of port control over the most important factors, we drew on previous proprietary studies, contacts with ports, and semi-structured interviews with both carriers and shippers. Our results were reviewed with key respondents to ensure that our interpretations were realistic. This approach allowed us to address issues for which statistical data do not exist, but which lie at the core of container port competition.

II. CONTAINERIZABLE CARGO VOLUMES AND SHARES

A. Source

The data base used for this analysis is derived from U.S. Bureau of the Census import and export data (SA305/705). It gives tonnage and value of cargo by commodity (Schedules A & E), by service (liner and non-liner), by commodity containerizability and density, by foreign country of origin or destination, and by U.S. port. Our ten-year time series for this analysis included only *containerizable, liner* cargo. We estimated the equivalent container volumes, by commodity, in two stages. First, we used proprietary containerizability factors to estimate the portion of each commodity likely to be containerized in each trade. Second, we converted containerizable tonnages to twenty-foot equivalent units (TEUs) using proprietary density factors.

The proprietary factors for both containerizability and density are empirically derived, and periodically updated with the cooperation of West Coast ports and container operators. The containerizability factor is derived from total and containerized tonnage figures within Schedule A and E commodity categories, and gives the percentage of cargo of each commodity group historically carried in containers. These factors vary from only a few percent (for heavy equipment) to 100 percent (for consumer goods in major trades). The density factors give the tons per TEU for each commodity group, allowing for stowage practices that typically result in less than complete space utilization. It was critical that individual density factors were used for each commodity, since densities range from 3 to 18 tons per TEU. Different commodity mixes can thus yield significantly different container volumes for the same tonnage, making the use of overall averages unreliable and misleading.

B. TEUs and Shares

Table 1 gives the ten-year time series for West Coast containerizable liner trade in TEUs, and the corresponding regional shares. The time series shows very strong growth in both Southern California and the Pacific Northwest since 1980, a reflection of both increased trade and increased intermodal traffic. San Francisco Bay TEUs grew by 67 percent between 1976 and 1985, but Bay Area share dropped from 24.5 to 17.0 percent. As the Pacific Northwest has the smallest of the three local markets, that port region is apparently drawing cargo to and from inland points.

The West Coast accounted for roughly 68 percent of the total U.S. growth in all liner trades (Table 2). The West Coast share grew from 28.2 percent in 1976 to 42.8 percent in 1985, and probably exceeded the East Coast share in 1986-1987. The growth of West Coast cargo has apparently shifted much of the containerized traffic from the Gulf, and absorbed much of the growth that would otherwise have occurred at East Coast ports. The dramatic increase in West Coast share is consistent with an influx of discretionary intermodal cargo.

C. Imports and Exports

Table 3 gives TEUs and TEU shares for Far East Asia and Total U.S. imports and exports for shown separately for 1976-1980 and 1980-1985. Two points are immediately apparent.

First, growth in U.S. trade with Far East Asia accounts for much of the total growth, for much of the increased West Coast share, and for much of the changes in shares within the West Coast. Trade with Far East Asia grew much faster than other trades, and exports to Far East Asia grew 25.6 percent between 1980 and 1985 when U.S. exports declined 15.6 percent overall. Thus, the ability of the West Coast ports to attract intermodal Far East Asia imports destined to inland points accounts for much of the West Coast growth.

Second, the logistics of discretionary imports and exports account for much of the change in West Coast shares. The San Francisco Bay ports have traditionally handled a large share of West Coast exports, and their export volume grew from 1976-1980. Since 1980, however, the Pacific Northwest ports have shown exceptional growth in Far East Asian and total exports, and the Bay Area share

TABLE 1
WEST COAST CONTAINERIZABLE LINER
TEUS AND TEU SHARES

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
TEUs (000)										
San Francisco Bay	263	307	346	367	394	384	411	384	455	438
Southern California	481	564	636	680	760	801	824	962	1,146	1,435
Pacific Northwest	265	303	338	354	406	433	407	470	573	617
Other West Coast	64	74	74	72	81	74	66	82	93	87
TOTAL	1,072	1,247	1,394	1,474	1,641	1,691	1,709	1,898	2,267	2,578
TEU Shares (Percent)										
San Francisco Bay	24.5	24.6	24.8	24.9	24.0	22.7	24.1	20.2	20.1	17.0
Southern California	44.9	45.2	45.6	46.2	46.3	47.3	48.2	50.7	50.6	55.7
Pacific Northwest	24.7	24.3	24.3	24.1	24.7	25.6	23.8	24.8	25.3	23.9
Other West Coast	5.9	5.9	5.3	4.9	4.9	4.4	3.9	4.3	4.1	3.4

TABLE 2
U.S. CONTAINERIZABLE LINER TEUS AND
TEU SHARES

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
TEUs (000)										
West Coast	1,072	1,247	1,394	1,474	1,641	1,691	1,709	1,898	2,267	2,578
East Coast	1,956	1,809	2,130	2,200	2,181	2,178	2,059	2,192	2,508	2,664
Gulf Coast	724	681	785	851	863	859	775	761	812	754
Great Lakes	51	60	64	57	46	28	24	20	24	24
TOTAL	3,803	3,797	4,373	4,581	4,731	4,757	4,566	4,871	5,610	6,019
TEU Shares (percent)										
West Coast	28.2	32.9	31.9	32.2	34.7	35.6	37.4	39.0	40.4	42.8
East Coast	51.4	47.6	48.7	48.0	46.1	45.8	45.1	45.0	44.7	44.3
Gulf Coast	19.0	17.9	18.0	18.6	18.3	18.1	17.0	15.6	14.5	12.5
Great Lakes	1.3	1.6	1.5	1.2	1.0	0.6	0.5	0.4	0.4	0.4

Source: Manalytics' Waterborne Trade Data Base.

has declined as a result. Increases in local production for export do not account for the Pacific Northwest growth; it is apparently due instead to increased flows of discretionary intermodal exports.

The major source of growth for Southern California ports was containerizable imports. From 1976 to 1985, Southern California container ports increased their overall import market share from 51.7 to 65.3

TABLE 3
CONTAINERIZABLE LINER IMPORT AND EXPORT TEUS AND TEU SHARES

	1976		1985		1976-80 Growth		1980-85 Growth	
Far East Asia Imports	TEU (000)	Share (%)	TEU (000)	Share (%)	Total (%)	Annual (%)	Total (%)	Annual (%)
S.F. Bay	75	16.8	133	10.0	36.0	8.0	30.4	5.5
So. Calif.	242	54.3	896	67.3	38.8	8.6	166.7	21.7
Pac. N.W.	120	26.9	294	22.1	36.7	8.1	79.3	12.4
Other W. Coast	9	2.0	8	0.6	-44.4	-13.7	60.0	9.9
West Coast	446	61.2	1,331	73.7	36.1	8.0	119.3	17.0
East Coast	260	35.7	462	25.6	0.4	0.1	77.0	12.1
Gulf Coast	22	3.0	12	0.7	-50.0	-15.9	9.1	1.8
Great Lakes	1	0.1	0	0	0	-20.5	0	0
TOTAL	729	--	1,805	--	20.6	4.8	105.3	15.5
Total U.S. Imports								
S.F. Bay	119	19.9	219	12.9	33.6	7.5	37.7	6.6
So. Calif.	309	51.7	1,108	65.3	44.7	9.7	147.9	19.9
Pac. N.W.	150	25.1	347	20.5	38.7	8.6	66.5	10.7
Other W. Coast	20	3.3	22	1.3	-35.0	-11.0	75.0	11.8
West Coast	597	30.2	1,696	43.8	38.4	8.5	105.1	15.4
East Coast	1,136	57.3	1,834	47.4	-2.2	-0.6	65.1	10.5
Gulf Coast	224	11.3	332	8.6	0.9	0.2	46.9	8.0
Great Lakes	24	1.2	7	0.2	-60.8	-20.9	-22.3	-4.9
TOTAL	1,981	--	3,869	--	9.7	2.3	78.0	12.2
Far East Asia Exports								
S.F. Bay	89	31.1	152	23.5	64.0	13.2	4.1	0.8
So. Calif.	113	39.5	244	37.7	86.7	16.9	15.6	2.9
Pac. N.W.	66	23.1	216	33.4	104.5	19.6	60.0	9.9
Other W. Coast	18	6.3	35	5.4	55.6	11.7	25.0	4.6
West Coast	286	76.3	647	74.9	81.8	16.1	24.4	4.5
East Coast	66	17.6	195	22.6	103.0	19.4	45.5	7.8
Gulf Coast	23	6.1	22	2.5	47.8	10.3	-35.3	-8.3
Great Lakes	0	0	0	0	0	0	0	0
TOTAL	375	--	864	--	83.5	16.4	25.6	4.7
Total U.S. Exports								
S.F. Bay	144	30.1	220	24.9	62.9	13.0	-6.1	-1.2
So. Calif.	173	36.1	328	37.2	80.9	16.1	4.8	0.9
Pac. N.W.	115	24.2	270	30.6	71.3	14.3	36.9	6.5
Other W. Coast	46	9.5	65	7.4	56.5	11.9	-9.2	-1.9
West Coast	478	26.2	884	41.1	71.0	14.4	8.2	1.6
East Coast	818	44.9	826	38.4	30.4	6.9	-22.6	-5.0
Gulf Coast	499	27.4	423	19.6	28.3	6.4	-33.9	-7.9
Great Lakes	26	1.4	20	0.9	38.3	8.5	-44.4	-11.1
TOTAL	1,821	--	2,153	--	40.6	8.9	-15.9	-3.4

Source: Manalytics' Waterborne Trade Data Base percent, and their share from Far East Asia from 54.3 percent to 67.3 percent. San Francisco Bay and Pacific Northwest shares were correspondingly reduced.

The statistics show cargo share shifts within the West Coast, and to the West Coast from other U.S. coasts. The available cargo statistics do not, however, capture the numerous influences at work or reveal anything about the degree of port control.

III. FACTORS IN PORT CHOICE

To explore the factors in port choice and cargo routing, we began with a "laundry list" of potential influences based on our own experience and on the maritime industry literature. That list was incorporated in semi-structured interviews with a number of major carriers and large shippers. The sample was not random: a number of potential interviewees were identified to obtain the views of participants with different traffic volumes and business strategies. From our interviews, we derived the rankings shown in Table 4. These are grouped according to the degree of port control. These findings suggest strongly that major factors in port choice and cargo routing are beyond direct control of the ports. In ranking these factors, we contacted ports, carriers, exporters, and importers, and found substantial agreement. Different parties are influenced by different factors, and Table 5 regroups the factors accordingly.

TABLE 4
RANKING OF PORT CHOICE FACTORS AND DEGREE OF PORT CONTROL

Major Factors

Outside Port Control

1) Local market size
2) Domestic transport costs

Under Port Influence

1) Port labor productivity
2) Railroad connections and transit times
3) Port access
4) Total transit time
5) Ocean carrier intermodal networks

Under Port Control

1) Terminal gate capacity
2) Channel and berth depth
3) Indirect port charges
4) Port charges on cargo
5) Port charges on carrier
6) Cargo handling equipment

Secondary Factors

Outside Port Control

1) Directional container balance
2) Domestic backhaul opportunities
3) Corporate relationships between carrier, shipper agent, or terminal operator

Under Port Control

1) Rail/water interface
2) Terminal container storage
3) Distribution center availability
4) Industrial park or foreign trade zone availability
5) Availability and price of bunker fuel
6) Reputation of port management and level of port service

Minor Factors

Under Port Control

1) Availability of an automated customs clearance service
2) Port-provided cargo tracking system
3) Port-provided cargo statistics system

TABLE 5
MAJOR FACTORS INFLUENCING USERS IN PORT REGION SELECTION

Exporters

1) Domestic transport cost
2) Total transit time
3) Indirect port costs
4) Local export market size
5) Port charges on cargo
6) Port access

Importers

1) Local import market size
2) Total transit time
3) Port access
4) Access to proprietary distribution networks
5) Availability of container storage
6) Port charges on cargo

Large, Intermodal Ocean Carriers

1) Local market size
2) Rail/water interface
3) Port access
4) Port charges (on carrier and cargo)
5) Railroad connections and transit time
6) Carrier intermodal network
7) Channel and berth depth

Smaller Container Carriers

1) Local market size
2) Port charges on cargo
3) Port charges on carrier
4) Terminal gate capacity
5) Labor productivity
6) Railroad connections and transit time
7) Availability and price of bunker fuel

A. Exporters

Table 5 ranks six major factors influencing the exporters' port choice. Only indirect port costs and charges to the cargo are under port control. Exporters choose ports first to minimize total transport cost, and second to minimize total transit time. Where the shipper is responsible for domestic transport, such as a California cotton exporter, domestic transport cost is the first criterion in port choice. A shipper who is not responsible for domestic transport, such as an exporter using an intermodal bill of lading, will emphasize transit time.

B. Importers

Six major factors influence the importers' port choice (Table 5). Only container storage space and port charges are under port control. The local import market is the major reason for importers selecting the Southern California ports. This import market leads transpacific ocean carriers to call at Southern California first. The carriers' routings satisfy the importers' second criterion: shortest transit time.

C. Large Intermodal Ocean Carriers

The large intermodal container operators typically require their own terminal, rely upon proprietary intermodal networks, and need efficient intermodal transfer. Table 5 lists seven major factors that influence large intermodal operators in port choice and intermodal routing. Their first port choice criterion is the size of the local import market. Although the majority of their cargo is discretionary, intermodal capabilities do not influence carriers in their *initial* port choice: once port rotation has been established by local market size, the discretionary cargo follows.

D. Smaller Ocean Carriers

Smaller container operators are less concerned about intermodal capabilities. Table 5 lists seven major factors that influence their port choice. Except for local market size, railroad connections, and transit time, the factors are under port influence or control. Since a large proportion of their cargo originates or terminates in the local hinterland, the size of the local market is of first importance. All aspects of cost are important to these smaller carriers. They are more likely to shift discretionary cargo between ports than are the large carriers with established intermodal networks.

How then do these factors and preferences operate to yield the observed cargo shares and cargo share shifts?

IV. LOCAL AND INTERMODAL MARKETS

A. Local Imports

In the Pacific trades, import containers outnumber export containers by a wide margin (Table 3). Ocean carrier logistics, including port choice, are thus dictated primarily by import flows. The size of the local import market, roughly defined as the local "hinterland" accessible by truck, is the greatest single influence on port choice.

The size of the Southern California hinterland market, which can include portions of Arizona and Nevada and the lower San Joaquin Valley, accounts more than any other factor for direct Los Angeles/Long Beach port calls in all trades. The size of this market is reflected in both population and economic activity. Table 6 shows the estimated population changes for Southern California, Northern California, and the Pacific Northwest over the past ten years. Southern California has the largest share and

TABLE 6
LOCAL MARKETS FOR WEST COAST PORTS

POPULATION (000)

	1970	1980	1983	Average Annual Growth 1970-1980	Average Annual Growth 1980-1983
Los Angeles Basin	9,981	11,498	12,191	1.5%	2.0%
LA/LB Hinterland	2,276	4,536	4,964	6.6%	3.1%
San Francisco Bay Area	4,754	5,368	5,624	1.3%	1.6%
SF/Oakland Hinterland	1,994	2,518	2,719	2.6%	1.6%
Seattle-Tacoma	1,837	2,093	2,187	1.4%	1.5%
Sea/Tac Hinterland	1,521	1,890	1,935	2.4%	0.8%

RETAIL AND WHOLESALE ACTIVITY ($000,000)

	1977	1982	Average Annual Growth 1977-1982
Los Angeles Basin	112,524	189,899	13.8%
LA/LB Hinterland	29,410	51,946	15.3%
San Francisco Bay Area	56,288	86,285	10.7%
SF/Oakland Hinterland	19,484	30,443	11.2%
Seattle-Tacoma	21,192	33,803	11.9%
Sea-Tac Hinterland	15,887	24,921	11.4%

Los Angeles Basin SMSAs: Anaheim, Los Angeles, Oxnard, Riverside.
LA/LB Hinterland SMSAs: Bakersfield, San Diego, Santa Barbara, Visalia, Las Vegas, Phoenix

San Francisco Bay SMSAs: San Francisco, Oakland, San Jose, Santa Cruz, Santa Rosa, Vallejo
SF/Oak Hinterland SMSAs: Fresno, Modesto, Sacramento, Salinas, Stockton

Seattle-Tacoma SMSAs: Seattle, Tacoma
Sea/Tac Hinterland SMSAs: Portland, Spokane

Sources: U.S. Statistical Abstract, 1985.
Metropolitan Statistical Abstract, 1985.

the highest growth rate of the three areas. Table 6 also compares economic activity for the three regions. Again, Southern California has the largest share, and a high growth rate.

B. Intermodal Imports

Major container carriers move much of their traffic to and from inland points. In effect, carriers are using intermodal services to serve a second, more distant hinterland through a single port of call. Such intermodal cargo is *discretionary*, in that ocean carriers can usually route the cargo through different West Coast ports with comparable efficiency. Chicago cargo, for example, can be readily shifted among West Coast ports as their relative advantages change. This discretionary cargo has become the prime focus of competition among container ports.

As of May, 1987, about 28 weekly double-stack trains originated in Southern California, 17 weekly trains in the Pacific Northwest, and 2 weekly trains in the San Francisco Bay Area. The volume of such traffic suggests that ocean carriers have routed most of their discretionary cargo movements through Southern California and the Pacific Northwest.

C. Local Exports

A large local export market leads carriers to make that region the *last* port of call. The availability of local exports depends on the extent of local production. On the West Coast, a large portion of the containerized exports consists of agricultural products that are containerized in the area of production and exported through the nearest port region. Most commodities, such as Pacific Northwest forest products and California rice, are thus economically limited to only one port region.

D. Intermodal Exports

With the expansion of intermodal services, exports from the East and Midwest (but not the Gulf) can move with comparable efficiency through any of the West Coast ports. As the strong growth in exports through the Pacific Northwest indicates, discretionary intermodal exports tend to move through the last U.S. port of call. This tendency can be altered, however, by the use of domestic freight to fill empty westbound containers, since the large local markets for imports also attract westbound domestic freight. A carrier may choose to combine westbound domestic freight with intermodal exports in a single train movement to Southern California, and to connect that train movement to a Southern California port call.

V. TRANSIT TIME AND VESSEL LOGISTICS

Vessel logistics dominate ocean carrier costs. Modern containerships are very large, up to 4,200 TEUs, and 70-80 percent of their costs are fixed. These costs, which can reach $30,000-$40,000 per day, lead carriers to minimize the number of port calls and the time in each port. Vessel logistics have encouraged the growth of intermodal movements: by using rail to serve the Gulf, for example, a transpacific carrier can turn the vessel on the West Coast instead of sailing through the Panama Canal. Ocean carriers prefer to unload import cargo at the first port of call to minimize transit time and maximize backhaul capacity. Carriers thus call first where the most import cargo (local *and* intermodal) can be unloaded, usually Southern California. The opposite is true for exports, which the ocean carrier seeks to load at the last port of call, usually San Francisco Bay or the Pacific Northwest.

Once first and last ports of call are established, they tend to attract the cargo of shippers seeking faster transit. The advantage of using the first port of call outweighs any small difference in rail transit time for intermodal imports. The last port of call gives the fastest possible transit time for exports, since they are not delayed while the vessel calls at other U.S. ports. Los Angeles and Long Beach have become important intermodal ports because the import market guarantees that they will usually be the first ports of call on the West Coast. Thus, intermodal cargoes transferred to rail at the first port of call in Southern California have shorter *total* transit times than cargoes discharged at later calls in the Bay Area or the Pacific Northwest, even though port and rail transit times are similar. The reverse is true for intermodal exports, and has contributed to the growth of Pacific Northwest cargo volumes.

In Table 7, we compare total transit times to Chicago through all three port regions. We assume that the foreign port is the last foreign port of call, and the U.S. port region is the first U.S. port of call. We also assume a 12-hour port time (from ship to rail), although less time may be required at some terminals. From the Far East, the Pacific Northwest has an advantage over San Francisco Bay, and San Francisco Bay has a similar advantage over Southern California. From Yokohama, for example, total transit time to Chicago is 265-273 hours through the Pacific Northwest, 278-290 hours through San Francisco Bay, and 292-300 hours through Southern California. As the inland destination is shifted south, the advantage gradually shifts to Southern California.

A. Ocean Steaming Time

Table 7 includes the steaming time for various foreign/West Coast port combinations. The Pacific Northwest is closer to the Far East, Southern California is closer to other points, and the Bay Area is in the middle of the range. At an average speed of 22 knots, a vessel from Yokohama could take 13 hours longer to reach San Francisco Bay than to reach the Pacific Northwest, and 14 hours longer yet to reach Southern California.

B. Port Time

If a vessel is prevented from docking because of berth congestion, voyage schedules are disrupted, cargo is delayed, and costs mount rapidly. Guaranteed availability of berth space to match vessel schedules is a minimum condition for calling at any port. Once docked, the vessel may be delayed due to terminal congestion. The San Francisco and the Pacific Northwest both have adequate berth and terminal capacity, and additional capacity under develop-

TABLE 7
TOTAL INTERMODAL TRANSIT TIMES TO CHICAGO FROM PACIFIC RIM PORTS
(Hours from Last Foreign Port)

Via First U.S. Port		Yokohama	Pusan	Sydney	Hong Kong
Bay Area (SF/Oakland)	Ocean	206	224	293	275
	Port	12	12	12	12
	Rail*	60-72	60-72	60-72	60-72
	TOTAL	278-290	296-308	365-377	347-359
Southern Calif. (LA/LB)	Ocean	220	239	296	290
	Port	12	12	12	12
	Rail	60-68	60-68	60-68	60-68
	TOTAL	292-300	311-319	368-376	362-370
Pacific Northwest (Seattle/Tacoma)	Ocean	193	209	310	262
	Port	12	12	12	12
	Rail	60-68	60-68	60-68	60-68
	TOTAL	265-273	281-289	382-390	334-342

* Wider range for Bay Area rail reflects 6-12 hours longer time for San Francisco.

Assumptions: Ocean transit at 22 knots; port times of 12 hours from vessel arrival to train departure.

Source: Distances Between Ports, 1965.

ment. Congestion is becoming serious in Southern California. Carriers may encounter congestion within the marine terminals, on port access roads, at truck gates, on freeways, and in Customs clearance. In this respect, the Ports of Los Angeles and Long Beach are the victims of their own success in attracting discretionary traffic. While the Southern California ports have plans for expansion and revision of marine terminals, they have less latitude, and much less influence, to improve port access. Further growth of Southern California container traffic will increase the congestion, and likely lead some ocean carriers to shift discretionary cargo to other ports.

C. Rail Transit Time

The effective rail transit time includes more than just the train movement. Rail transit begins when the last containers are accepted for loading onto the train. Rail transit ends with the transfer of containers onto chassis, when the containers are released by the railroad to the consignee. An examination of rail distances suggests that the Southern California ports have an advantage to the Gulf, and the Pacific Northwest ports have a small advantage to Chicago. The San Francisco Bay Area ports can be competitive to all midwest points, but they do not have a compelling advantage or disadvantage anywhere. At 50-70 MPH, a 100-mile route difference makes only a 1.5-2.0 hour transit time difference. Larger differences are more a function of contract terms and operating practices than of route distances. Chicago remains the major mid-continent rail destination and interchange, and transit times to Chicago are comparable for all three West Coast port regions. Our discussions with ocean carriers found a minimum scheduled transit time of *60-62 hours* to Chicago from Oakland, Seattle, or Los Angeles. Transit times for lower priority intermodal service are 64-72 hours, depending on route.

VI. PORT CAPACITY AND TERMINAL PRODUCTIVITY

Port capacity and terminal productivity influence the choice of ports or terminals within a region, and the choice of port for discretionary intermodal cargo that is not tied to a particular region. The number and productivity of container cranes, the terminal space available, and labor productivity are directly related to cargo throughput capacity vessel turn time, and underlying unit cost.

Vessel turn time depends largely on the rate at which container cranes can move containers on and off the ship. The prime considerations are the container moves per crane-hour, and the number of cranes available (usually two or three). The provision of container cranes can be a significant issue in securing an agreement from an ocean carrier to use a particular terminal. All the West Coast ports have responded by installing new cranes as needed. Crane productivity, however, is a function of labor productivity, as discussed below.

Terminal space requirements are affected by the type of terminal operation. Some of the larger carriers calling at West Coast ports, APL and Sea-Land for example, favor chassis operations, and thus have an exceptionally high demand for terminal space. All of the West Coast ports have room for expansion, although expansion is more difficult and expensive where the port areas are highly developed. This is especially true in Southern California, where expansion plans entail extensive filling of San Pedro Bay. In the San Francisco Bay Area and the Pacific Northwest, port expansion is being accomplished by converting older facilities to container terminals.

Labor and terminal productivity are closely linked, since labor accounts for most of the terminal operating costs. Hard data on labor productivity are uncommon and inconsistent, so carrier routing decisions are based on the *perceived* terminal productivity. To assess this factor, we interviewed representatives of five ocean carriers regarding the *perceived* rankings of West Coast ports in terminal productivity. The rankings we obtained are given below.

to the influx of intermodal discretionary cargo into Southern California and the Pacific Northwest. Competition for this cargo among port regions remains very keen. Factors in this competition include facility characteristics and transfer charges.

A. Intermodal Transfer Facilities

Current West Coast transfer facilities range from "on-dock" transfers in or adjacent to the marine terminal, to separate rail facilities 20 miles or more away. The merits of one arrangement over another is less an issue of distance than an issue of jurisdiction and transfer cost. The container typically passes from the ocean carrier's jurisdiction to a drayman at the marine terminal gate, and from the drayman to the railroad at the rail yard gate. Two inspections are performed in this procedure, with two sets of documents and attendant delays. Since the drayage cost is based on time, the ocean carrier sees delay as a direct cost. One alternative to the double-transfer system is to eliminate drayage by bringing the rail transfer "on-dock." In such a system, the container passes directly from the ocean carrier to the railroad, with only one inspection and only one set of paperwork.

Other things being equal, the ability to provide on-dock intermodal transfer and eliminate drayage is a competitive advantage for discretionary cargo. Other things are seldom equal, however, and savings in drayage may be offset by gate fees or terminal productivity differences. On-dock transfers now take place in Tacoma, Portland, San Francisco, and Long Beach. The Ports of Seattle and Oakland are in the process of adding on-dock rail transfer at some terminals. Ports and railroads that do not offer on-dock transfer have pursued other strategies to remain competitive.

Ocean Carrier Productivity Rankings of West Coast Ports

	A	B	C	D	E
Highest	Oakland	Tacoma	Tacoma	Tacoma	Tacoma
	Tacoma	LA/LB	Oakland	Seattle	Oakland
	Seattle	Oakland	Seattle	Portland	Seattle
	Portland	Seattle	Portland	Oakland	Portland
Lowest	LA/LB	Portland	LA/LB	LA/LB	LA/LB

Tacoma's high ranking was attributed to management and labor cooperation. Carriers generally agree that the favorable labor climate in Tacoma results from the union's aggressive approach to getting and keeping traffic, and thus maintaining employment for its members. Oakland's productivity was ranked differently by different carriers. The attitude and ability of the Bay Area labor force were generally praised, while port and stevedore management policies and practices received some criticism. Carriers consistently rank the Southern California ports low on terminal productivity, and attribute that ranking to a poor labor/management climate, as well as to increasing congestion. The one carrier who ranked Los Angeles/Long Beach high in productivity cited superior management at a particular terminal.

VII. INTERMODAL CAPABILITIES

Ten-year time series suggests that a large portion of the shift in West Coast cargo shares is attributable

Increased traffic, especially the advent of double-stack container trains, has strained the capacity and efficiency of older intermodal yards. New facilities have been built in Seattle, Tacoma, San Francisco, and Los Angeles. Existing facilities are being upgraded at Seattle, Oakland, and Los Angeles. Upgrading and new construction have set a higher standard of performance: railroads and ports with older facilities are perceived to be disadvantaged.

B. Intermodal Transfer Charges

Transfer charges may include drayage; chassis positioning or per diem; and gate charges at the rail terminal. Overall, the Pacific Northwest ports have the lowest transfer costs and the Southern California ports the highest, with San Francisco Bay ports in between. However, the charges are determined by a mix of port and railroad policies, and can change quickly.

The Pacific Northwest has a mixed system. For its contract container traffic, BN absorbs the drayage costs (if any) for loaded movements at Seattle, Tacoma, and Portland. Otherwise, the drayage cost in Seattle is $30-$75 per container, depending on marine terminal delay and the need for chassis repositioning. UP customers pay similar drayage costs. In Tacoma, most intermodal moves use the on-dock transfers. At the North Intermodal Terminal, operators charge $33 per container for this transfer (as of May, 1986). The South Intermodal Terminal is operated under contract for Sea-Land traffic. The port-operated Portland rail facility is on-dock, and served by BN and UP.

In Oakland, drayage charges have been roughly $35 per container for the SP and UP yards, and Santa Fe has historically equalized drayage charges to its Richmond Yard. The San Francisco ICTF is operationally on-dock, requiring no drayage, and is served by SP.

Drayage is the rule in Southern California. "K" Line uses on-dock UP service at Long Beach. All other carriers dray containers to UP's City of Commerce Yard, Santa Fe's Hobart Yard, or SP's new Intermodal Container Transfer Facility (ICTF). The UP and Santa Fe yards are over 20 miles from the marine terminals, and drayage averages $75-$80 per container. Highway congestion and other delays can raise the drayage cost to $120 per container. The Santa Fe yard has a chassis pool, enabling ocean carriers to reduce empty chassis repositioning. The SP ICTF is about 4 miles from the ports, reducing drayage costs to about $45-50 per container. There is a $30 per container gate charge at the ICTF, however, raising the total cost to about $75-80 per container.

VIII. PORT CHARGES

Within each of the three port regions, differences in port charges could influence a carrier to call at one port over another. Traditionally, the ship was charged for the use of the dock (dockage), and the cargo for the use of the wharf (wharfage). Other port charges were separate. Today, the various charges are being replaced by contractual, all-inclusive rates.

In choosing among regions, however, port charges are not a significant factor. Wharfage is expressed as a dollar charge per revenue ton, or per TEU. Wharfage tends to be 10-20 percent of total port costs, and the variations between ports are small. Dockage is based on vessel characteristics and time in port. For medium-sized ocean carriers, dockage on the order of $5 per container might be typical. In comparison to other ocean carrier costs, wharfage and dockage are minor considerations on a per-container basis.

IX. CONCLUSIONS

Our findings suggest that long-term cargo flows are mainly influenced by factors outside the control of the ports. Exporters consider domestic transportation costs and total transit time the two most important criteria in choosing among ports. Importers consider the local market size and transit time the two most criteria. The size of the local market unquestionably the single biggest reason why carriers elect to call at a particular port region. The local market is also a major factor influencing port rotation, and port rotation determines the routing of discretionary intermodal cargo. Following the size of the local market, carrier port routing criteria vary by the size and strategy of the various carriers. Large intermodal operators look for efficient, large-scale, intermodal connections; smaller container operators look for port cost and service efficiencies.

The Southern California cargo volumes have grown, and continue to grow, because the large local market attracts the first U.S. port calls. Those first calls lead carriers and importers to route discretionary cargo through Southern California. The Pacific Northwest cargo volumes have grown faster than the local market size would imply because of favorable intermodal capabilities and the attraction of being the last port of call for exports. While the San Francisco Bay cargo volumes have grown, their share has declined due to factors beyond their control that draw discretionary cargo north or south.

ENDNOTE

*Manalytics, Inc.