Container Flows in World Trade, U.S. Waterborne Commerce and Rail Shipments in North American Markets

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ABSTRACT

The analysis describes world trade in containers by country, through time, by importers and exporters, and by port areas. In addition, it includes an analysis of containerization of cargo. Specifically, we used the data to analyze the extent that cargos that traditionally were shipped in bulk, have become to be shipped in containers. We refer to this as containerization. This report also shows the results of an analysis of U.S. container movements by rail.

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1. INTRODUCTION

The container shipping industry is one of the fastest growing segments of the domestic and international logistical systems. International container volumes have increased from 47 million TEU (20-Foot Equivalent Units) to more than 140 million TEU in the period from 1996 to 2008 (projected). This implies an annual average growth rate of nearly 10% per year. Most projections are for this to continue. North America is the third largest importing market for containers (at 21 million TEU) following Asia (40 million TEU) and Europe (30 million TEU). The TransPacific trade routes have the highest trade volumes (22 million TEU at 10% average growth rate), followed by the Far East to Europe (17 million TEU at 12% average growth rate) and distantly the TransAtlantic route (6 million TEU at 5% growth) in 2007 and then domestic growth rates. North America is also a large container exporter. More than one-half its exports go to Asia, with this trend forecast to continue (Drewery). However, North America imports more containers than it exports and forecasts for growth in U.S. container trade are greater for imports than exports.

These trends have important implications for infrastructure planning. Indeed mammoth investments are required by terminals, railroads, and ports, as well as shipping companies in response to these changes in demand. In fact, major investments are already being made, or planned to be made in this sector. No doubt, this will continue as the industry matures and rationalizes.

2. PURPOSE AND ORGANIZATION

The purpose of this report is to analyze world trade in containers by country and by region, through time, by importers and exporters, as well as by port areas. In addition, it includes an analysis of containerization of cargo. Specifically, data analysis measures the extent that cargos that traditionally were shipped in bulk, are now shipped in containers. This process is referred to as containerization. This report also shows the results of an analysis of U.S. container movements by rail.

A companion report (Wilson and Sarmiento) provides an econometric analysis of domestic demand for containers at the BEA level using spatial econometrics.[1]

[1] These data could be analyzed using other models. One of these is using Markov processes to assess the shifting amongst ports through time. Another would be to analyze demand for container shipments as a product life cycle to explore the extent that these may be maturing markets.

3. DATA SETS ON CONTAINER FLOWS

There are several important data sets that describe and analyze container shipments and trade. These are described in this section. Appendix A and B profile detail on data used from these data sets.

3.1 World Trade in Containers

Two large consulting and data/information companies report large amounts of data on world shipping and on containers in particular. These are Clarkson (http://www.crsl.com) and Drewry (http://www.drewry.co.uk). Each company provides multiple reports on varying aspects of shipping and trade. In addition, they each have a number of specific reports on container shipping.

The data set from Clarkson was used in this study to analyze and describe world trade in containers.

3.2. U.S. Waterborne Commerce Data

The Waterborne Commerce Data set was used to analyze some aspects of trade in containers and is managed by the U.S. Army Corp of Engineers (ACE). This is an on-line data set of shipments in waterborne commerce. The data is collected and assembled for easy access at the ACE Data Center.

For this study, the ACE created separate downloads to assemble the data on a consistent basis over time. This data is used to analyze the containerization of shipments to and from the United States. The data set is referred to as the national Waterborne databank.

3.3 U.S. STB Data

The United States Surface Transportation Board (STB) reports data on rail shipments. These can be used to infer the shipments of containers and trailers among origins and destinations. STB data for the years 1995-2005 was used to describe trade in containers within the United States. This data was from the Surface Transportation Board (STB) Confidential Waybill data set and was assembled by the Tennessee Valley Authority (TVA).

Confidentiality These data are limited in their distribution and are subject to confidentiality requirements. For these reasons, sections of this report are deleted to preserve the confidentiality of this data.

3.4 Units Reported

The units used to measure container shipments vary by source. Clarkson reports data in TEUs (Twenty-Foot Equivalent Unit) as does the American Association of Port Authorities (AAPA) and the Secretaría de Comunicaciones y Transportes of Mexico. The Waterborne Commerce Data is reported in kilograms and converted to short tons. Finally, the STB data is reported in the number of containers and trailers. Separate fields are shown for containers and trailers. To be consistent, the data is reported directly. However, in several cases attempts are made to reconcile the reported data amongst sources.

3.5 Other Data Sets

There are other data sets that could be used to analyze container shipments. These are mentioned briefly but are not used as the primary data in this report. Appendix B to this report documents how these associations report their data and how they are comparable or not to each other.

American Association of Port Authorities (Industry association of ports). This data is used in analysis of North American Ports. It is used to supplement data from Clarkson. It has greater detail and is the appropriate data. This is compared and the results are comparable.

Secretaría de Comunicaciones y Transportes of Mexico. This is the Mexican source used by the AAPA for North American statistics.

Intermodal Association of North America (IANA). This data set can be used to track container/trailer data in the United States. It is used to validate our STB container data. In addition, IANA's web-based intermodal terminal directory is used to develop BEA intermodal terminals. This association counts containers/trailers differently than AAR.

American Association of Railroads (AAR). The AAR tracks container/trailer on railroads in the United States. It is used to validate our STB container data. The numbers are comparable, but the STB data set counts containers differently. Specifically, the AAR counts only Class 1 traffic, so their numbers are smaller.

PIERS. The PIERS' web site indicates that "PIERS is a world leader in providing current, accurate and comprehensive data on international trade." This is a more costly data set and thus is not used in this study. However, it is a primary information source for TEU-based container trade.

4. WORLD TRADE IN CONTAINERS

4.1 Data Details and Organization of Results

The Clarkson data set is used to describe and analyze details of world trade in containers. This data covers the period between 1996 and 2006 with estimates for 2007 and 2008.

Variables of particular interest to this analysis include:

- Aggregate container trade–major flows: Transpacific, Far East-Europe, Transatlantic, Other;
- Container exports, million TEU by world origins;
- To import countries and North American Ports; and
- Major port throughput as measured as TEU lifts.

Unless indicated otherwise, the data used in this section are as reported in Clarkson Research Services, 2007, during 3rd quarter 2007, Container Intelligence Quarterly. Supplemental data is used from the American Association of Port Authorities and the Secretaría de Comunicaciones y Transportes of Mexico.

4.2 Results: World Trade in Containers

Global Container Trade. (See Figures 4.2.1-4.2.7 and in Tables 4.2.1-4.2.2) Global trade in containers for major trade route container traffic indicate that trade has increased from 47 million TEU to over 140 TEU million projected for 2008 (208% increase from 1996). The increase through 2006 is to over 117 million TEUs (150% increase from 1996). Projections as reported by Clarkson (2007-2008) are shown, and traffic increases are expected to continue through 2008.

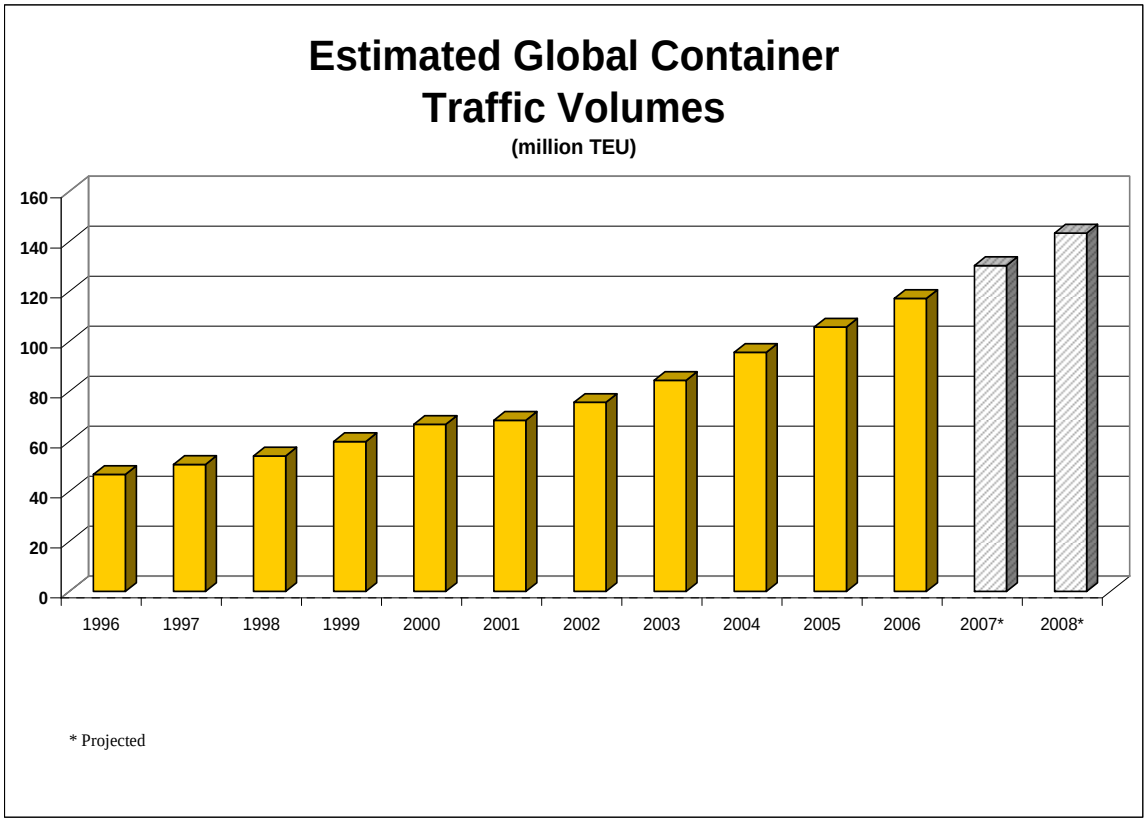


Figure 4.2.1 Estimated Global Container Traffic Volumes, 1996-2008.

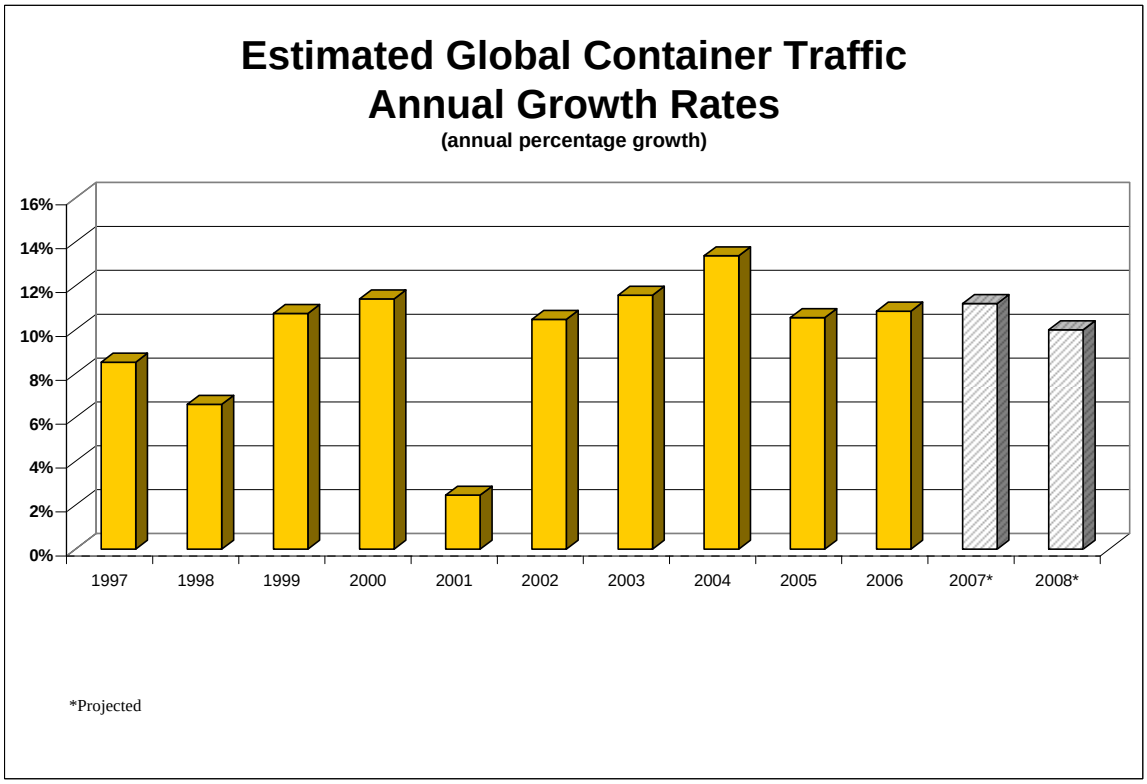


Figure 4.2.2 Estimated Global Container Traffic Annual Growth Rates.

The annual rate of increase ranges from 2.5% (2001) to 13.4% (2004) with an average of the annual growth rates of 9.8%/year. In all but three years there have been double digit increases. The only year with a smaller increase was 2001. Projections from Clarkson are for continuing traffic increases (2007-2008).

Global Import Container Trade. The major import region for container shipments is Asia. Taken together, Asia, Europe and North America have about two-thirds of the import container market. Europe imports more containers than North America. All regions have experienced annual increases for the reported period, and short-term forecasts are for continued growth.

While all regions have experienced increases in imports, Other and Latin America & Caribbean have increased their market share in the past two years. Other market share increased from 20% to a forecasted 25%. Asia increased in total volume, but its market share decreases from an estimated 32% in 2006 to a projected 31% in 2008. Europe and North America are projected to decline in market share about two percentage points from 2006 to 2008.

Table 4.2.1 Estimated Major Region Container Imports, million TEU

	Importing Region					
Year	**Europe**	**North America**	**Asia**	**Latin America & Caribbean**	**Australia & New Zealand**	**Other**
2000	19.9	12.6	21.9	3.3	1.8	7.2
2001	20.3	12.8	21.9	3.3	1.8	8.4
2002	21.1	14.5	23.1	3.4	2.0	11.5
2003	22.1	15.5	26.9	3.6	2.2	14.0
2004	24.0	17.6	31.2	4.2	2.5	16.1
2005	25.8	19.3	34.0	4.4	2.7	19.5
2006*	28.0	20.6	37.4	5.3	2.9	22.9
2007**	29.5	21.1	40.3	6.7	3.1	29.5
2008**	31.4	22.1	43.7	7.1	3.4	35.6

* Estimated
** Forecast

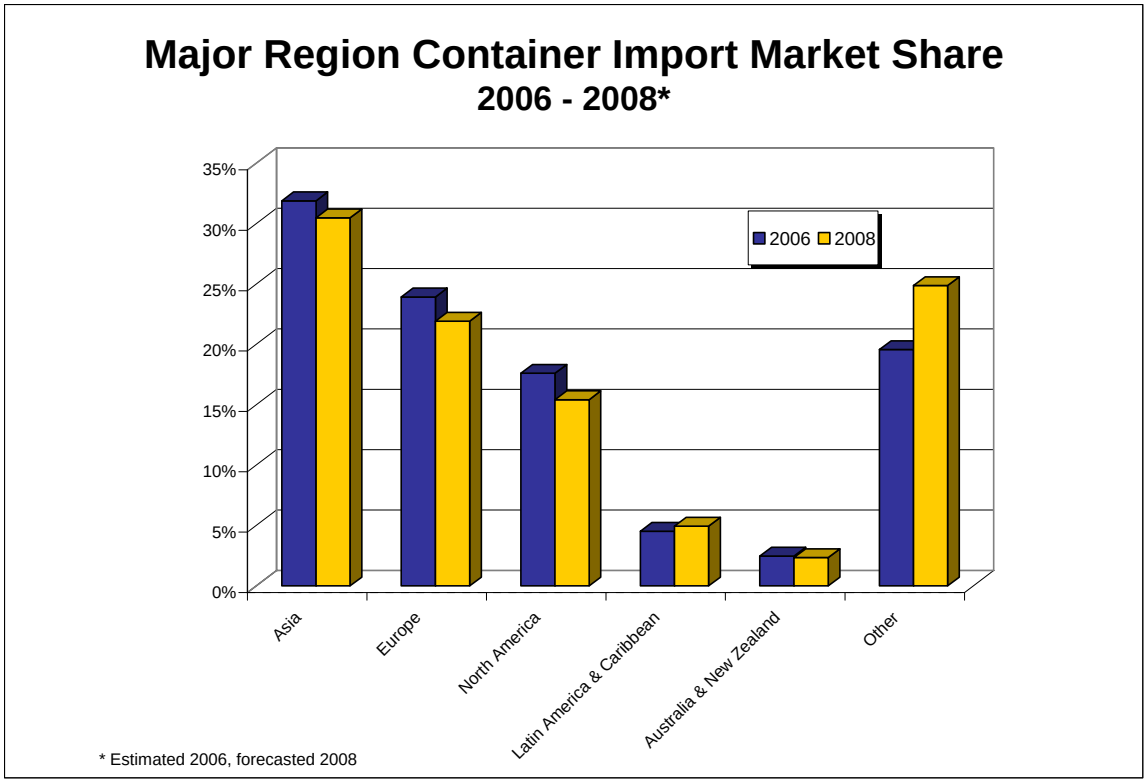


Figure 4.2.3 Container Regional Import Market Shares.

Each region has trend growth rates exceeding 7%. Other growth is the largest at over 18% followed by Latin America & Caribbean at 15%. Of the three largest regions in terms of volume, Asia has the highest 5-year growth trend at 10% followed by an identical 7% for Europe and North America.

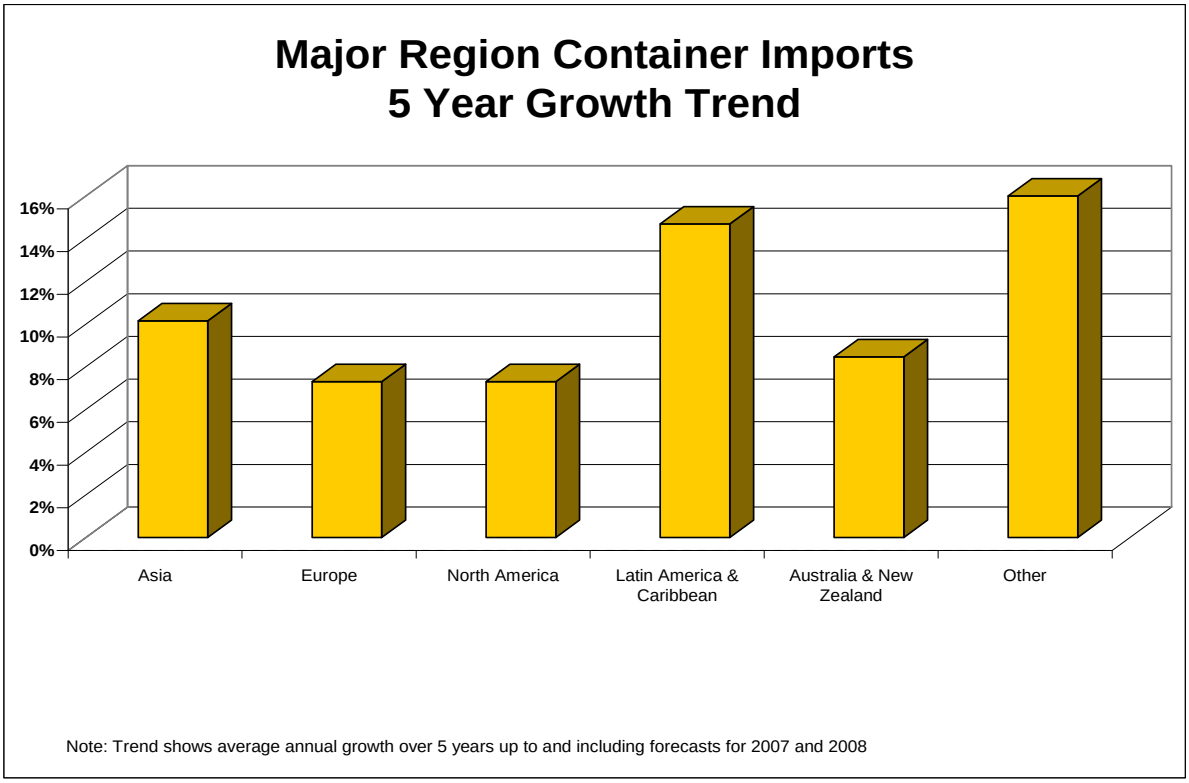


Figure 4.2.4 Major Region Container Imports 5-Year Growth Trend.

Global Export Container Trade. Asia is the largest exporter of containers, with over 50% of exported containers originated. Europe, Asia, Latin America & Caribbean and Australia & New Zealand have all experienced annual increases for the reported period. North America experienced annual increases for all reported years except 2001. Nearby forecasts are for continued growth for all regions.

While all regions have increased exports, Asia and Other have increased their market share. Asia dominates export container market share. Europe's market share decreases from an estimated 21% to a forecasted 19%. North America increases in total volume (see above table) but its market share decreased from an estimated 9% in 2006 to a projected 9% in 2008.

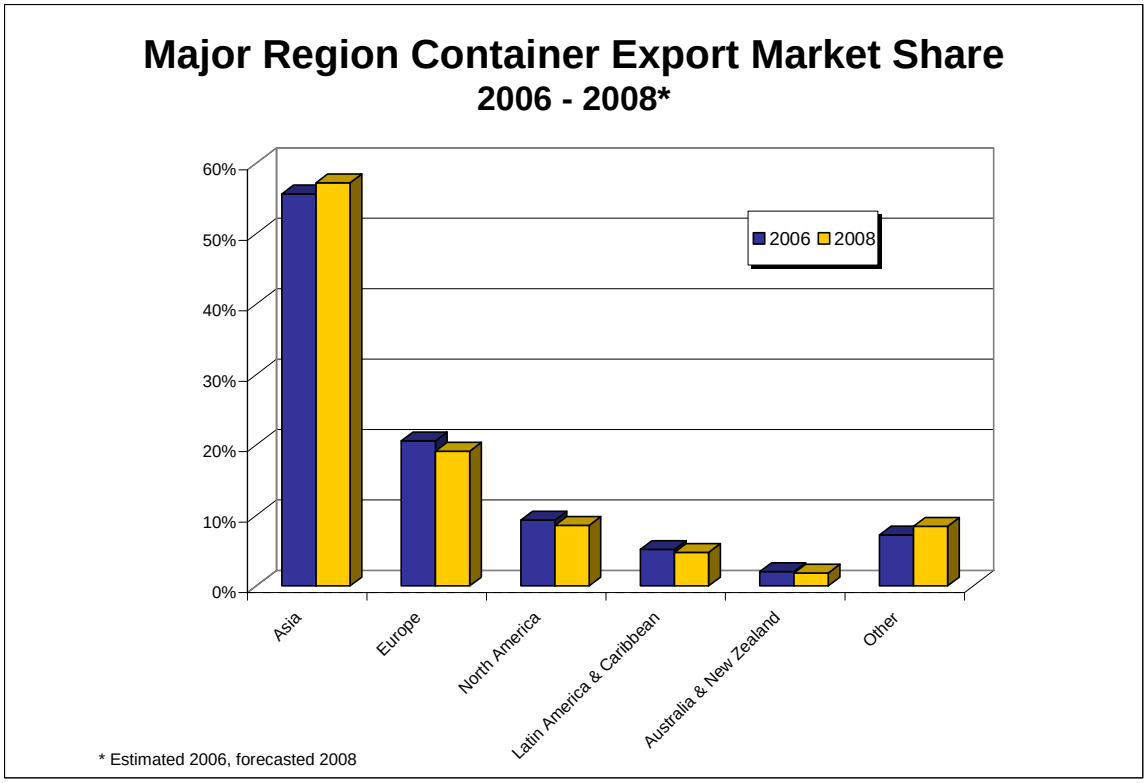


Figure 4.2.5 Export Market Shares.

Table 4.2.2 Estimated Major Region Container Exports, million TEU

	Exporting Region					
Year	**Europe**	**North America**	**Asia**	**Latin America & Caribbean**	**Australia & New Zealand**	**Other**
2000	18.21	8.31	28.03	3.92	1.90	6.40
2001	18.83	8.26	28.48	3.97	1.95	6.93
2002	19.29	8.47	32.65	4.23	2.05	8.89
2003	19.75	9.02	39.09	4.39	2.05	10.04
2004	21.20	9.76	48.29	4.53	2.25	9.58
2005	22.50	10.39	56.32	5.10	2.29	9.10
2006*	24.11	10.95	65.22	6.05	2.36	8.48
2007**	25.66	11.55	73.62	6.45	2.44	10.57
2008**	27.41	12.32	82.03	6.82	2.61	12.12

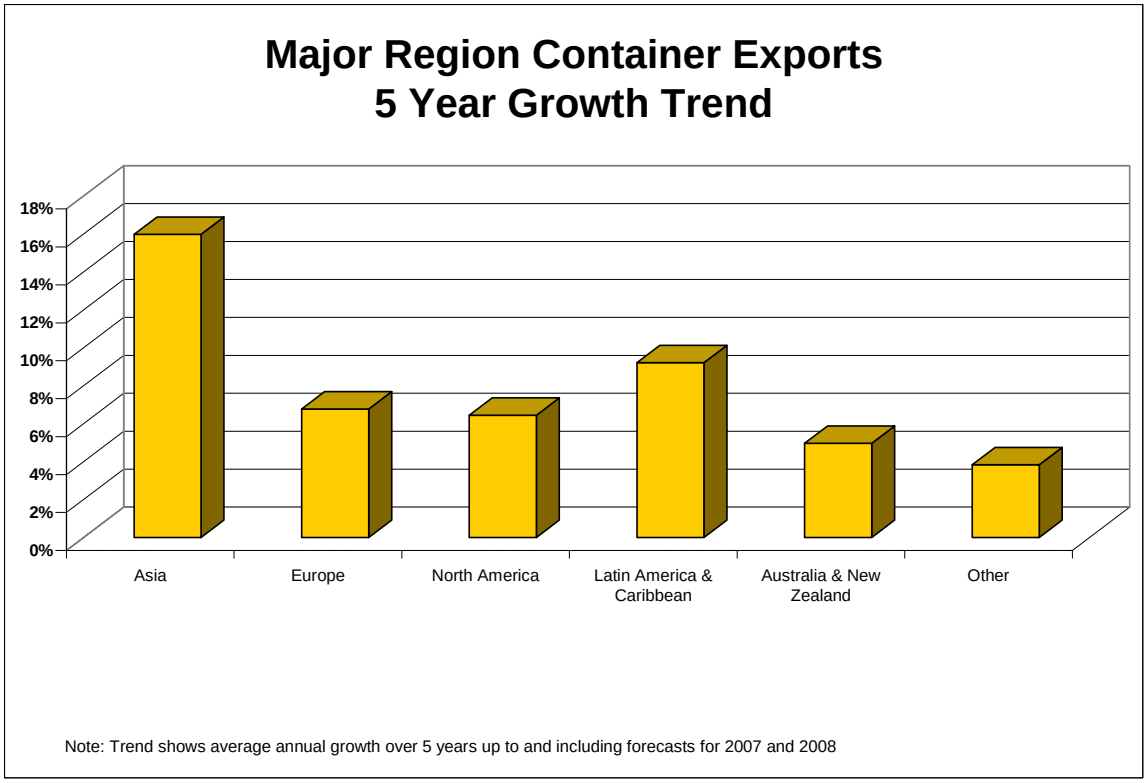


Figure 4.2.6 Region Container Exports 5-Year Growth Trend.

Asia's 5-year growth trend is 16%/year, the largest by far, and is the only major region to exceed the global 5-year growth trend of 11%. Latin America & Caribbean, with a small market share, have the second highest 5-year growth trend at 9%. Of the three largest regions in terms of volume, Asia has the highest 5-year growth trend followed by 7% for Europe and 6% for North America.

Global Import/Export Container Trade Comparison. Figure 4.2.7 summarizes imports and exports of TEU trade projected for 2008. These show that 1) Asia dominates the import and export container market; 2) both Europe and North America import more containers than they export; 3) only Asia exports more containers than it imports and 4) North America's import/export imbalance is larger than Europe's.

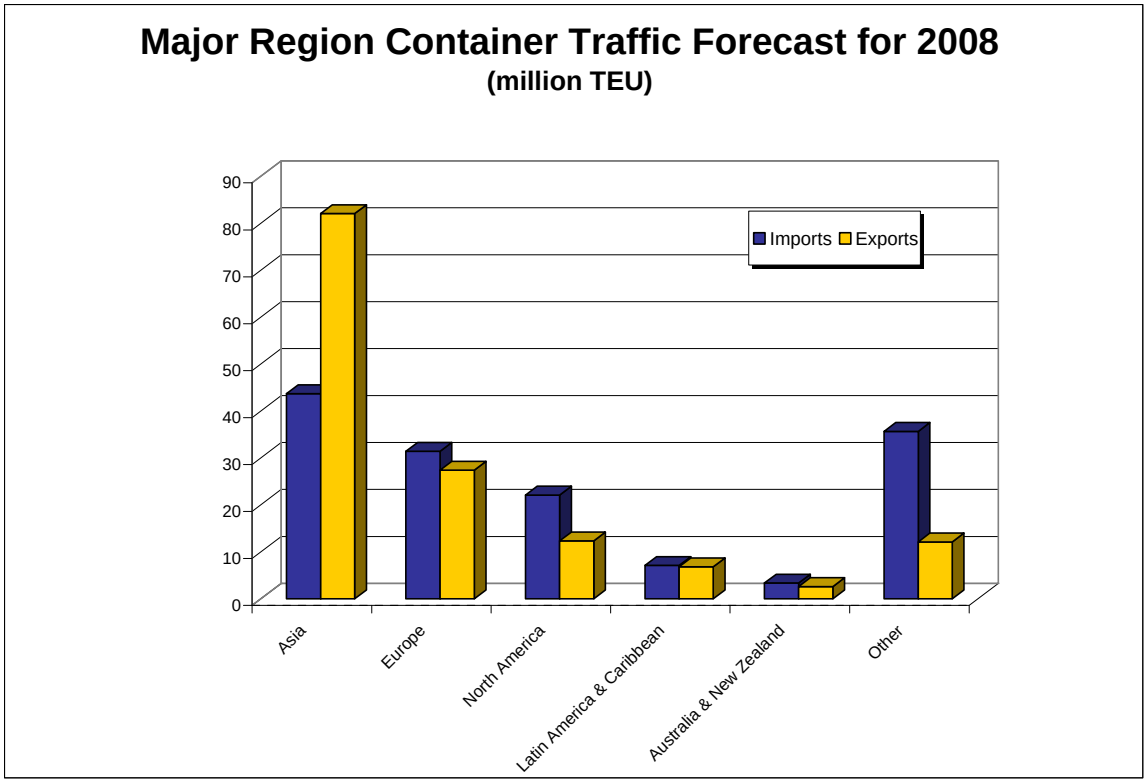


Figure 4.2.7 Global Import/Export Container Trade Comparison.

4.3 Mainlane Container Trade

Clarkson categorizes container trade using geographic definitions for what are '*Mainlane*' trades. There are three 'mainlane' or major trade routes. Transpacific refers to U.S., Canada and Mexico to/from Asia. Transatlantic refers to U.S., Canada and Mexico to/from Europe including Central and Eastern Europe and European CIS. Far-East-Europe refers to Asia to/from Europe plus Central and Eastern Europe and European CIS.

These results are summarized in Tables 4.3.1-4.3.3 and Figures 4.3.1-4.3.2. Important conclusions from these results are:

- Transpacific has highest trade volumes for every year reported;
- Far East-Europe has the highest annual growth rates;
- Transatlantic has the smallest annual increases including one negative growth year (2001);
- Annual growth rates for Far East-Europe and Transpacific are two to three times or more than that of Transatlantic;
- Average annual growth rates for the reported period are as follows: Far East-Europe 12%, Transpacific 10%, and Transatlantic 5%;
- Projections are for continued double-digit growth for Far East-Europe with nearly double-digit projected growth for Transpacific.

Further, the mainlane traffic is about one-third of global trade. The average annual growth rate for Mainlane trade is slightly less than Other, at 9% versus 10% for Other.

These results also show that (Figure 4.3.1) Far East-Europe has largest increase in container traffic followed by Transpacific and Transatlantic. Far East-Europe container traffic has increased 290% for the reported period. The gap between the Far East-Europe and Transpacific growth with the Transatlantic growth continues to widen (post 2001). Finally, Far East-Europe growth appears to be increasing faster than the other mainlane routes.

Table 4.3.1 Mainlane Container Trade, 1996-2008

	Transpacific		**Far East-Europe**		**Transatlantic**	
Year	Million TEU	Annual Growth Rate	Million TEU	Annual Growth Rate	Million TEU	Annual Growth Rate
1996	8.2		4.8		3.8	
1997	8.9	8%	5.4	12%	4.4	13%
1998	9.2	4%	5.9	10%	4.7	7%
1999	10.2	10%	6.6	11%	4.8	3%
2000	11.5	14%	7.2	10%	5.1	6%
2001	11.5	0%	7.7	6%	5.1	-1%
2002	13.2	15%	8.3	8%	5.3	4%
2003	14.3	8%	9.6	16%	5.4	2%
2004	16.3	14%	11.1	16%	5.7	6%
2005	18.4	13%	12.3	10%	5.9	4%
2006	20.2	10%	14.7	20%	6.1	3%
2007*	21.9	9%	16.7	13%	6.3	3%
2008*	24.2	10%	18.8	12%	6.5	4%

*Projected

Table 4.3.2 Mainlane Container Trade Compared to Other Global Container Trade

	Mainlane		**Other**	
Year	Million TEU	Annual Growth Rate	Million TEU	Annual Growth Rate
1996	16.8		29.9	
1997	18.6	11%	32.2	7%
1998	19.8	7%	34.3	7%
1999	21.5	9%	38.4	12%
2000	23.9	11%	42.9	12%
2001	24.3	2%	44.2	3%
2002	26.8	11%	48.8	11%
2003	29.2	9%	55.1	13%
2004	33.1	13%	62.5	14%
2005	36.6	11%	69.1	11%
2006	41.0	12%	76.1	10%
2007*	44.9	10%	85.3	12%
2008*	49.5	10%	93.8	10%

*Projected

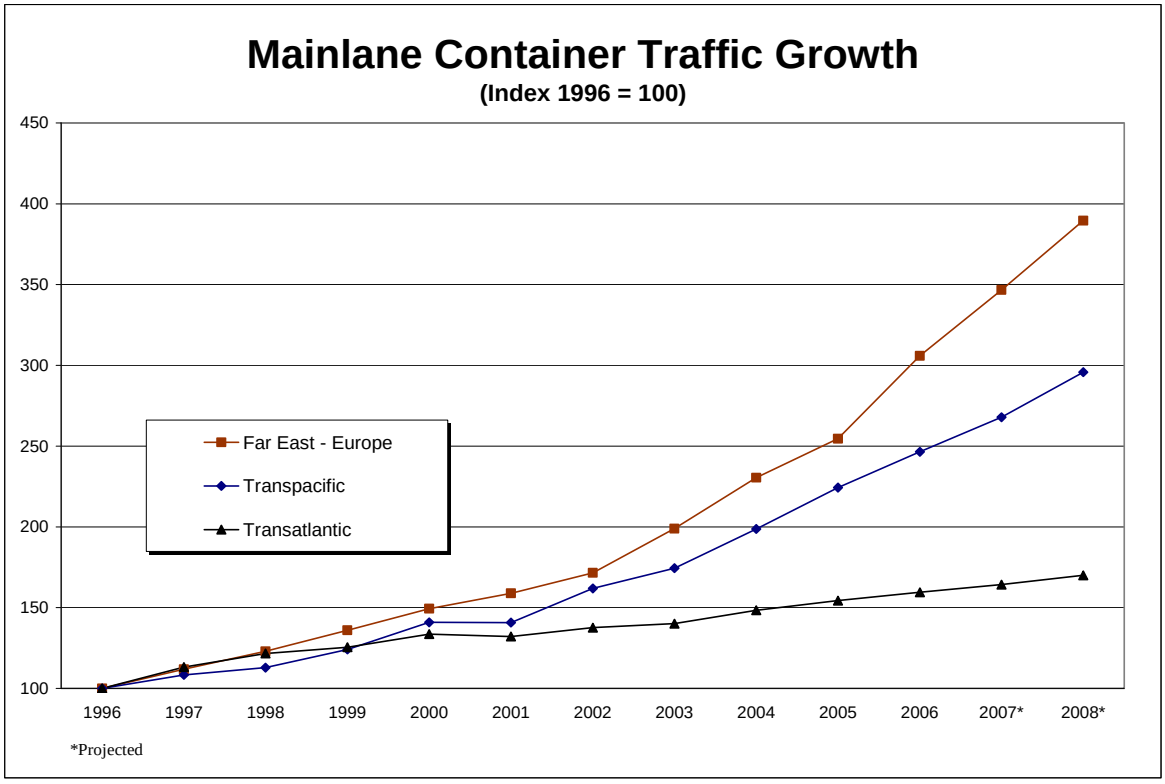


Figure 4.3.1 Mainlane Container Traffic Growth, 1996-2008.

Table 4.3.3 and Figure 4.3.2.show the directional balance of these mainlane trades. As noted,

- East Bound Transpacific is the largest container trade lane;
- West Bound Transpacific has only about 40% of the traffic the East Bound has;
- West Bound Far East-Europe is nearly three times greater than East Bound Far East-Europe; and
- 2001 West Bound Transpacific, 2001 East Bound Transatlantic and 2003 West Bound Transatlantic are the only categories not to have an annual increase in traffic levels.

The annual growth rates indicate that West Bound Far East-Europe has experienced the highest annual growth rates for the reported period. Both East and West Bound Transatlantic show the smallest growth rates averaging 3% to 4% and Transpacific and Far East-Europe growth rates are substantially higher than Transatlantic growth rates.

Table 4.3.3 Mainlane East and West Bound Container Trade, thousand TEU

	Transpacific		Far East-Europe		Transatlantic	
	East Bound	West Bound	East Bound	West Bound	East Bound	West Bound
2000	7,473	4,057	2,710	4,531	2,193	2,944
2001	7,622	3,897	2,760	4,899	2,134	2,943
2002	9,079	4,165	2,930	5,336	2,168	3,119
2003	9,688	4,580	3,103	6,486	2,306	3,076
2004	11,361	4,892	3,539	7,571	2,473	3,228
2005	12,960	5,391	3,720	8,557	2,631	3,302
2006	14,361	5,798	4,026	10,729	2,731	3,399
2007	15,950	6,220	4,448	12,360	2,814	3,540
2008	17,745	6,825	4,922	13,928	2,907	3,715

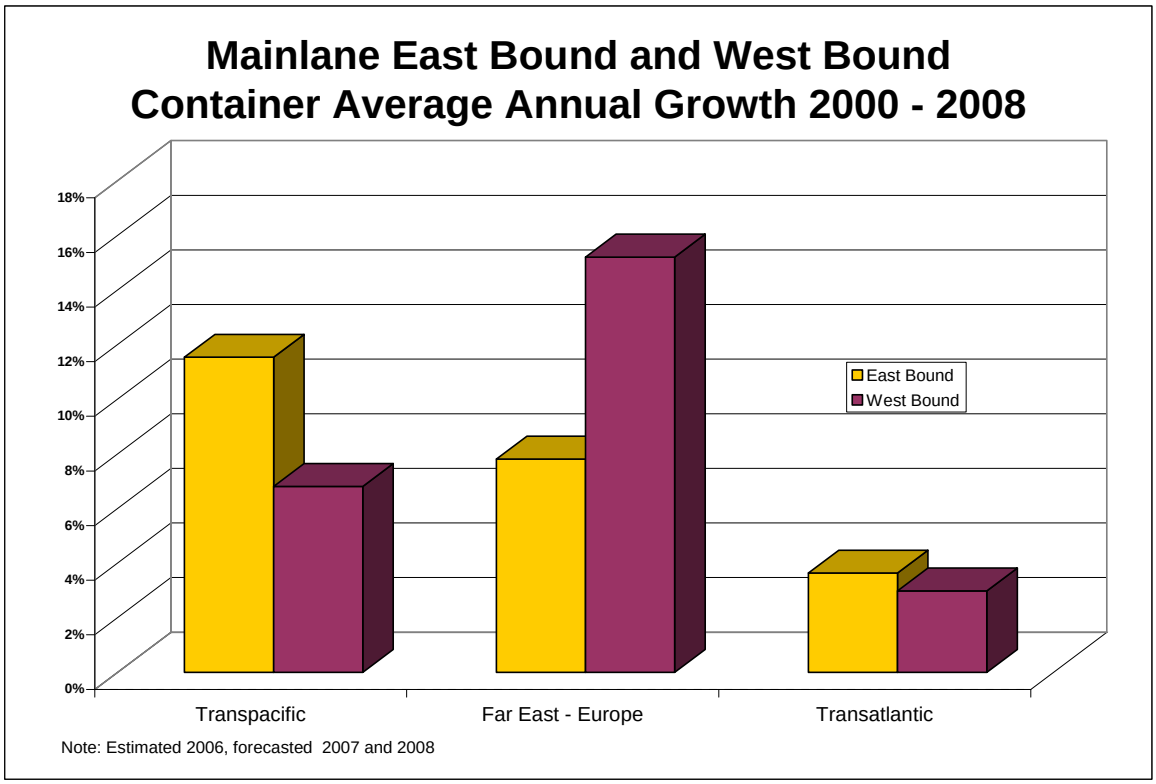


Figure 4.3.2 Mainlane East and West Bound Container Average Annual Growth, 2000-2008.

4.4 North America Container Trade

This section provides a summary of trade to and from North American ports.

Figure 4.4.1 shows that over 60% of North American container TEUs are imports. Both container imports and exports are forecast to grow. Asia dominates North America imports with almost 18 million TEU forecast for 2008 (Figure 4.4.2).[2] Asia's market share of North American imports grows from 61% in 2000 to a projected 78% in 2008. Imports from Europe increase steadily but more slowly. Over half of North American container exports go to Asia (Figure 4.4.3). North American container exports to Asia and Europe are projected for continued growth.

The results (Figure 4.4.4) indicate a global 5-year growth trend of over 11% is substantially larger than North American and United States growth trends. The import 5-year growth trends are larger than exports for both North American and the United States, and the United States export 5-year growth trend is slightly larger than North America's.

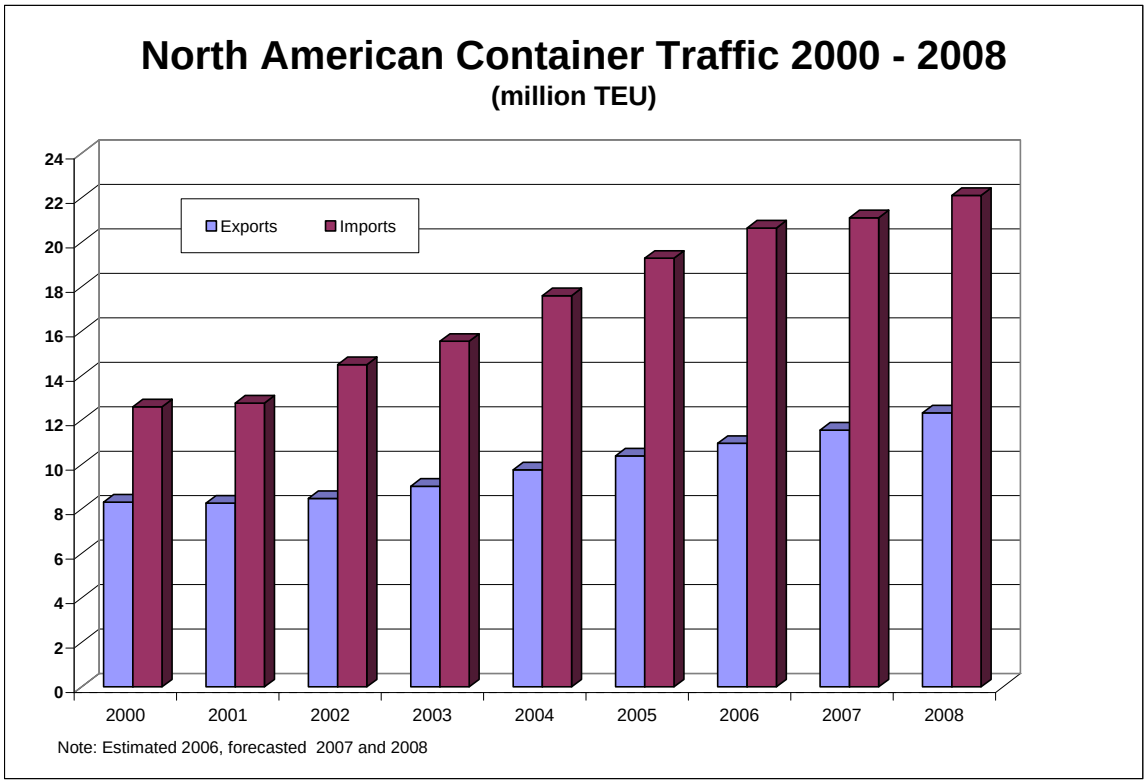


Figure 4.4.1 North American Container Traffic, 2000-2008.

[2] For this section the paper CIQ 2nd quarter report has breakdown at the bottom of Table 2.2 and Table 2.4. The spreadsheet of the 3rd quarter does not. The 2nd and 3rd quarter numbers do not match; the 3rd quarter is an update but does not have the breakdowns.

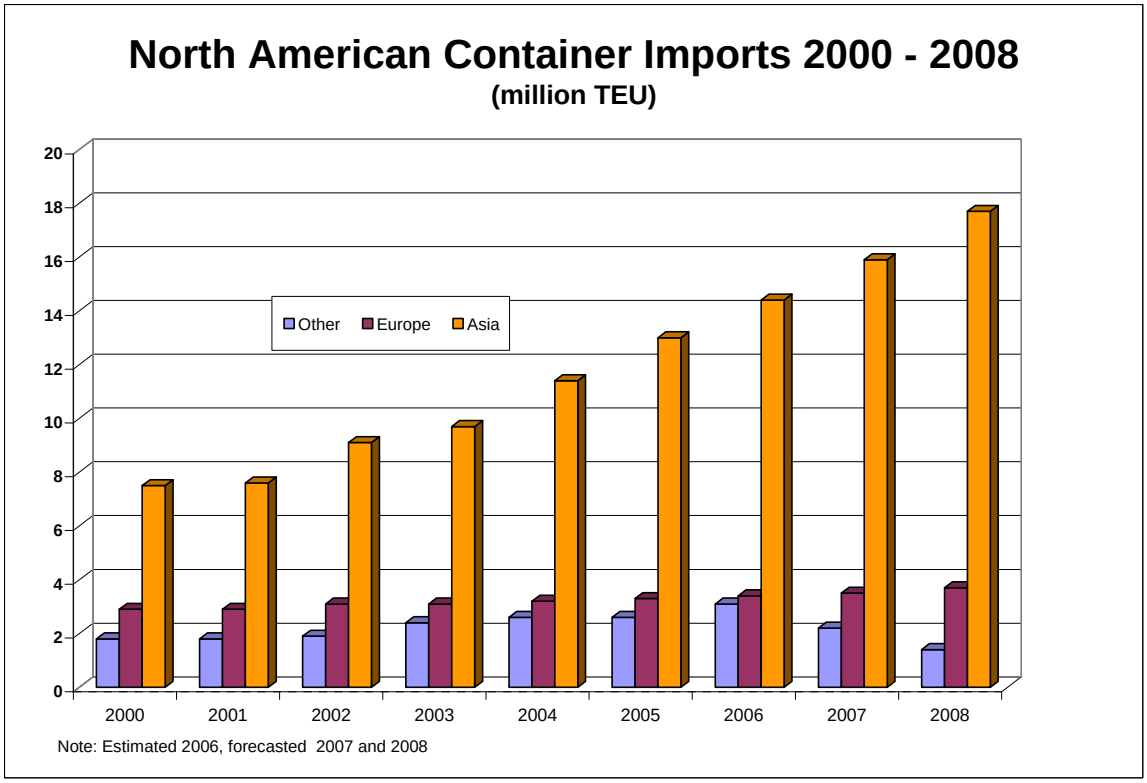


Figure 4.4.2 North American Container Imports, 2000-2008.

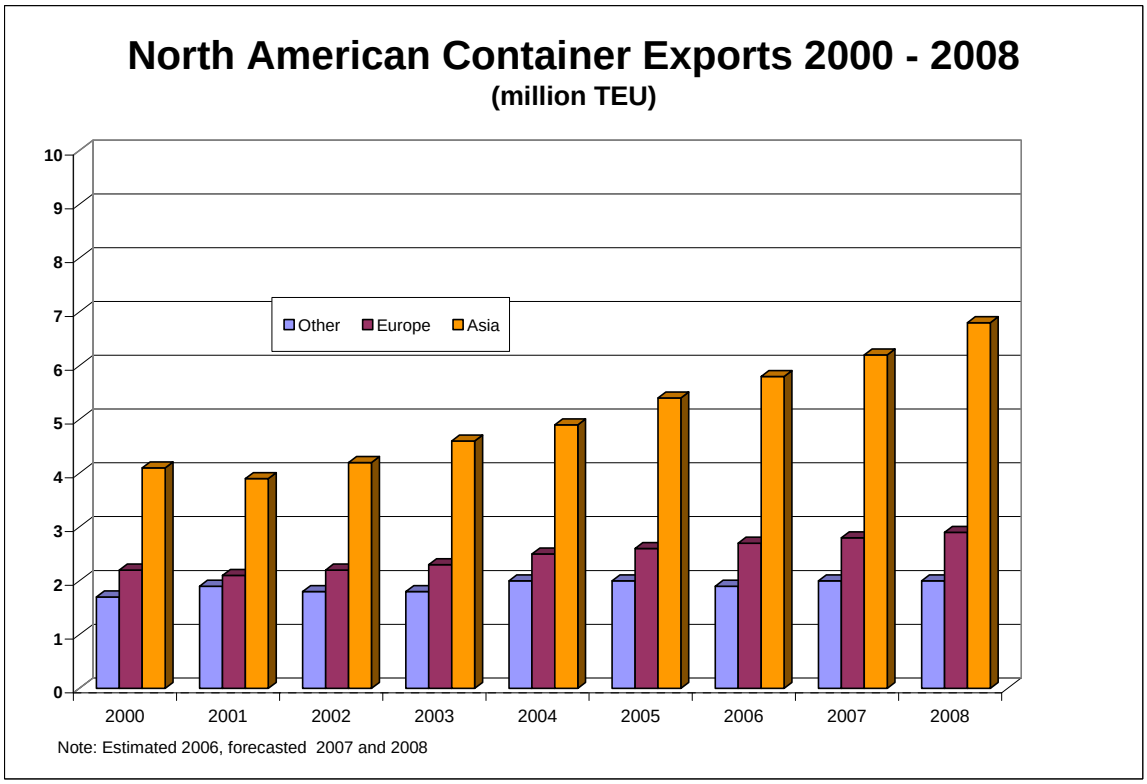


Figure 4.4.3 North American Container Exports, 2000-2008.

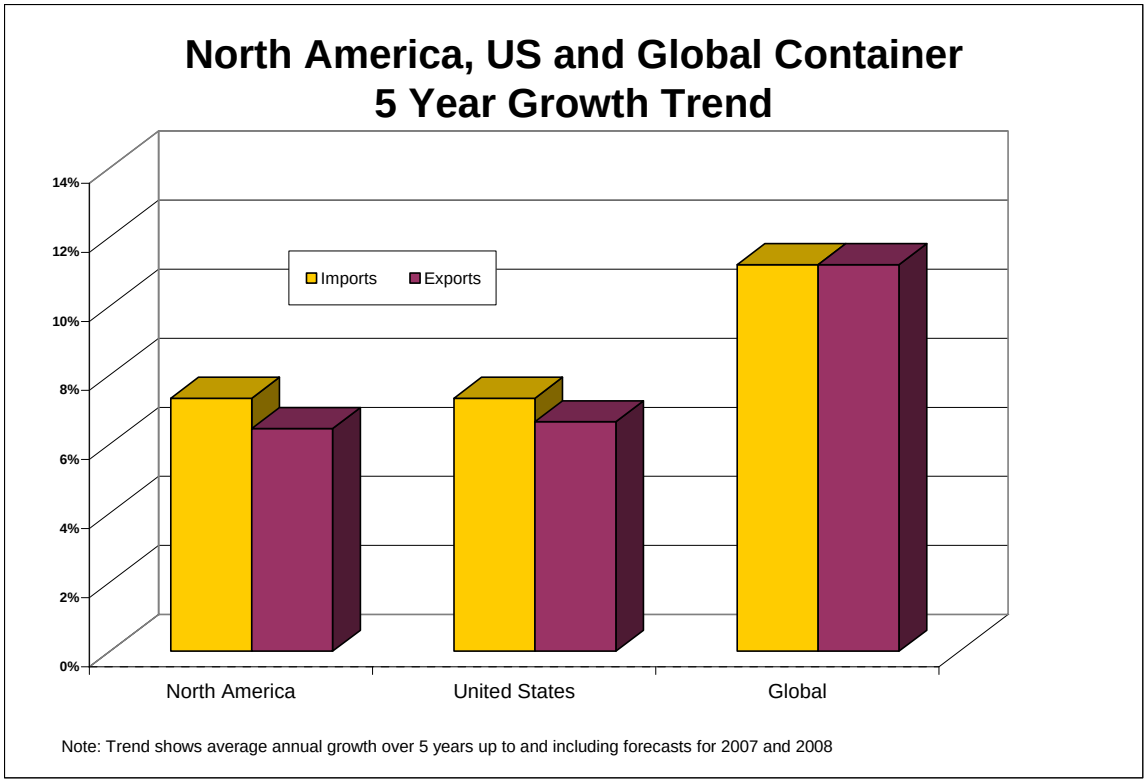


Figure 4.4.4 North America, U.S. and Global Container 5-Year Growth Trend.

4.5 Global Port Container Throughput

This section provides a comparison of Container Port throughput as reported by Clarkson. The data are from Clarkson, 2nd Quarter, Container Intelligence Quarterly. North America includes the United States and Canada.

Asian port throughput is, by far, the largest in the world. Northern and Mediterranean Europe combined have about one-third of Asia's projected 2008 port throughput. Northern Europe port throughput is larger than North America port throughput. Asia and Other port throughput volumes are forecast to double or more during the reported period with Northern Europe falling just short of doubling its throughput volume.

The Asian port throughput is the only region to exceed the global 5-year growth trend. The 5-year growth rate for each exceeds 6% per year. The volume of Asia port throughput has been the largest of any region on the global 5-year growth trend. Finally, Northern Europe port throughput has grown at a faster pace than North America port throughput during the reported period.

Table 4.5.1 Regional Container Port Throughput, million TEU lifts

Year	Northern Europe	Med Europe	North America	Asia	Other	Global
2001	34	18	30	115	43	239
2002	37	21	33	138	45	275
2003	41	22	36	153	53	305
2004	46	23	40	175	59	343
2005	51	26	43	194	67	381
2006	56	27	45	219	74	420
2007*	59	28	47	257	79	471
2008*	63	30	50	290	86	519

*Projected

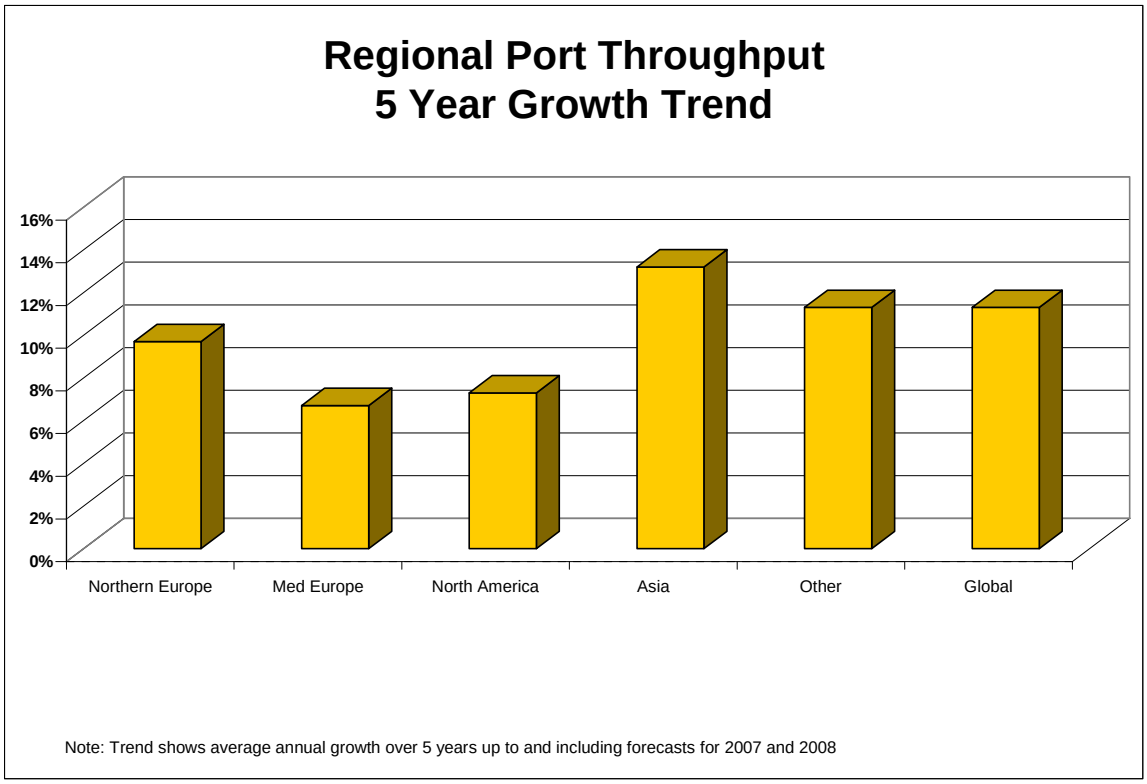


Figure 4.5.1 Regional Port Throughput: 5-Year Growth Trend.

Among individual ports, Singapore has the largest throughput in the world, slightly more than Hong Kong (Figure 4.5.2). The top six ports in the world, as measured by TEU lifts, are located in Asia. Los Angeles is the only North America port in the top 10 world ports, while 15 of the top 25 ports are located in Asia. All ports in the top 20 grow at least 30% from 2001 to 2006, and seven of these ports have triple digit growth from 2001 to 2006.

Table 4.5.2 Top 25 Global Major Container Port Throughput

Rank	Port	Million TEU Lifts		Percent Change	Region
		2006*	2001		
1	Singapore	24.80	15.57	59%	Asia
2	Hong Kong	23.23	17.80	31%	Asia
3	Shanghai	21.71	6.33	243%	Asia
4	Shenzhen	18.47	5.08	264%	Asia
5	Busan	12.03	8.07	49%	Asia
6	Kaohsiung	9.77	7.54	30%	Asia
7	Rotterdam	9.60	6.10	57%	NW Europe
8	Dubai	8.92	3.50	155%	Middle East
9	Hamburg	8.90	4.69	90%	NW Europe
10	Los Angeles	8.47	5.18	63%	N America
11	Qingdao	7.62	2.64	189%	Asia
12	Long Beach	7.29	4.46	63%	N America
13	Ningbo	7.09	1.21	486%	Asia
14	Antwerp	7.01	4.22	66%	NW Europe
15	Port Klang	6.32	3.76	68%	Asia
16	Tianjin	5.95	2.01	196%	Asia
17	New York/New Jersey	5.13	3.32	55%	N America
18	Tanjung Pelepas	4.77	2.05	133%	Asia
19	Bremen/Bremerhaven	4.47	2.92	53%	NW Europe
20	Laem Chebang	4.12	2.34	76%	Asia
21	Tokyo	3.67	2.77	32%	Asia
22	Algeciras	3.24	2.15	51%	Med Europe
23	Yokohama	3.20	2.30	39%	Asia
24	Colombo	3.08	1.73	78%	Asia
25	Felixstowe	3.00	2.80	7%	NW Europe

*Estimated

The 5-year growth rates are derived for the top 25 ports (Table 4.5.3). These results show that:

- Singapore, the world's largest port as measured by container lift throughput, is ranked 12th;
- The top five ports, as measured by the 5-year growth trend, are located in Asia;
- Ningbo is the highest ranked port as measured by 5-year growth trend, the 13th largest port as measured by TEU lifts;
- Two of Asia's largest throughput ports, Shenzhen and Shanghai, rank two and three experiencing 42% and 29% growth trends;
- Two Northwest European ports are in the top 10;
- Los Angeles and Long Beach have a growth trend of 10% followed closely by New York/New Jersey at 9%; and,
- Hong Kong, ranked second in the volume of port throughput, is ranked 23rd in the growth trend of the top 25 ports.

Table 4.5.3 Top 25 Global Major Container Port 5-Year Growth Trend

Rank	Port	5-Year Growth Trend*	Region
1	Ningbo	42%	Asia
2	Shenzhen	29%	Asia
3	Shanghai	28%	Asia
4	Qingdao	24%	Asia
5	Tianjin	24%	Asia
6	Dubai	21%	Middle East
7	Tanjung Pelepas	18%	Asia
8	Hamburg	14%	NW Europe
9	Laem Chebang	12%	Asia
10	Antwerp	11%	NW Europe
11	Port Klang	11%	Asia
12	Singapore	10%	Asia
13	Rotterdam	10%	NW Europe
14	Los Angeles	10%	N America
15	Long Beach	10%	N America
16	New York/New Jersey	9%	N America
17	Bremen/Bremerhaven	9%	NW Europe
18	Algeciras	9%	Med Europe
19	Busan	8%	Asia
20	Yokohama	7%	Asia
21	Colombo	7%	Asia
22	Tokyo	6%	Asia
23	Hong Kong	5%	Asia
24	Kaohsiung	5%	Asia
25	Felixstowe	1%	NW Europe

* Trend shows average annual growth over five years up to and including the estimated 2006 TEU lifts.

4.6 North American Port Container Throughput

Similar data are presented in this section on North American ports. The data from Clarkson is supplemented with data from the American Association of Port Authorities (www.aapa-ports.org) and the Secretaría de Comunicaciones y Transportes (www.sct.gob.mx).[3]

The United States has, by far, the greatest container throughput in North America. Canada has about one-tenth of the United States' throughput, or a little more than 8% of North American container traffic. Mexico has the smallest portion of North American container throughput at about 5%. North American port container throughput has grown at an average annual rate of 8% during the past five years. Mexico, with a small percentage of all North American port container throughput volume, has the highest average

[3] The NA definition in Clarkson includes Mexico except for regional port throughput. Data in this section use AAPA data. It does not exactly match Clarkson but is comparable. It is also more complete and includes more U.S. ports and also includes Mexican ports.

annual growth in North America. The Canadian average annual port container throughput growth is slightly larger, at 8.4%, than the United States' rate of 8%.

Table 4.6.1 North American Port Container Throughput by Country, TEUs

	Mexico	**Canada**	**United States**	**North American Total**
1990	324,404	1,503,820	15,571,928	17,400,152
1991	348,688	1,426,630	16,316,213	18,091,531
1992	441,297	1,379,217	17,315,256	19,135,770
1993	456,927	1,464,849	18,698,801	20,620,577
1994	543,053	1,671,522	20,488,364	22,702,939
1995	569,874	1,740,442	22,337,254	24,647,570
1996	682,331	1,996,023	22,610,610	25,288,964
1997	902,875	2,201,039	24,524,146	27,628,060
1998	1,009,228	2,354,677	26,165,657	29,529,562
1999	1,117,779	2,694,810	28,007,332	31,819,921
2000	1,308,331	2,950,305	30,395,763	34,654,399
2001	1,358,662	2,890,388	30,663,813	34,912,863
2002	1,564,541	3,299,668	32,702,862	37,567,071
2003	1,685,367	3,618,515	36,300,043	41,603,925
2004	1,903,845	3,923,555	38,654,658	44,482,058
2005	2,133,476	4,163,424	41,968,412	48,265,312
2006	2,676,749	4,309,212	44,351,700	51,337,661

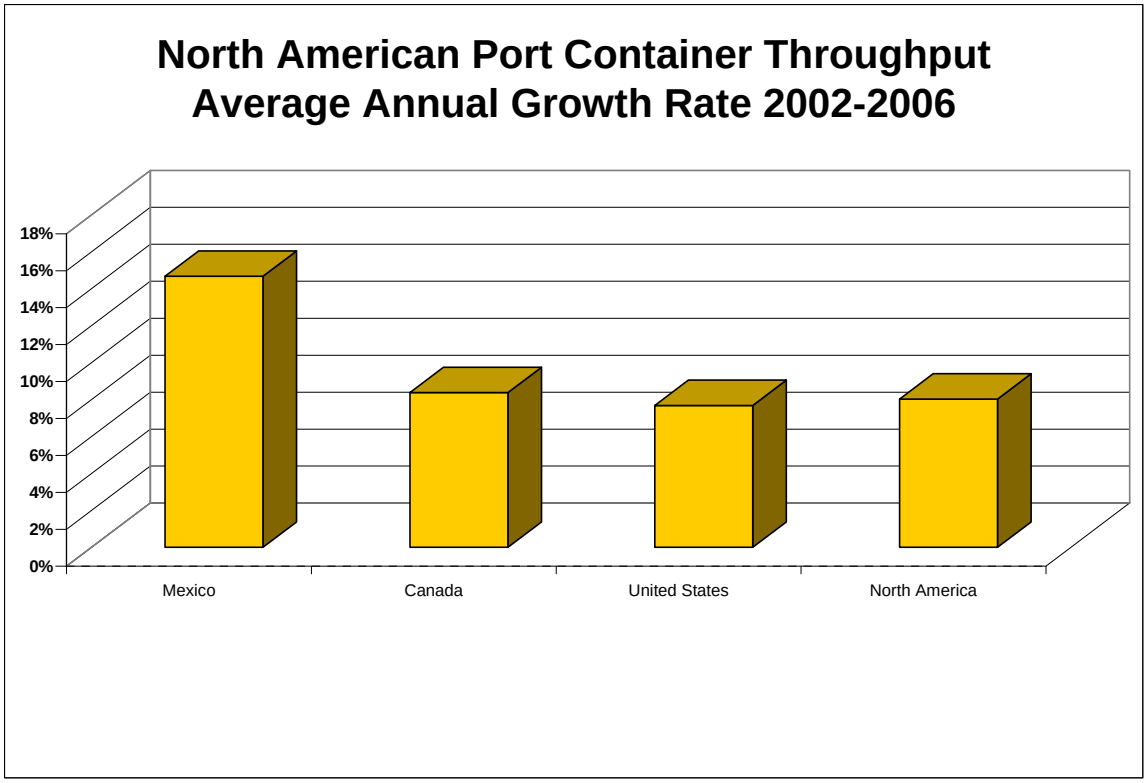


Figure 4.6.1 North American Port Container Throughput Average Annual Growth Rate, 2002-2006.

Source: American Association of Port Authorities, www.aapa-ports.org, Secretaría de Comunicaciones y Transportes, www.sct.gob.mx.

Table 4.6.2 North American Port Container Throughput Annual Increase and Market Share by Country, TEUs

	North American Total Throughput Increase	Market Share Percent of Increase		
		Mexico	Canada	United States
1991	691,379	4%	11%	108%
1992	1,044,239	9%	-5%	96%
1993	1,484,807	1%	6%	93%
1994	2,082,362	4%	10%	86%
1995	1,944,631	1%	4%	95%
1996	641,394	18%	40%	43%
1997	2,339,096	9%	9%	82%
1998	1,901,502	6%	8%	86%
1999	2,290,359	5%	15%	80%
2000	2,834,478	7%	9%	84%
2001	258,464	20 %	-23%	104%
2002	2,654,208	8%	15%	77%
2003	4,036,854	3%	8%	89%
2004	2,878,133	8%	11%	82%
2005	3,783,254	6%	6%	88%
2006	3,072,349	18%	5%	78%

Source: American Association of Port Authorities, www.aapa-ports.org, Secretaría de Comunicaciones y Transportes, www.sct.gob.mx.

This data are also grouped by the largest three, 10 and 20 ports (Figure 4.6.2). The results show that the 20 largest ports handle 90% of 2006 North American container traffic. The three largest ports together handle almost 41% of 2006 North American container traffic.

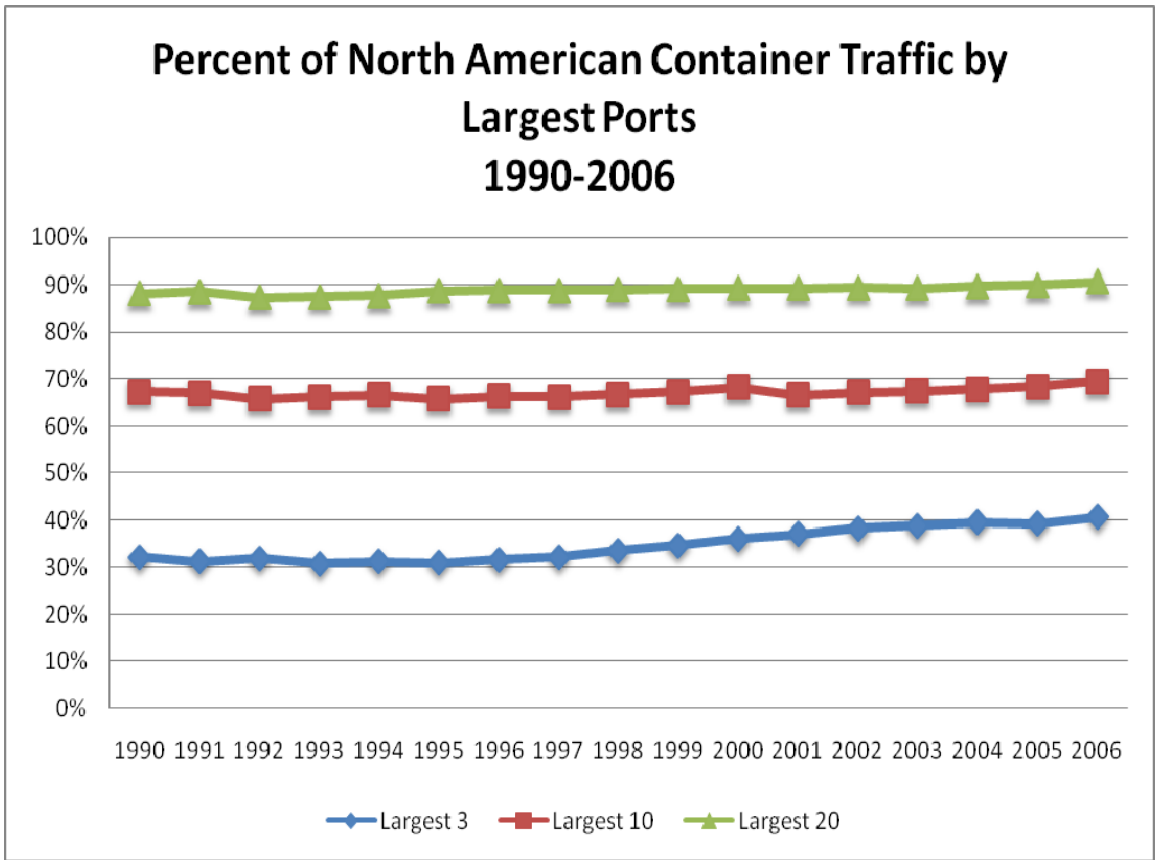


Figure 4.6.2 Northern American Container Traffic by Largest Ports, 1990-2006.
Source: American Association of Port Authorities, www.aapa-ports.org, Secretaría de Comunicaciones y Transportes, www.sct.gob.mx.

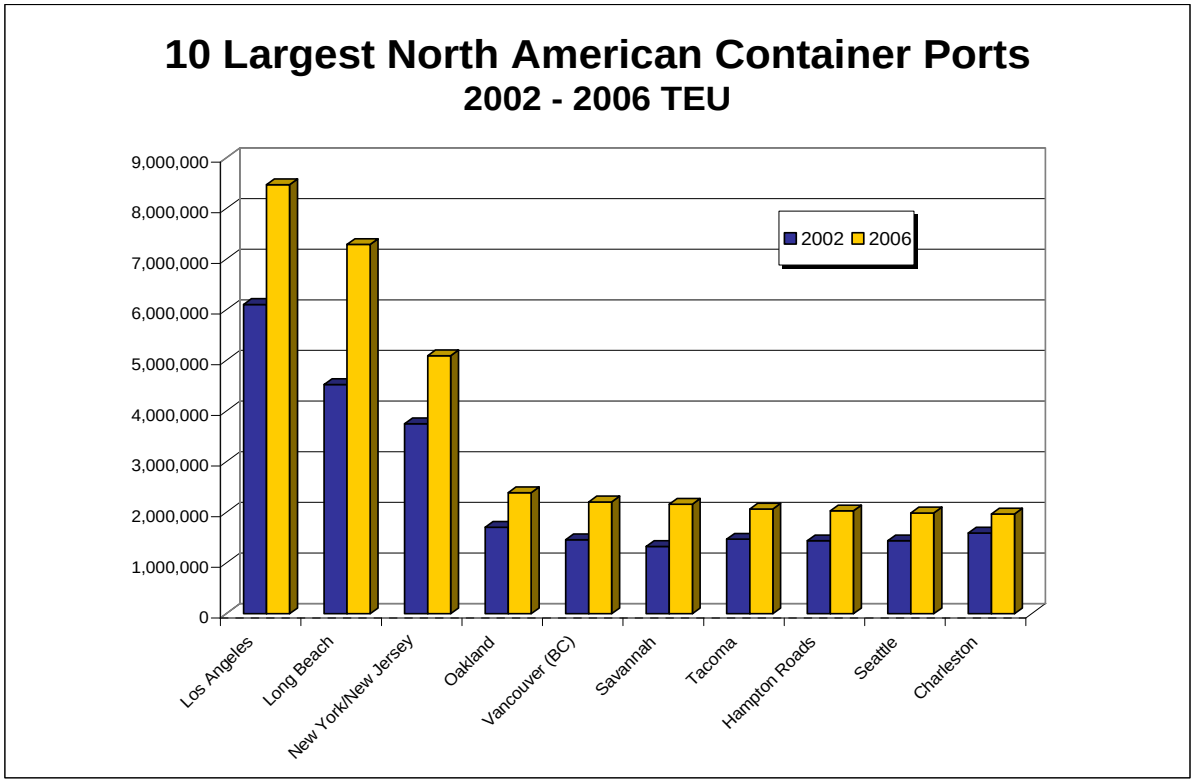


Figure 4.6.3 Ten Largest North American Container Ports, 2002-2006.
Source: American Association of Port Authorities, www.aapa-ports.org, Secretaría de Comunicaciones y Transportes, www.sct.gob.mx.

The largest ports in the United States, Los Angeles, Long Beach and New York/New Jersey, are ranked 1, two and three during the 2002 and 2006 period (Table 4.6.3). All top ten ports experience increased TEUs from 2002 to 2006. Nine of the top 10 North American container ports are in the United States, while the largest Canadian port is Vancouver. Mexico and Canada both have two ports in the top 20. Seattle and Charleston are two of the top 10 ports experiencing a decline in port container throughput from 2005 to 2006.

The fastest growing North American container port from 2002 to 2006 is Manzanillo, the 14th largest North American port for container throughput. Savannah, a U.S. port on the Atlantic, had the second fastest average annual growth from 2002 to 2006 followed, in third place, by Vancouver, B.C. Los Angeles and Long Beach are ranked 4th and 5th in growth rates. Six of the 10 fastest growing North American containers ports from 2002 to 2006 are located on the Pacific Coast, three on the Atlantic Coast and one on the U.S. Gulf coast.

Table 4.6.3 Top 20 North American Ports for Container Throughput, TEUs

Rank	Port	2006	2005	2004	Country
1	Los Angeles	8,469,853	7,484,624	7,321,440	U.S.
2	Long Beach	7,289,365	6,709,818	5,779,852	U.S.
3	New York/New Jersey	5,092,806	4,785,318	4,478,480	U.S.
4	Oakland	2,390,262	2,272,525	2,043,122	U.S.
5	Vancouver (BC)	2,207,730	1,767,379	1,664,906	Canada
6	Savannah	2,160,168	1,901,520	1,662,021	U.S.
7	Tacoma	2,067,186	2,066,447	1,797,560	U.S.
8	Hampton Roads	2,029,799	1,981,955	1,808,933	U.S.
9	Seattle	1,987,360	2,087,929	1,775,858	U.S.
10	Charleston	1,968,474	1,986,586	1,863,917	U.S.
11	San Juan (FY)	1,729,294	1,727,389	1,625,704	U.S.
12	Houston	1,606,360	1,594,366	1,437,585	U.S.
13	Montreal	1,288,910	1,254,560	1,226,296	Canada
14	Manzanillo	1,252,215	872,569	830,777	Mexico
15	Honolulu (FY)	1,113,789	1,077,468	1,041,455	U.S.
16	Miami (FY)	976,514	1,054,462	1,009,500	U.S.
17	Port Everglades (FY)	864,030	797,238	653,628	U.S.
18	Jacksonville (FY)	768,239	777,318	727,660	U.S.
19	Veracruz	671,281	620,858	591,736	Mexico
20	Baltimore	627,947	602,475	557,877	U.S.

Note: FY indicates Fiscal Year. Source: American Association of Port Authorities, www.aapa-ports.org, Secretaría de Comunicaciones y Transportes, www.sct.gob.mx.

Table 4.6.4 Average Annual Growth Rates of the 20 Largest North American Container Ports, 2002-2006

Rank	Port	Average Annual Growth Rate 2002-2006	Country	Region
1	Manzanillo	23%	Mexico	Pacific Coast
2	Savannah	15%	United States	Atlantic Coast
3	Vancouver (BC)	14%	Canada	Pacific Coast
4	Long Beach	11%	United States	Pacific Coast
5	Los Angeles	11%	United States	Pacific Coast
6	Tacoma	10%	United States	Pacific Coast
7	Hampton Roads	9%	United States	Atlantic Coast
8	Seattle	9%	United States	Pacific Coast
9	New York/New Jersey	9%	United States	Atlantic Coast
10	Houston	9%	United States	U.S. Gulf Coast
11	Oakland	8%	United States	Pacific Coast
12	Port Everglades (FY)	7%	United States	Atlantic Coast
13	Montreal	5%	Canada	Atlantic Coast
14	Charleston	5%	United States	Atlantic Coast
15	Baltimore	5%	United States	Atlantic Coast
16	Veracruz	4%	Mexico	Gulf/Caribbean
17	Honolulu (FY)	4%	United States	Pacific Coast
18	Jacksonville (FY)	2%	United States	Atlantic Coast
19	Miami (FY)	1%	United States	Atlantic Coast
20	San Juan (FY)	-3%	United States	Atlantic Coast

Note: FY indicates Fiscal Year

Source: American Association of Port Authorities, www.aapa-ports.org, Secretaría de Comunicaciones y Transportes, www.sct.gob.mx.

Table 4.6.5 Average Annual Container TEU Traffic Increase of the 20 Largest North American Container Ports, 2002-2006

Rank	Port	Average Annual Volume Increase 2002-2006	Country	Region
1	Los Angeles	657,267	United States	Pacific Coast
2	Long Beach	565,281	United States	Pacific Coast
3	New York/New Jersey	355,306	United States	Atlantic Coast
4	Savannah	216,538	United States	Atlantic Coast
5	Vancouver (BC)	212,231	Canada	Pacific Coast
6	Manzanillo	158,749	Mexico	Pacific Coast
7	Tacoma	149,382	United States	Pacific Coast
8	Oakland	149,337	United States	Pacific Coast
9	Hampton Roads	145,200	United States	Atlantic Coast
10	Seattle	134,450	United States	Pacific Coast
11	Houston	109,698	United States	U.S. Gulf Coast
12	Charleston	88,088	United States	Atlantic Coast
13	Montreal	59,897	Canada	Atlantic Coast
14	Port Everglades (FY)	48,522	United States	Atlantic Coast
15	Honolulu (FY)	37,969	United States	Pacific Coast
16	Baltimore	26,962	United States	Atlantic Coast
17	Veracruz	25,591	Mexico	Gulf/Caribbean
18	Jacksonville (FY)	13,867	United States	Atlantic Coast
19	Miami (FY)	4,169	United States	Atlantic Coast
20	San Juan (FY)	-65,688	United States	Atlantic Coast

Note: FY indicates Fiscal Year

Source: American Association of Port Authorities, www.aapa-ports.org, Secretaría de Comunicaciones y Transportes, www.sct.gob.mx.

5. WATERBORNE COMMERCE: CONTAINER FLOWS AND CONTAINERIZATION

5.1 Data Details and Organization of Results

An additional data source that can be used to analyze features of container flows is the Waterborne Commerce Data (United States, Army Corps of Engineers). This data are from 1990-2005 and categorized by port area, foreign country and commodity using the Harmonized Commodity Description and Coding System (HS). The HS is an internationally standardized system for classifying internationally trades commodities and products. This data are used to analyze containerization. Specifically, this study examines shifts from non-container to container movements, i.e., to what extent are there shifts from non-container moves to container moves.

Commodity data results are reported at a two-digit HS level corresponding to the United States International Trade Commission's HS chapter headings found at http://www.usitc.gov/tata/hts/bychapter/index.htm. The volume data units are short tons converted from the kilograms reported in the data set. A series of queries are utilized to validate data results with ACE Waterborne Commerce internal data queries. As well, a number of programs combine these data across years. These are documented in Appendix A. Finally, once developed, the data are reported at the national level, by import/export, and by commodity HS class.

5.2 Results: Data Summary

The national Waterborne tonnage increases from 964 million tons in 1990 to 1,509 million tons in 2005, or by 56%. The imported tons increase from 552 million tons in 1990 to 1,114 million tons in 2005, an increase of 102%. Tons exported decrease from 412 million tons in 1990 to 394 million tons in 2005.

Table 5.2.1 Import/Export Tonnage Summary 1990-2005, million tons

Year	Imported Tons	Index (1990=100)	Exported Tons	Index (1990=100)	Total Tons	Index (1990=100)
1990	552	100	412	100	964	100
1991	500	91	433	105	934	97
1992	535	97	430	104	965	100
1993	592	107	391	95	983	102
1994	658	119	374	91	1,032	107
1995	628	114	450	109	1,078	112
1996	689	125	433	105	1,122	116
1997	785	142	414	100	1,199	124
1998	837	152	384	93	1,221	127
1999	861	156	379	92	1,239	129
2000	891	161	383	93	1,274	132
2001	947	172	368	89	1,315	136
2002	927	168	357	87	1,284	133
2003	985	178	367	89	1,351	140
2004	1,085	196	387	94	1,472	153
2005	1,114	202	394	96	1,509	156

Source: National Waterborne Databanks, 1990-2005, United States Army Corps of Engineers.

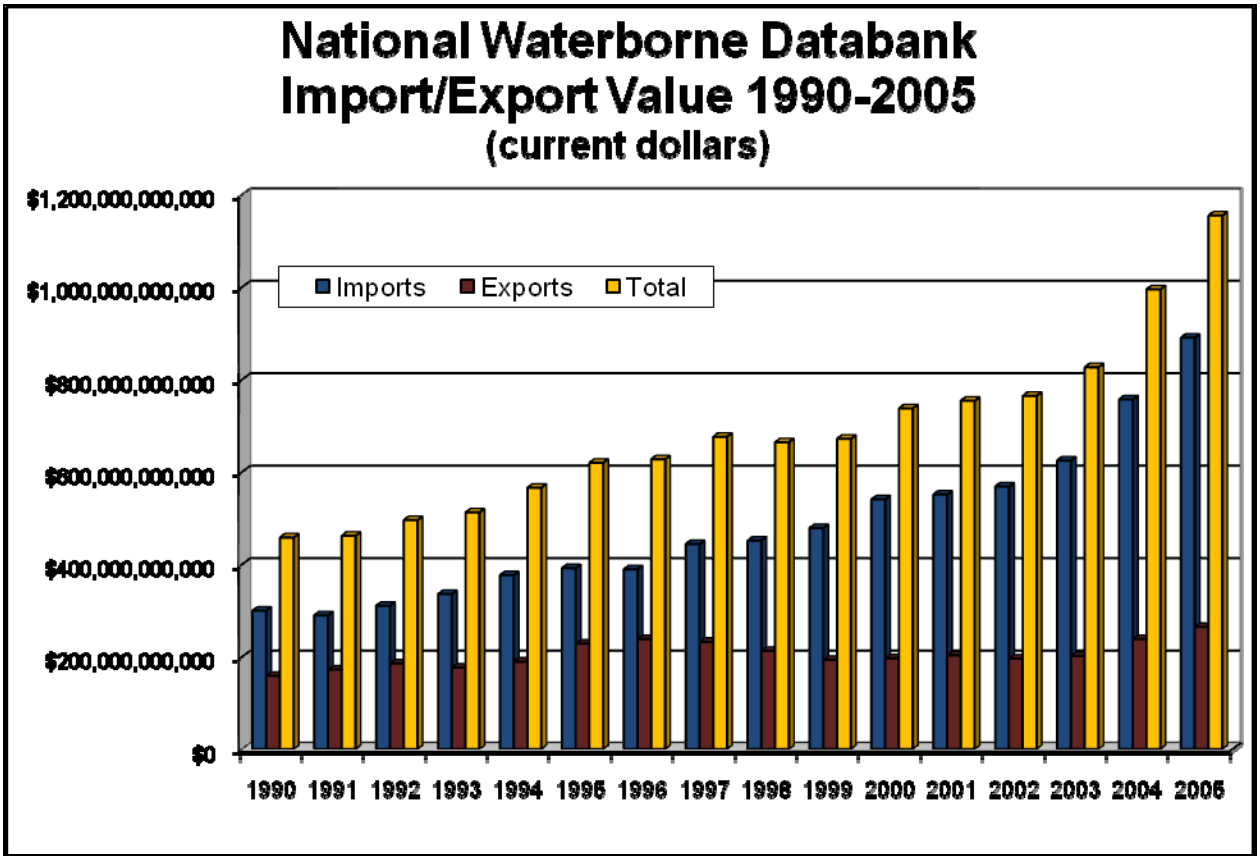


Figure 5.2.1 Import/Export Value Summary, current dollars, 1990-2005.

The value of trade in current dollars reported increased by 150% from 1990 to 2005. The value in current dollars of imports increases over 190% from 1990 to 2005. The imported value is considerably greater than the exported value. Finally, the export value, as a percentage of the Total value, has declined since 1990.

The commerce value, as expressed in 1990 dollars, increased from $458 billion in 1990 to $853 billion in 2005. The 1990 to 2005 Waterborne Commerce value, as expressed in 1990 dollars, increases 86%. The import value increases from $300 billion in 1990 to $658 billion in 2005, an increase of 119%; the export value did not increase as greatly as the import value, increasing 23% from 1990 to 2005, as expressed in 1990 dollars. Overall, the commerce value, expressed in real 1990 dollars, increases in all years but one.

Table 5.2.2 Import/Export Value Summary 1990-2005, real 1990 dollars (billions)

Year	Imports	Index (1990=100)	Exports	Index (1990=100)	Total	Index (1990=100)
1990	300	100	158	100	458	100
1991	289	96	172	109	461	101
1992	308	103	184	116	492	107
1993	328	109	173	109	501	109
1994	364	121	183	116	546	119
1995	365	122	213	135	578	126
1996	354	118	217	137	571	125
1997	404	135	212	134	616	134
1998	422	141	199	126	621	136
1999	443	148	179	113	622	136
2000	474	158	173	109	646	141
2001	477	159	176	111	653	143
2002	504	168	174	110	678	148
2003	526	175	170	107	696	152
2004	600	200	189	119	789	172
2005	658	219	195	124	853	186

Source: National Waterborne Databanks, 1990-2005, United States Army Corps of Engineers.

5.3 Container Traffic National Summary 1990-2005

The number of waterborne commerce shipments increases from slightly over 1 million shipments to over 1.7 million shipments in 2005. The shipments generally increase from 1990 to 1998 before decreasing during the 1999-2002 time period and again increasing from 2003 to 2005. Total shipments increase 71% over the period from 1990 to 2005, and the number of containerized shipments increase from 921,000 in 1990 to 1.65 million in 2005, or, by 79% from 1990 to 2005. Non-containerized shipments have seen increasing and decreasing periods during the 1990 to 2005 timeframe.

Table 5.3.1 Containerized and Non-containerized Shipments, 1990-2005

Year	Containerized Shipments	Index (1990 =100)	Non-containerized Shipments	Index (1990 =100)	Total Shipments	Index (1990 =100)
1990	921,012	100	91,862	100	1,012,974	100
1991	978,521	106	90,679	99	1,069,306	106
1992	983,049	107	81,806	89	1,064,962	105
1993	1,041,775	113	82,727	90	1,124,615	111
1994	1,072,383	116	88,305	96	1,160,804	115
1995	1,112,835	121	98,950	108	1,211,906	120
1996	1,299,325	141	102,124	111	1,401,590	138
1997	1,345,437	146	98,735	107	1,444,318	143
1998	1,487,390	161	112,590	123	1,600,141	158
1999	1,245,066	135	107,364	117	1,352,565	134
2000	1,177,360	128	129,774	141	1,307,262	129
2001	1,199,551	130	143,221	156	1,342,902	133
2002	1,250,898	136	127,835	139	1,378,869	136
2003	1,401,331	152	120,826	132	1,522,309	150
2004	1,363,981	148	225,537	246	1,589,666	157
2005	1,650,052	179	79,421	86	1,729,652	171

Source: National Waterborne Databanks, 1990-2005, United States Army Corps of Engineers.

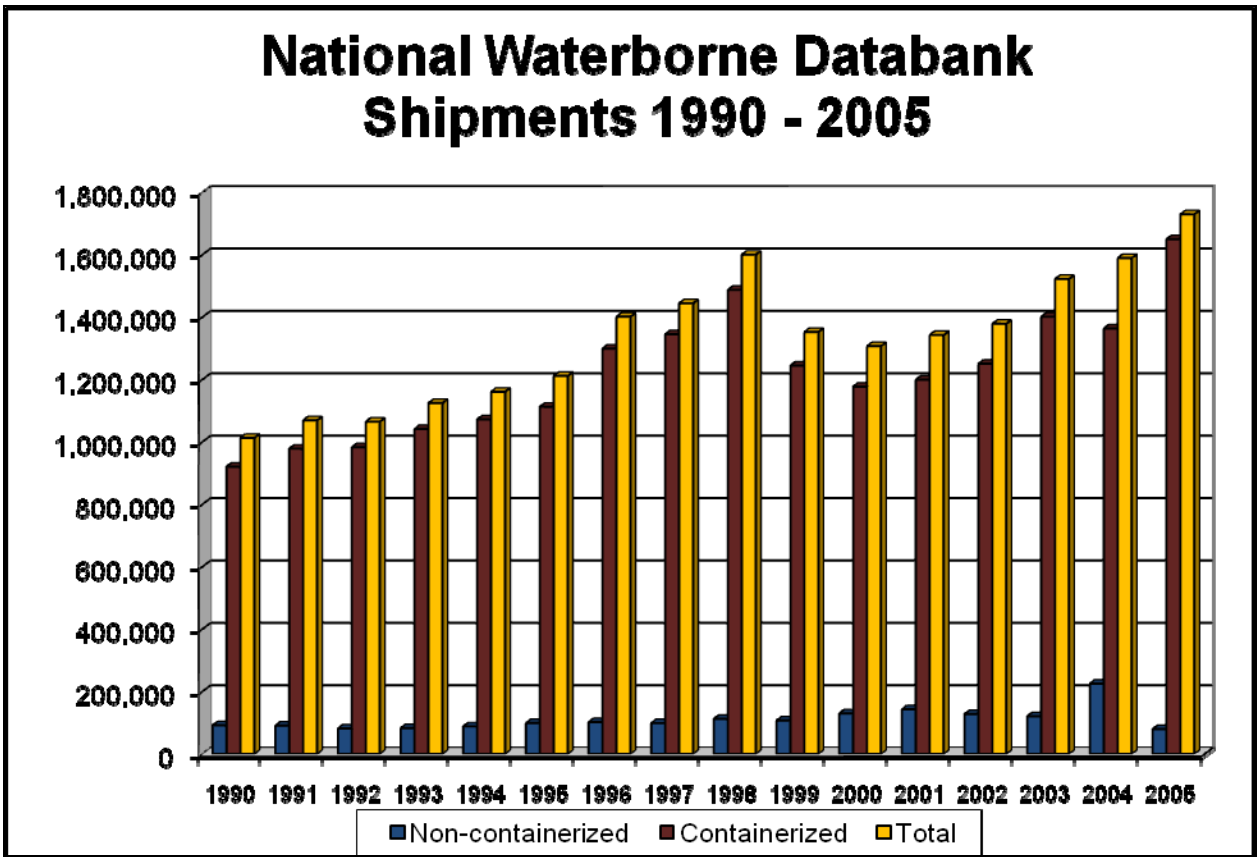


Figure 5.3.1 Containerized and Non-containerized Shipments, 1990-2005.

The results show that containerized shipments make up the largest portion of shipments with non-containerized shipments forming a small portion of shipments. Total shipments increase from 1990 to 1998, experienced a reduction in reported shipments during 1999 and 2000 before increasing again to 2005. Containerized and total shipments reported in 2005 are significantly higher than 1990. Finally, there were fewer non-containerized shipments reported in 2005 than in 1990.

Total commerce increases from 964 million tons in 1990 to 1,509 million tons in 2005. Non-containerized shipments make up the majority of reported tonnage with 80% of all tons in 2005 and have increased by 43% from 1990 to 2005, less than containerized tonnage during that time period. Containerized tonnage increases 161% percent during the 1990-2005 timeframe, more than the 56% increase of all tonnage. From 1990 to 2005, only two years see a decrease in tonnage.

Table 5.3.2 Containerized and Non-containerized Tonnage Summary 1990-2005, million tons

	Non-containerized			**Containerized**			**Total**	
Year	**Tons**	**% of Total**	**Index (1990=100)**	**Tons**	**% of Total**	**Index (1990=100)**	**Total**	**Index (1990=100)**
1990	851	88%	100	113	12%	100	964	100
1991	817	87%	96	117	13%	103	934	97
1992	839	87%	99	126	13%	111	965	100
1993	877	89%	103	106	11%	94	983	102
1994	920	89%	108	111	11%	99	1,032	107
1995	948	88%	111	130	12%	115	1,078	112
1996	995	89%	117	127	11%	112	1,122	116
1997	1,060	88%	125	140	12%	124	1,199	124
1998	1,077	88%	127	144	12%	127	1,221	127
1999	1,089	88%	128	150	12%	133	1,239	129
2000	1,117	88%	131	157	12%	139	1,274	132
2001	1,156	88%	136	158	12%	140	1,315	136
2002	1,113	87%	131	172	13%	152	1,284	133
2003	1,181	87%	139	170	13%	151	1,351	140
2004	1,276	87%	150	196	13%	173	1,472	153
2005	1,214	80%	143	295	20%	261	1,509	156

Source: National Waterborne Databanks, 1990-2005, United States Army Corps of Engineers.

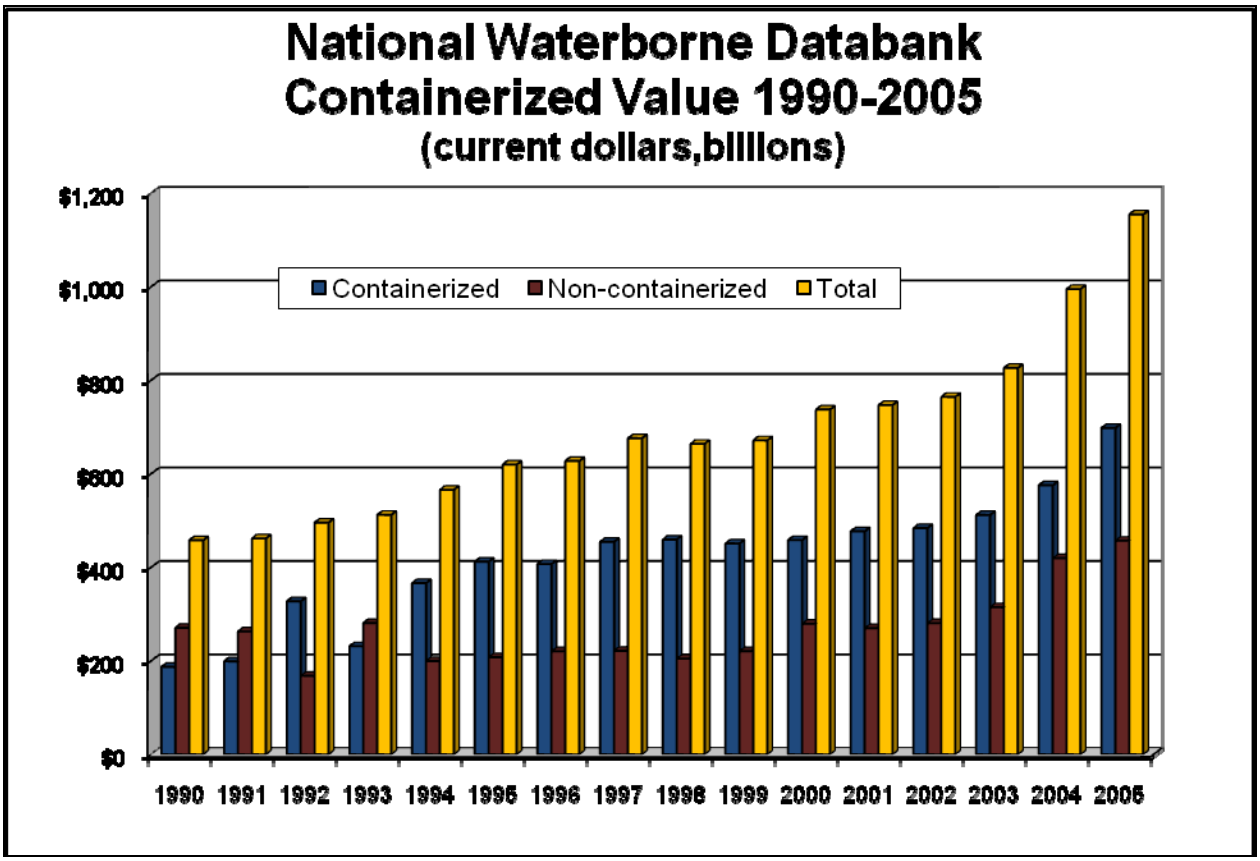


Figure 5.3.2 Containerized and Non-containerized Value, current dollars, 1990-2005.

The value of these shipments is shown in Figure 5.3.2. Results show that the value reported totals $1,155 billion in 2005 as measured in current dollars. The containerized commerce value has made up the largest portion of commerce since 1994. The non-containerized value, in current dollars, remained fairly constant during the mid-1990s. In contrast to Waterborne Commerce measured by tonnage, containerized commerce measured by value is much larger than non-containerized value.

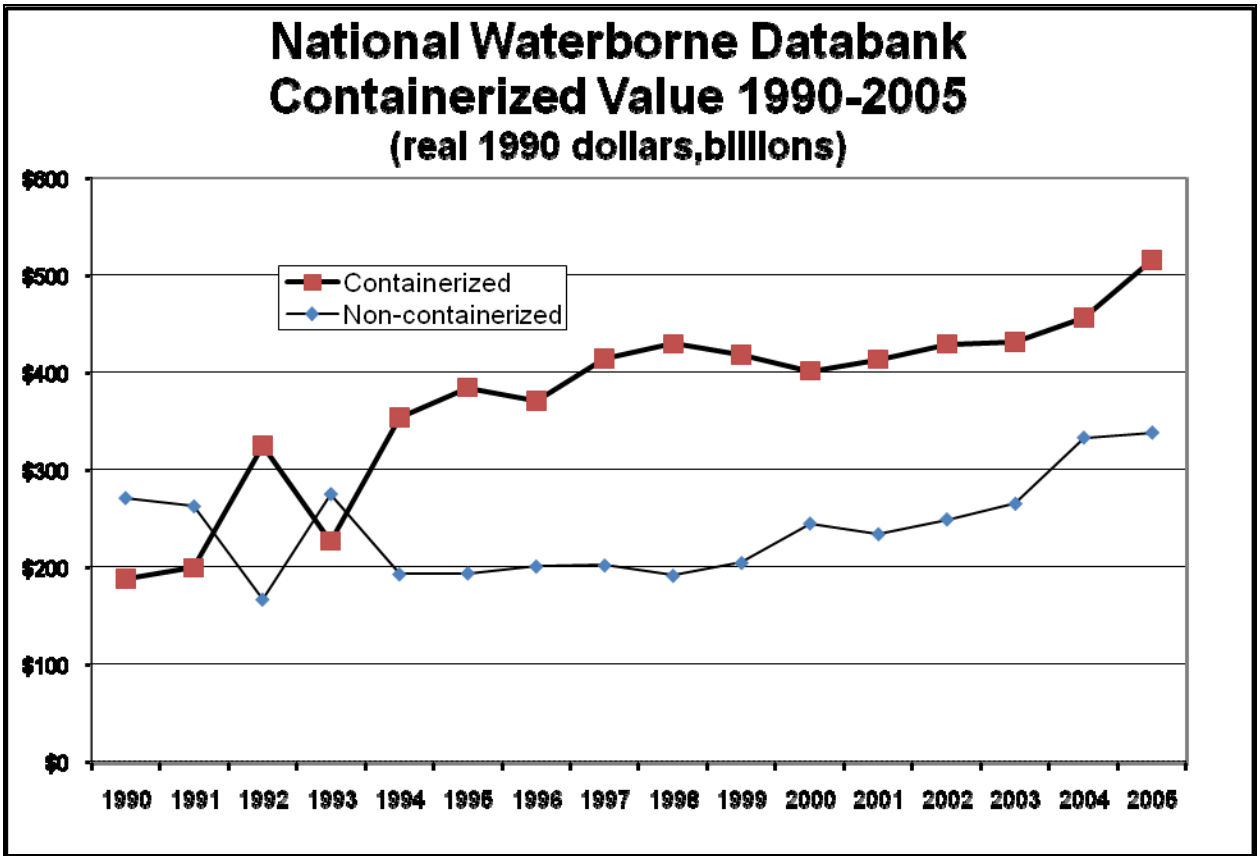


Figure 5.3.3 Containerized and Non-containerized Value, real 1990 dollars, 1990-2005.

Finally, Figure 5.3.3 shows the growth in value in these shipments. The containerized value comprises the largest portion of all reported commerce except for three years early in the 1990 to 2005 timeframe. The containerized value, in real 1990 dollars, increases 176% between 1990 and 2005; non-containerized value, as measured by real 1990 dollars, only increases 25% between 1990 and 2005.

5.4 Containerization of Trade at the Two-digit Harmonized Commodity Description and Coding System (HS) Level

This section analyzes the trade data to assess the extent of containerization occurring. The data are reported first for all trade (imports and exports), and then separately for imports and exports in the subsections to follow.

This data are used to analyze containerization, which refers to the extent to which a commodity which traditionally ships by bulk begins to ship by containers. Specifically, this report examines shifts from non-container to container movements, i.e., to what extent are there shifts from non-container moves to container moves.

To do so, the data is categorized at the two-digit HS level corresponding to the United States International Trade Commission's HS chapter headings found at http://www.usitc.gov/tata/hts/bychapter/index.htm. Then, the analysis derives the portion of total trade for that HS commodity level that is shipped by containers versus the total shipped, and compares them from 1990 to 2005. Results are reported first for the aggregate of imports and exports, and then separately for imports and exports.

All commodities, with the exception of cereals, have larger 2005 tonnages than in 1990 (Table 5.4.1). The 2005 tonnage figure for Cereal is the lowest reported from 1990 to 2005. Oil is the largest commodity group, followed by Salt; Sulfur; Earth & Stone; Lime & Cement Plaster. Only three of the top 20 commodities ranked by tons see a decrease in the percentage of containerized tons between 1990 and 2005.

Oil is the largest commodity in 1990 and 2005 and for all reported years 1990 to 2005. The containerized shipments of Oil, as measured by tons, only constitute 2% of 2005 tons. In contrast, 17 of the top 20 commodities ranked by tons had an increase in the percentage of containerized tons between 1990 and 2005. None of the top seven commodities ranked by tons has more than 28% containerized.

Commodities showing significant increases in their percentage of containerized tonnage include Oil Seeds etc. (26 vs. 9%), Wood & Articles of Wood (54 vs. 13%), Inorganic Chemicals (26 vs. 13%), Vehicles, Paper and Food Industry Residues & Waste (87 vs. 45%). Four commodities, Nuclear Reactors, Plastics, Furniture and Electric Machinery, with high percentages of containerization in 1990 and 2005, greatly increase the number of tons shipped between 1990 and 2005.

Figure 5.4.1 (and Table 5.4.2) ranks the commodities by the change in percentage of shipments that are containerized (i.e., the change from 1990 to 2005). Results show that all but three of the 20 commodities shown in the figure have increased percentages of containerized shipments between 1990 and 2005. The Paper and Wood commodities each increase their containerized tonnages by more than 40 percentage points. The percent of containerized Paper tonnages increases from 45% in 1990 to 87% in 2005. The percent of containerized Wood tons increases from 13% in 1990 to 54% in 2005. Oil, the largest commodity as measured by tons, only increases one percent point, from 1% in 1990 to 2% in 2005. Almost one-third of the top 20, six commodities, had increases of over 20 percentage point between the two reported years.

Similar results are shown in Tables 5.4.3 and 5.4.4, and Figure 5.4.2 when the containerized shipments are measured in terms of value. The largest increase in containerized shipments is Footwear, Gaiters etc.., Toys, Games and Sport Equipment, and Wood, and Articles of Wood. Generally, these data (see Figure 5.4.2) show that the higher valued products are increasing their percentage shipped by containers. The exception is Wood and Articles of Wood, and Paper and Paperboard Articles (which are largely backhauls from the United States).

Table 5.4.1 Top 20 Commodities as Ranked by Tons, Containerized Summary for 1990 and 2005

Commodity	2005				1990			
	Rank	Tonnage (thousands)			Rank	Tonnage (thousands)		
		All Tons	Containerized			All Tons	Containerized	
			Tons	%			Tons	%
Mineral Fuel, Oil etc..; Bitumin Subst; Mineral Wax	1	858,856	20,889	2	1	530,072	3,941	1
Salt; Sulfur; Earth & Stone; Lime & Cement Plaster	2	104,333	18,299	18	3	46,311	7,143	15
Cereals	3	77,600	5,905	8	2	98,887	1,440	1
Iron & Steel	4	45,869	12,648	28	6	27,116	2,721	10
Ores, Slag and Ash	5	43,380	2,718	6	4	43,146	9,856	23
Organic Chemicals	6	32,491	8,096	25	10	13,995	4,396	31
Oil Seeds etc..; Misc Grain, Seed, Fruit, Plant etc.	7	29,899	7,915	26	7	18,072	1,693	9
Wood and Articles of Wood; Wood Charcoal	8	26,714	14,515	54	5	35,489	4,721	13
Inorg Chem; Prec & Rare-earth Met & Radioact Compd	9	25,070	6,526	26	8	17,165	2,219	13
Fertilizers	10	22,422	1,641	7	19	4,064	464	11
Wood Pulp etc.; Recovd (waste & scrap) Ppr & Pprbd	11	19,555	15,605	80	11	11,301	6,714	59
Nuclear Reactors, Boilers, Machinery etc..; Parts	12	15,600	13,140	84	15	6,819	5,275	77
Plastics and articles thereof	13	15,471	14,666	95	16	6,526	5,654	87
Vehicles, except Railway or Tramway, and parts etc..	14	15,310	8,490	55	12	9,469	3,810	40
Paper & Paperboard & Articles (inc papr pulp artl)	15	13,280	11,563	87	13	8,834	3,975	45
Articles of Iron or Steel	16	12,428	8,374	67	17	4,970	2,249	45
Food Industry Residues & Waste; Prep Animal Feed	17	11,380	4,816	42	9	15,262	1,371	9
Edible Fruit & Nuts; Citrus Fruit or Melon Peel	18	10,601	8,729	82	14	7,052	4,158	59
Furniture; Bedding etc.; Lamps nesoi etc.; prefab bd	19	10,590	10,404	98	nr	1,588	1,513	95
Electric Machinery etc.; Sound Equip; TV Equip; pts	20	8,413	7,824	93	nr	3,204	2,887	89

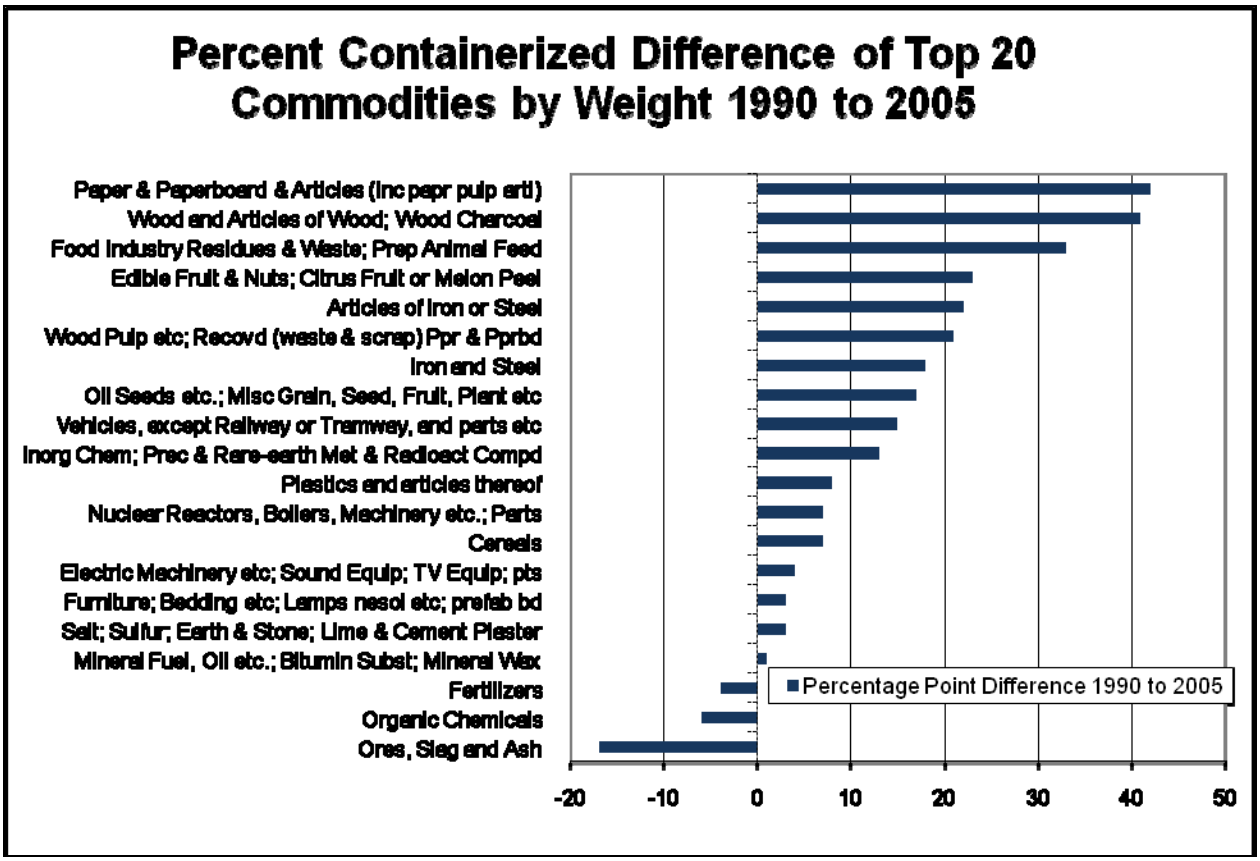


Figure 5.4.1 Percent Containerized Differences between 1990 and 2005 of the Top Commodities Ranked by Weight.

Table 5.4.2 Top 20 Commodities Ranked by Increase in Containerized Percentage Shipping Weight, 1990 and 2005*

Commodity	Rank	Percent Tons Containerized		Percentage Point Difference 1990 to 2005	Containerized Percent Increase 1990 to 2005
		1990	2005		
Paper & Paperboard & Articles (inc papr pulp artl)	1	45%	87%	42	94%
Fish, Crustaceans & Aquatic Invertebrates	2	51%	92%	41	81%
Wood and Articles of Wood; Wood Charcoal	3	13%	54%	41	308%
Miscellaneous Chemical Products	4	49%	83%	34	69%
Food Industry Residues & Waste; Prep Animal Feed	5	9%	42%	33	370%
Sugars and Sugar Confectionary	6	7%	32%	25	349%
Animal or Vegetable Fats, Oils etc.. & Waxes	7	13%	37%	24	190%
Edible Fruit & Nuts; Citrus Fruit or Melon Peel	8	59%	82%	23	39%
Articles of Iron or Steel	9	45%	67%	22	49%
Milling Products; Malt; Starch; Inulin; Wht Gluten	10	34%	54%	21	61%
Wood Pulp etc.; Recovd (waste & scrap) Ppr & Pprbd	11	59%	80%	20	34%
Soap etc.; Waxes, Polish etc.; Candles; Dental Preps	12	74%	94%	20	27%
Dairy Prods; Birds Eggs; Honey; ed animal pr nesoi	13	75%	94%	19	25%
Iron & Steel	14	10%	28%	18	176%
Rubber and articles thereof	15	70%	88%	17	25%
Oil Seeds etc..; Misc Grain, Seed, Fruit, Plant etc.	16	9%	27%	17	182%
Prep Vegetables, Fruit, Nuts or other plant parts	17	78%	94%	16	20%
Vehicles, except Railway or Tramway, and parts etc..	18	40%	56%	15	38%
Beverages, Spirits and Vinegar	19	74%	88%	15	20%
Inorg Chem; Prec & Rare-earth Met & Radioact Compd	20	13%	26%	13	102%

*Minimum of one million tons shipped in 2005.

Table 5.4.3 Top 20 Commodities Ranked by Value in Current Dollars, Containerized Summary 1990 and 2005

Commodity	2005				1990			
	Rank	Dollars (millions)			Rank	Dollars (millions)		
		Total Dollars	Containerized			Total Dollars	Containerized	
			Dollars	%			Dollars	%
Mineral Fuel, Oil etc..; Bitumin Subst; Mineral Wax	1	$252,267	$6,210	2	1	$62,278	$1,048	2
Nuclear Reactors, Boilers, Machinery etc..; Parts	2	$138,305	$117,163	85	3	$55,170	$30,396	55
Vehicles, except Railway or Tramway, and parts etc.	3	$136,360	$56,027	41	2	$58,578	$9,203	16
Electric Machinery etc.; Sound Equip; TV Equip; pts	4	$76,267	$70,361	92	4	$34,154	$18,981	56
Organic Chemicals	5	$33,071	$18,571	56	5	$13,044	$7,084	54
Plastics and articles thereof	6	$32,583	$30,817	95	7	$11,607	$8,926	77
Apparel Articles and Accessories, Not Knit etc..	7	$27,790	$25,224	91	8	$9,912	$7,235	73
Furniture; Bedding etc.; Lamps nesoi etc.; prefab bd	8	$27,020	$26,344	97	20	$5,271	$4,066	77
Apparel Articles and Accessories, Knit or Crochet	9	$27,014	$22,869	85	15	$6,802	$4,447	65
Iron & Steel	10	$23,299	$10,149	44	9	$9,043	$1,979	22
Toys, Games & Sport Equipment; Parts & Accessories	11	$22,042	$21,597	98	10	$8,462	$4,059	48
Articles of Iron or Steel	12	$19,788	$15,445	78	17	$6,341	$3,767	59
Footwear, Gaiters etc.. and Parts thereof	13	$15,868	$15,329	97	11	$8,451	$3,250	38
Optic, Photo etc.., Medic or Surgical Instruments etc..	14	$14,582	$12,953	89	12	$8,138	$4,923	60
Rubber and Articles thereof	15	$14,520	$13,208	91	19	$5,673	$3,839	68
Inorg Chem; Prec & Rare-earth Met & Radioact Compd	16	$13,303	$7,504	56	16	$6,377	$2,172	34
Wood and Articles of Wood; Wood Charcoal	17	$13,068	$10,303	79	13	$7,279	$2,592	36
Paper & Paperboard & Articles (inc papr pulp artl)	18	$11,822	$10,665	90	18	$6,166	$3,362	55
Beverages, Spirits and Vinegar	19	$11,770	$11,033	94	nr	$4,201	$2,558	61
Aluminum and Articles thereof	20	$9,985	$6,964	70	nr	$3,727	$2,206	59

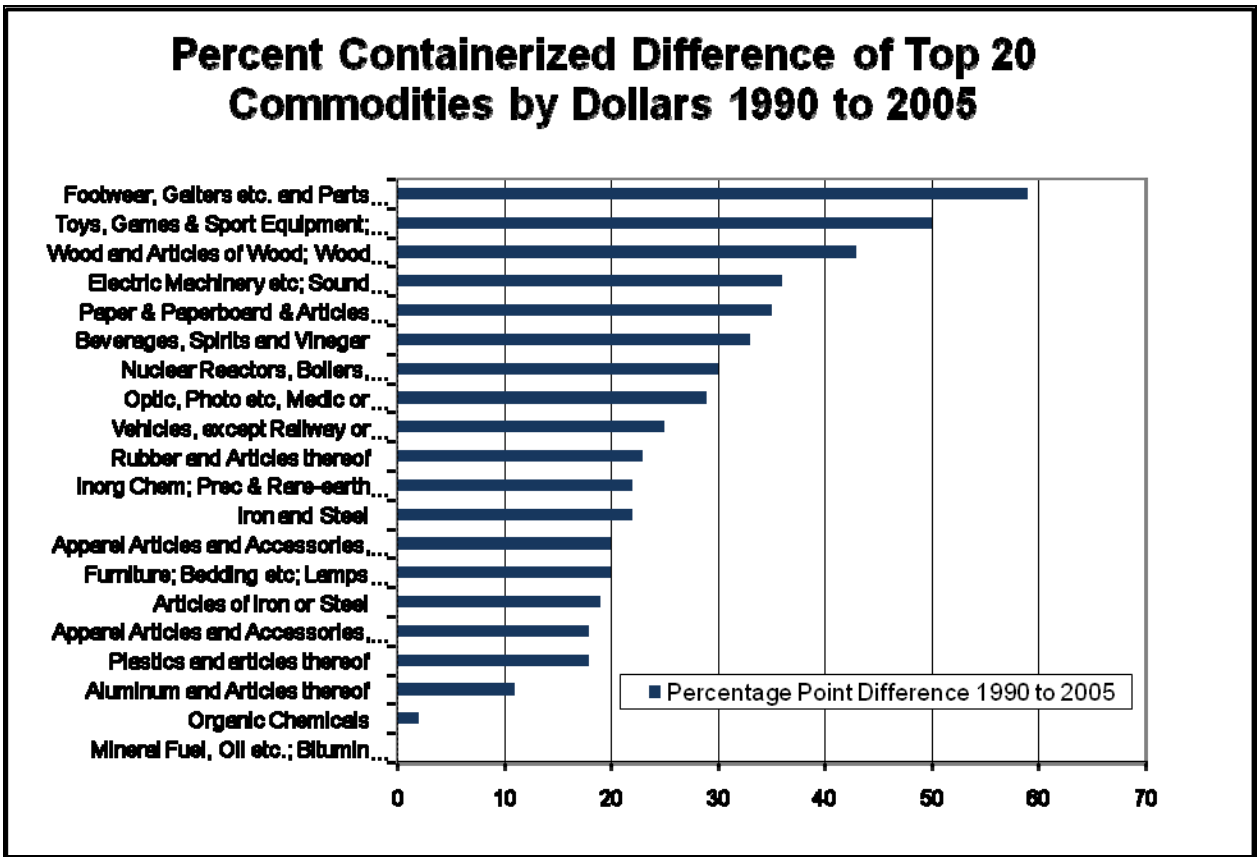


Figure 5.4.2 Percent Containerized Differences between 1990 and 2005 of the Top Commodities Ranked by Dollar Value.

Table 5.4.4 Top 20 Commodities Ranked by Increase in Containerized Percentage Shipping Value in Current Dollars, 1990 and 2005*

Commodity	Rank	Percent Dollars Containerized		Percentage Point Difference 1990 to 2005	Containerized Percent Increase 1990 to 2005
		1990	2005		
Tobacco and Manufactured Tobacco Substitutes	1	27	91	64.4	239
Footwear, Gaiters etc.. and parts thereof	2	39	97	58.1	151
Aircraft, Spacecraft, and parts thereof	3	32	84	51.2	158
Toys, Games & Sport Equipment; parts & accessories	4	48	98	50	104
Fish, Crustaceans & Aquatic Invertebrates	5	43	92	49.6	116
Raw Hides and Skins (no furskins) and Leather	6	45	92	46.7	103
Leather art; Saddlery etc.; Handbags etc.; Gut art	7	49	96	46.5	94
Meat and Edible Meat Offal	8	47	93	46.2	98
Food Industry Residues & Waste; Prep Animal Feed	9	19	64	44.5	232
Wood and Articles of Wood; Wood Charcoal	10	36	79	43.2	121
Arms and Ammunition; parts and accessories thereof	11	46	88	42.6	93
Prep Feathers, Down etc.; Artif Flowers; h hair art	12	54	96	42.3	78
Nickel and articles thereof	13	49	90	40.6	83
Coffee, Tea, Mate & Spices	14	58	96	37.8	65
Electric Machinery etc.; Sound Equip; TV Equip; pts	15	56	92	36.7	66
Paper & Paperboard & Articles (inc papr pulp artl)	16	55	90	35.7	66
Sugars and Sugar Confectionary	17	22	58	35.1	157
Wood Pulp etc.; Recovd (waste & scrap) Ppr & Pprbd	18	39	72	33.6	87
Beverages, Spirits and Vinegar	19	61	94	32.8	54
Animal or Vegetable Fats, Oils etc.. & Waxes	20	27	59	32.8	123

*Minimum of one billion dollars shipped in 2005.

Containerization of Import Trade. The data above are segmented by imports and exports. This section shows comparable results for imports into the United States. See Table 5.4.5 and 5.4.6 and Figure 5.4.3.

The results show that oil dominates all commodities in import tonnage with 8-10 times the tons of the next largest commodity. However, containerized imported tons of oil only constitutes 2% of 2005 tons. All commodities, with the exception of Ores, Slag and Ash, have larger 2005 tonnages than in 1990. Containerization of import tons increase for every commodity with the exception of Ores, Slag and Ash, and Organic Chemicals. The second largest commodity category, Salt, Sulfur, Earth & Stone and Lime & Cement Plaster, only had 14% of import tons containerized in 2005, a slight increase from the 13% containerized in 1990.

Thirteen commodity groups have import tons containerized at over 50% in 2005 compared to nine in 1990. Commodities showing significant increases in their percentage on containerized import tonnage include Wood and Articles of Wood, Vehicles, Articles of Iron or Steel, Edible Fruit & Nuts, Paper & Paperboard and Rubber and Articles thereof.

The difference in shares of imports that were containerized in 1990 and 2005 are shown in Figure 5.4.3. These results show that all but four of the 20 commodities have increased percentages of containerized import waterborne tons between 1990 and 2005. The paper & paperboard commodity increases its containerized import tons by more than 50 percentage points, from 34% in 1990 to 86% in 2005. The percent of import containerized wood tons increases from 25% in 1990 to 59% in 2005. Oil, the largest commodity as measured by import tons, only increased slightly more than one percentage point, from 0.4% in 1990 to 2% in 2005.

Almost one-half of the top 20 commodities, nine in all, have increases between one and seven percentage points between the two reported years.

The top commodities ranked by the increase in containerized shipments are shown in Table 5.4.6. Results show that the top 13 commodities, as measured by the percentage point increase in containerized import tons, all have percentage point increases of 21 or greater between 1990 and 2005. The largest percentage point increase between 1990 and 2005 is 60 percentage points by the Food Industry Residues & Waste; Prep Animal Feed. Cereals have the second largest percentage point increase between 1990 and 2005 at 59. Seven commodities more than double their percentage containerized. On a percent increase basis, Sugars and Sugar Confectionary and Cereals have the largest increase.

Table 5.4.5 Top 20 Commodities as Ranked by Import Tons, Containerized Summary for 1990 and 2005

Commodity	2005				1990			
	Rank	Import Tonnage (thousands)			Rank	Import Tonnage (thousands)		
		All Tons	Containerized			All Tons	Containerized	
			Tons	%			Tons	%
Mineral Fuel, Oil etc..; Bitumen Subset; Mineral Wax	1	744,493	12,567	2	1	378,236	1,458	0
Salt; Sulfur; Earth & Stone; Lime & Cement Plaster	2	96,152	13,134	14	3	36,806	4,875	13
Iron & Steel	3	33,622	7,186	21	4	14,178	1,951	14
Ores, Slag and Ash	4	31,278	2,018	7	2	37,381	9,196	25
Wood and Articles of Wood; Wood Charcoal	5	16,577	9,738	59	14	3,373	839	25
Organic Chemicals	6	15,385	3,386	22	11	3,862	946	25
Inure Chem.; Perk & Rare-earth Met & Radio act Comp	7	13,542	3,508	26	5	9,388	1,074	11
Vehicles, except Railway or Tramway, and parts etc.	8	12,043	6,740	56	6	7,926	3,120	39
Nuclear Reactors, Boilers, Machinery etc..; Parts	9	11,726	10,307	88	8	4,319	3,663	85
Articles of Iron or Steel	10	11,344	7,716	68	9	4,318	1,988	46
Fourniture; Redding etc..; Lampas ensoi etc..; prêta bd	11	10,282	10,142	99	nr	1,403	1,368	98
Fertilizers	12	9,503	1,249	13	10	4,050	462	11
Edible Fruit & Nuts; Citrus Fruit or Melon Peel	13	8,266	6,643	80	7	5,086	2,557	50
Electric Machinery etc.; Sound Equip; TV Equip; pts	14	7,353	6,944	94	16	2,463	2,306	94
Plastics and articles thereof	15	7,285	7,056	97	19	1,922	1,817	95
Beverages, Spirits and Vinegar	16	6,816	6,023	88	15	3,041	2,577	85
Paper & Paperboard & Articles (inc paper pulp art)	17	6,192	5,339	86	12	3,722	1,267	34
Ceramic Products	18	5,941	5,653	95	nr	1,362	1,315	97
Art of Stone, Plaster, Cement, Asbestos, Mica etc..	19	5,772	5,528	96	nr	869	813	94
Rubber and articles thereof	20	5,053	4,328	86	17	2,216	1,477	67

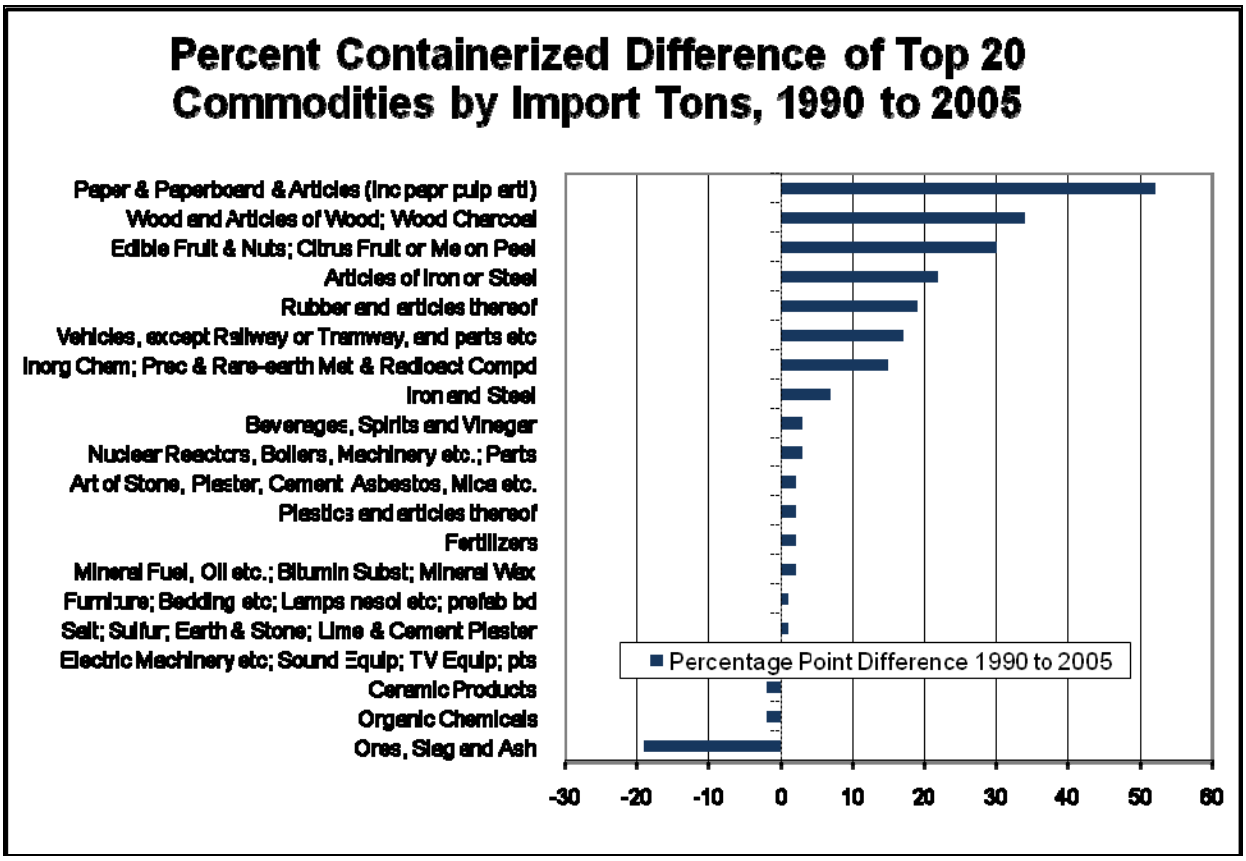


Figure 5.4.3 Percent Containerized Differences between 1990 and 2005 of the Top Commodities Ranked by Import Tons.

Table 5.4.6 Top 20 Commodities Ranked by Increase in Containerized Percentage of Import Tons, 1990 and 2005*

Commodity	Rank	Percent Import Tons Containerized		Percentage Point Difference 1990 to 2005	Containerized Percent Increase 1990 to 2005
		1990	2005		
Food Industry Residues & Waste; Prep Animal Feed	1	24	84	60	248
Cereals	2	22	81	59	272
Paper & Paperboard & Articles (inc paper pulp art)	3	34	86	52	153
Wood and Articles of Wood; Wood Charcoal	4	25	59	34	136
Oil Seeds etc..; Misc Grain, Seed, Fruit, Plant etc.	5	59	90	31	53
Edible Fruit & Nuts; Citrus Fruit or Melon Peel	6	50	80	30	60
Milling Products; Malt; Starch; Insulin; What Gluten	7	62	91	29	46
Fish, Crustaceans & Aquatic Invertebrates	8	69	97	28	41
Miscellaneous Chemical Products	9	59	84	25	43
Animal or Végétale Fats, Oïl etc.. & Waxes	10	22	45	24	108
Articles of Iron or Steel	11	46	68	22	48
Prep Vegetables, Fruit, Nuts or other plant parts	12	73	94	21	29
Sugars and Sugar Confectionary	13	6	26	21	363
Rubber and articles thereof	14	67	86	19	29
Vehicles, except Railway or Tramway, and parts etc.	15	39	56	17	42
Inure Chem.; Perk & Rare-earth Met & Radio act Comp	16	11	26	15	127
Miscellaneous Edible Preparations	17	85	96	11	13
Iron & Steel	18	14	21	8	55
Coffee, Tea, Mate & Spices	19	89	96	7	8
Cocoa and Cocoa Preparations	20	65	70	5	8

*Minimum of one million tons shipped in 2005.

Containerization of Export Trade. Comparable data are shown on export shipments in Tables 5.4.7 and 5.4.8 and Figure 5.4.4.

Results show that Oil is the largest commodity in export tonnage, followed by Cereals. Fertilizer, Cereals, and Oil have the least containerized 2005 export tons with three, six and seven percent respectively.

All but three of the top 20 commodities listed in the table increase their export tons containerized between 1990 and 2005. Oil Seeds, Wood, Food, Salt and Miscellaneous Chemical Products have significant increases in the percentage containerized between 1990 and 2005. Ten commodities have less than 50% of their export tons in containers.

Figure 5.4.4 shows the change in percent of export shipments that were containerized between 1990 and 2005. These results show that all but three of the 20 commodities have increased percentages of containerized export waterborne tons between 1990 and 2005, and six commodities have increases of over 30 percentage points of containerized export tons. The largest reported percentage point increase is 39 noted for two commodities, Salt, Sulfur, Earth & Stone, Lime & Cement Plaster and Iron & Steel. Three commodities reported 35 percentage point increases including Chemical Products, Paper and Paperboard Articles, and Wood and Articles of Wood.

Cereals, the second largest commodity as measured by export tons, also increases five percentage points, from 1% in 1990 to 6% in 2005.[4]

These export commodities are ranked by percentage point differences in Table 5.4.8. The top 18 commodities, as measured by the percentage point increase in containerized export tons, all have percentage point increases of 21 or greater between 1990 and 2005. The largest percentage point increase is 52 percentage points by the Fish, Crustaceans & Aquatic Invertebrates commodity category. Sugars and Sugar Confectionary had the second largest percentage point increase between 1990 and 2005 of 48.

Four commodity groups show 40 or greater containerized percent point increases. Only five commodities in 2005 reported in the table have containerized percentages below 50%. Nine commodities double or more their percentage containerized. On a percent increase basis, Iron & Steel, Food Industry Residues & Waste; Prep Animal Feed, and Sugars and Sugar Confectionary have the largest increases, all over 300%. Wood and Articles of Wood; Wood Charcoal and Animal or Vegetable Fats, Oils, etc. & Waxes had very large percent basis increases of 289%.

[4] In fact, this was recently analyzed. Mongelluzzo (2007) indicated a growth in container shipments of grain. He indicated specifically that grain exports in container has increased due to: 1) higher ocean rates on bulk commodities; 2) faster payment terms due to tighter shipping schedules; 3) flexibility allowing buyers to buy in smaller lots; and 4) the increased DDG shipments due to ethanol growth. Currently, he cites that container shipments of grain have increased by about 14% and are growing much faster than the export market as a whole, and, though container shipments are very popular to Asia, grain shipments by containers are also occurring in numerous other ports (Pacific, as well as East and Gulf coast ports).

Table 5.4.7 Top 20 Commodities as Ranked by Export Tons, Containerized Summary for 1990 and 2005

Commodity	2005				1990			
	Rank	Export Tonnage (thousands)			Rank	Export Tonnage (thousands)		
		All Tons	Containerized			All Tons	Containerized	
			Tons	%			Tons	%
Mineral Fuel, Oil etc..; Bitumin Subst; Mineral Wax	1	114,363	8,322	7	1	151,836	2,482	2
Cereals	2	76,202	4,771	6	2	97,593	1,158	1
Oil Seeds etc..; Misc Grain, Seed, Fruit, Plant etc.	3	29,476	7,532	26	4	17,807	1,537	9
Wood Pulp etc.; Recovd (waste & scrap) Ppr & Pprbd	4	17,702	15,005	85	7	10,417	6,456	62
Organic Chemicals	5	17,107	4,711	28	8	10,133	3,451	34
Fertilizers	6	12,919	392	3	nr	14	2	14
Iron & Steel	7	12,247	5,461	45	6	12,938	770	6
Ores, Slag and Ash	8	12,102	700	6	11	5,765	660	11
Inorg Chem; Prec & Rare-earth Met & Radioact Compd	9	11,527	3,018	26	10	7,777	1,145	15
Food Industry Residues & Waste; Prep Animal Feed	10	10,998	4,497	41	5	14,905	1,285	9
Wood and Articles of Wood; Wood Charcoal	11	10,138	4,777	47	3	32,117	3,882	12
Plastics and articles thereof	12	8,186	7,610	93	13	4,604	3,837	83
Salt; Sulfur; Earth & Stone; Lime & Cement Plaster	13	8,181	5,165	63	9	9,505	2,268	24
Paper & Paperboard & Articles (inc papr pulp artl)	14	7,088	6,224	88	12	5,112	2,707	53
Nuclear Reactors, Boilers, Machinery etc..; Parts	15	3,874	2,834	73	14	2,500	1,612	64
Cotton, including Yarn and Woven Fabric thereof	16	3,733	3,407	91	17	1,954	1,707	87
Meat and Edible Meat Offal	17	3,527	3,106	88	nr	1,130	804	71
Vehicles, except Railway or Tramway, and parts etc.	18	3,268	1,750	54	19	1,543	690	45
Edible Fruit & Nuts; Citrus Fruit or Melon Peel	19	2,335	2,086	89	16	1,967	1,602	81
Miscellaneous Chemical Products	20	2,260	1,862	82	18	1,572	737	47

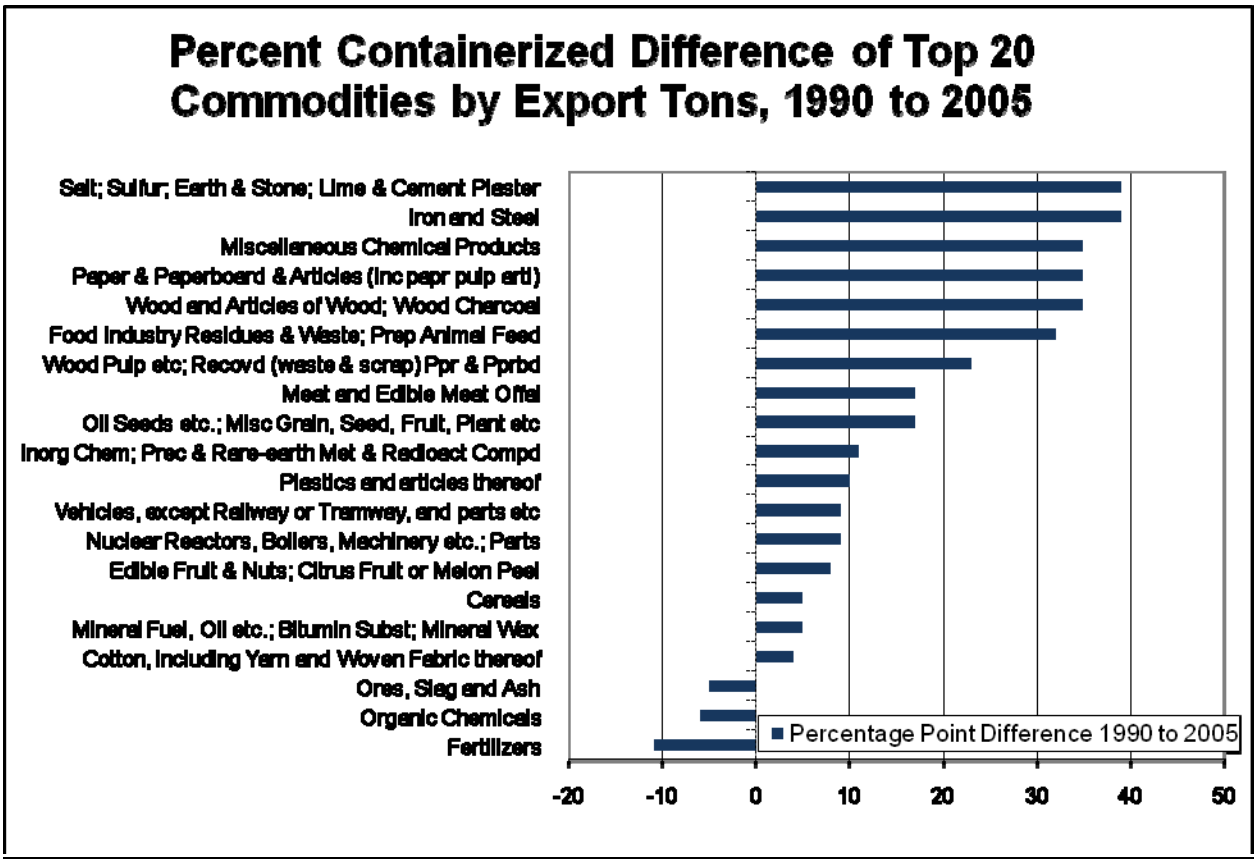


Figure 5.4.4 Percent Containerized Differences between 1990 and 2005 of the Top Commodities Ranked by Export Tons.

Table 5.4.8 Top 20 Commodities Ranked by Increase in Containerized Percentage of Export Tons, 1990 and 2005*

Commodity	Rank	Percent Export Tons Containerized		Percentage Point Difference 1990 to 2005	Containerized Percent Increase 1990 to 2005
		1990	2005		
Fish, Crustaceans & Aquatic Invertebrates	1	34	86	52	154
Sugars and Sugar Confectionary	2	16	64	48	308
Beverages, Spirits and Vinegar	3	44	88	44	99
Dairy Prods; Birds Eggs; Honey; ed animal pr nesoi	4	49	88	40	81
Salt; Sulfur; Earth & Stone; Lime & Cement Plaster	5	24	63	39	164
Iron & Steel	6	6	45	39	643
Coffee, Tea, Mate & Spices	7	47	85	38	80
Miscellaneous Chemical Products	8	47	82	36	76
Wood and Articles of Wood; Wood Charcoal	9	12	47	35	289
Paper & Paperboard & Articles (inc papr pulp artl)	10	53	88	35	66
Edible Preparations of Meat, Fish, Crustaceans etc.	11	57	91	34	60
Food Industry Residues & Waste; Prep Animal Feed	12	9	41	32	376
Ceramic Products	13	56	86	30	53
Leather Art; Saddlery etc.; Handbags etc.; Gut Art	14	63	91	27	43
Soap etc.; Waxes, Polish etc.; Candles; Dental Preps	15	68	92	24	35
Wood Pulp etc.; Recovd (waste & scrap) Ppr & Pprbd	16	62	85	23	37
Animal or Vegetable Fats, Oils etc.. & Waxes	17	8	29	22	289
Articles of Iron or Steel	18	40	61	21	52
Oil Seeds etc..; Misc Grain, Seed, Fruit, Plant etc.	19	9	26	17	198
Meat and Edible Meat Offal	20	71	88	17	24

*Minimum of one million tons shipped in 2005.

6. U.S. CONTAINER FLOWS

This section contains a detailed presentation of container flows within the United States. The purpose of this section is to quantify and analyze historical movements of containers by rail in the U.S. markets. Market sizes and changes in market size are derived.

Parts of this section are deleted due to confidentiality reasons but are available for inspection at the office of the Institute for Water Resources (IWR).

6.1 Data Details and Organization of Results

The data used in this section are from the Surface Transportation Board (STB) and reports on rail shipments of containers in the United States. These data can be used to infer the shipments of containers and trailers among origins and destinations. The data are from the Surface Transportation Board (STB) Confidential Carload Waybill Sample data set.[5] This data are for the years 1995-2005 and is assembled by the Tennessee Valley Authority (TVA). These data are limited in their distribution and are subject to strict confidentiality requirements. For these reasons, the results reported here are selective.

The data are specified in several respects as described below:

Years. 1995-2005.

Geographical Scope. The data are reported in several different geographic aggregations, ranging from zip codes to counties, to BEAs, to states. For several reasons, the BEA was selected as the geographic scope. While data could be analyzed at a less aggregated level, it would be spotty and infringe on confidentiality, and further, would unlikely have corresponding macro-level data. Broader data would likely be too aggregated. Hence, the BEA is used as reported and defined in 2004.

Containers and trailers. This document reports the number of containers and trailers transported by railroad. The market size of a BEA is the number of containers terminating by railroad in the BEA.

Units. The data reported are the number of containers and trailers. The major container and trailer tracking organizations using this data set report in units of containers or trailers. These organizations, the Association of American Railroads (AAR) and the Intermodal Association of North America (IANA) publish annual descriptive statistics of container and trailer traffic volumes. Our data report in the same units and are validated by comparisons to the published AAR and IANA traffic volumes. The data validation is described in Appendix B.

The results are presented in the following sections. Section 6.2 contains an overview of the container shipments. Section 6.3 shows a matrix of shipments amongst BEAs for different time periods and Section 6.4 show selective trends in shipments.

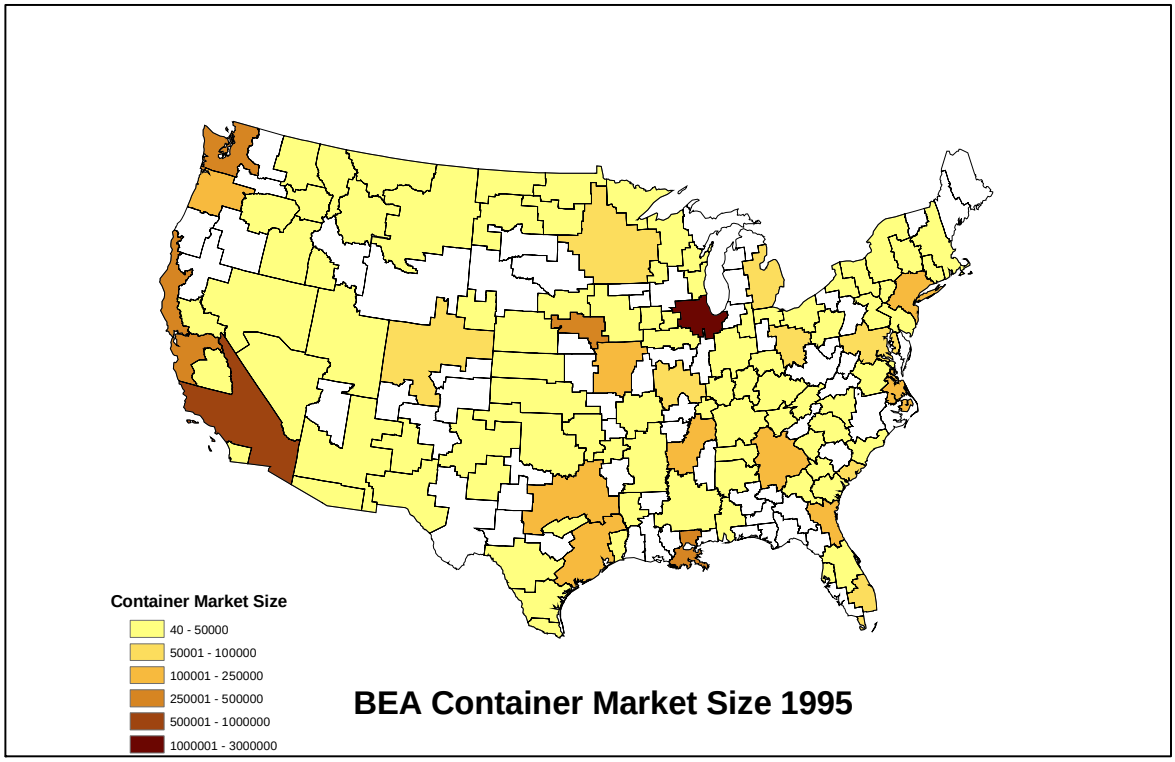
[5] Interpretation of the data is limited to the extent that some shipment occurs by trucks. There are no data to our knowledge on truck shipments of containers at the sub-regional level.

6.2 Overview of Rail Container Shipments

Figures 6.2.1 shows density maps of container terminations in 1995 and 2005 to illustrate the geographic concentration of container shipments. There are 179 BEAs in the United States and, in 2005, there are 89 that did not receive container shipments by rail (Table 6.2.1). The number of BEAs not receiving container shipments has generally increased from 1995 to 2005. Only slightly more than one-half of BEAs in 2005 receive container shipments. Moreover, a number of BEAs experience a significant increase of container shipment density between 1995 and 2005

This data are shown in Figures 6.2.2 and 6.2.3. Chicago and Los Angeles area BEAs are by far the largest markets for terminating containers in 2005. These are followed quite distantly by Seattle, Dallas, Memphis, San Jose and New York area BEAs. The top 10 BEAs comprise 70% of the total U.S. market for rail terminations of containers in 2005. Beyond that, there are another 80 that receive container shipments. Figures 6.2.2 shows the top 25 BEAs that comprise 89% of the total U.S. market. The market share of the top 25 BEAs is shown in Figure 6.2.3. Four of the five largest BEAs, including the two largest, increase their market share between 1995 and 2005.

Finally, the rail data contain information on container and trailer shipments. These are summarized in Table 6.2.2. Container shipments are generally increasing in percentage terms, and that for trailers is decreasing. Specifically, container shipments have increased 98% since 1995, where trailers have only increased nominally. Further, the share of total shipments by container has increased from 68% in 1995 to 81% in 2005, and that for trailers has decreased from 32% to 19% of the total.



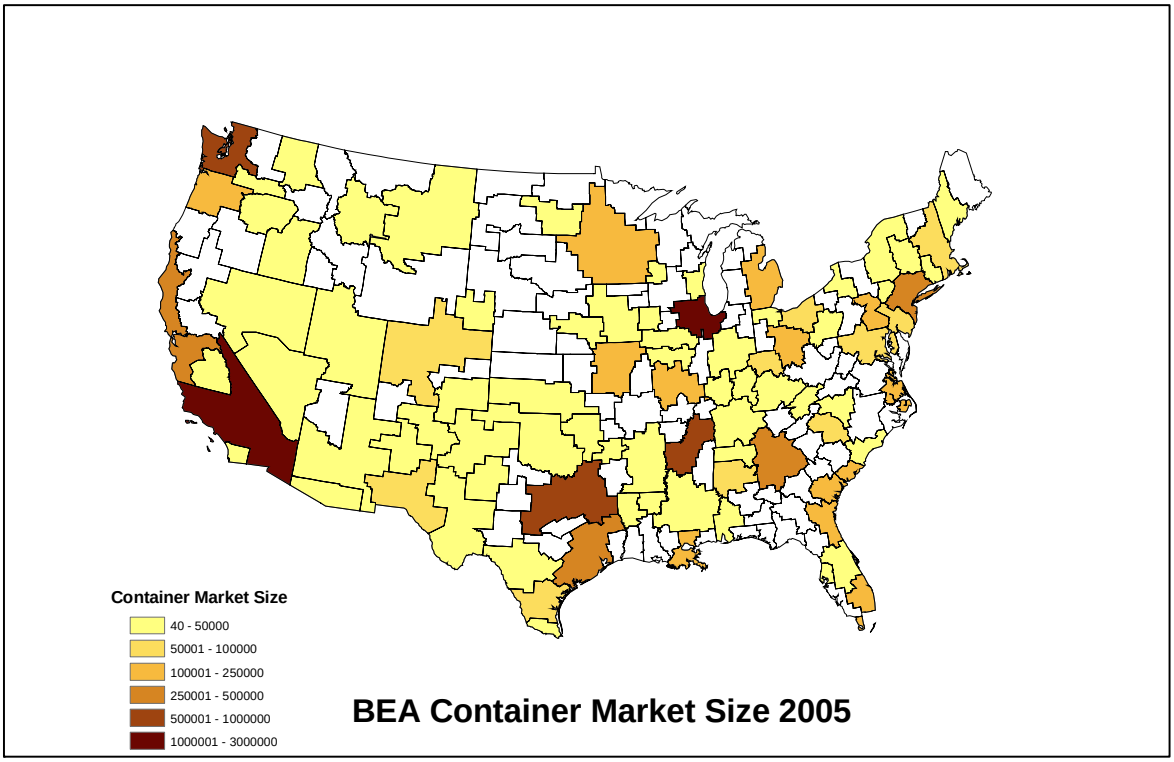


Figure 6.2.1 BEA Railroad Container Terminations, 1995 and 2005.

Table 6.2.1 Number of BEAs with Railroad Terminating Container Traffic, 1995-2005

Year	Number of BEAs	
	Without Container Terminating Traffic	With Container Terminating Traffic
1995	69	110
1996	75	104
1997	67	112
1998	72	107
1999	75	104
2000	80	99
2001	80	99
2002	39	140
2003	82	97
2004	84	95
2005	89	90

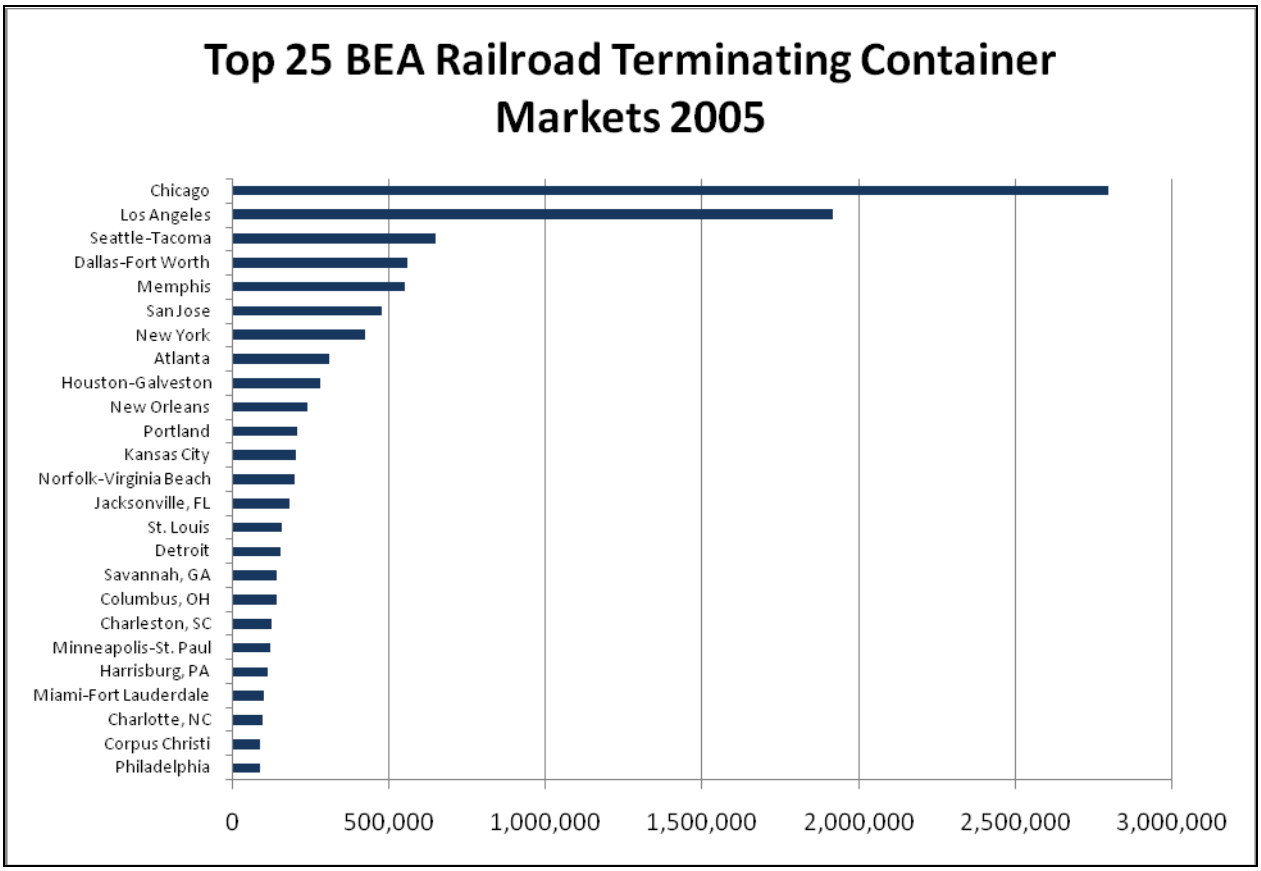


Figure 6.2.2 Top 25 BEA Markets for Railroad Terminating Containers, 2005.

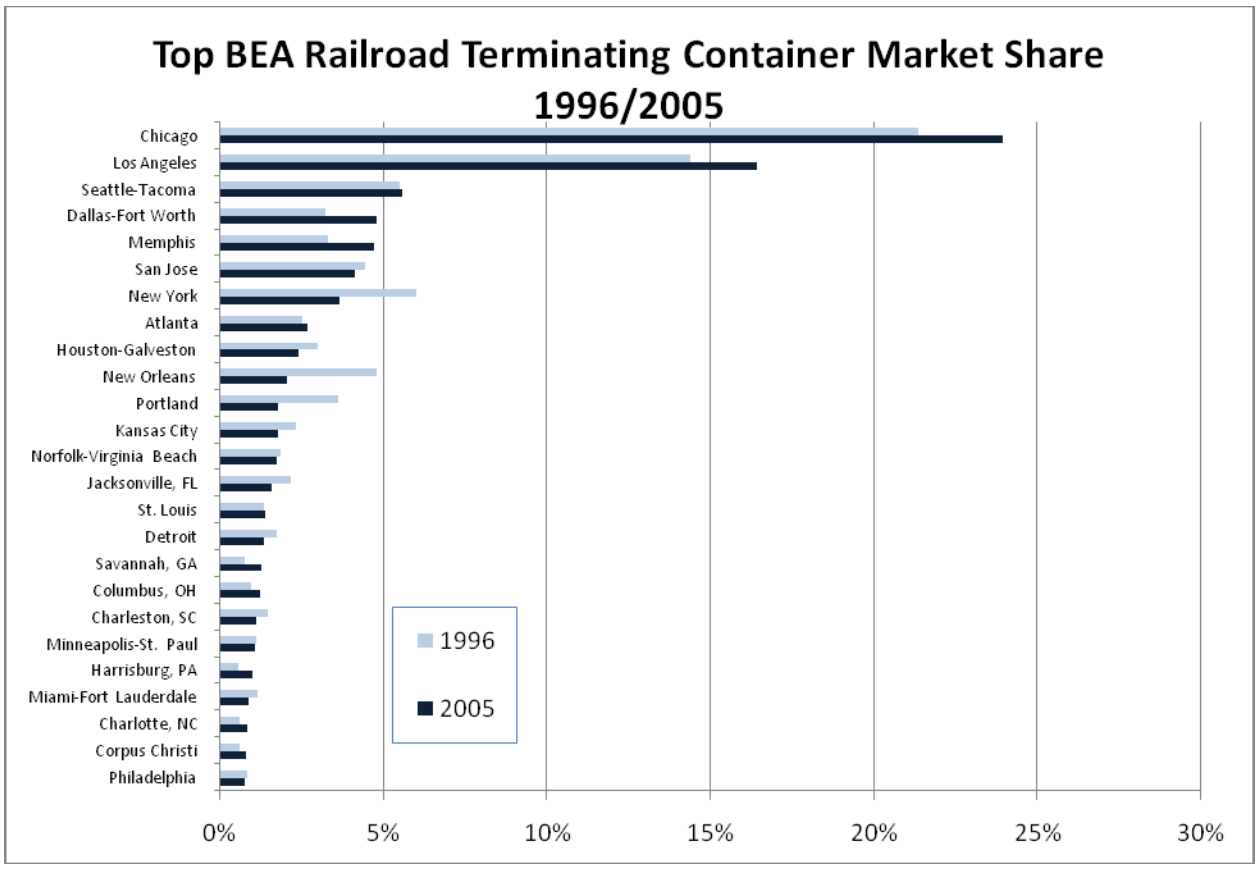


Figure 6.2.3 Top BEA Railroad Terminating Container Market Share, 1996 and 2005.

Table 6.2.2 Container and Trailer Shipments, 1995-2005

Year	Containers	% of total	Index (1995=100)	% change previous year	Trailers	% of total	Index (1995=100)	% change previous year	Total
1995	5,901,474	68	100		2,793,468	32	100		8,694,942
1996	6,063,863	68	103	3	2,811,086	32	101	1	8,874,949
1997	6,362,961	68	108	5	2,942,908	32	105	5	9,305,869
1998	6,712,458	70	114	5	2,875,853	30	103	-2	9,588,311
1999	7,409,372	72	126	10	2,923,768	28	105	2	10,333,140
2000	8,525,560	76	144	15	2,677,600	24	96	-8	11,203,160
2001	8,656,220	79	147	2	2,316,840	21	83	-13	10,973,060
2002	9,318,410	81	158	8	2,177,424	19	78	-6	11,495,834
2003	10,425,071	83	177	12	2,202,456	17	79	1	12,627,527
2004	10,870,152	82	184	4	2,375,600	18	85	8	13,245,752
2005	11,679,124	81	198	7	2,820,660	19	101	19	14,499,784

6.3 Container Shipments among BEAs[6]

The largest market in 1995 is Chicago, followed by Los Angeles. All other markets are relatively small. By 2005, the Chicago market more than doubled, as did Los Angeles. However, a number of other markets escalated in relative importance. These include St Louis, Memphis, Dallas and Atlanta.

Because both Canada and Mexico are potentially important sources of container shipments to the U.S. market, shipments from these markets are isolated. In 1996 (there were no reported shipments in 1995, so the values commence with 1996), the largest origin for shipments from Canada is Quebec, followed distantly by Ontario. British Columbia is nearly inconsequential. The primary markets served from Quebec are Chicago and Detroit. Shipments from Mexico are nearly inconsequential in 1996.

By 2005, there are a number of notable changes. First, shipments from all origins increased. Shipments from both British Columbia and Mexico increase substantially. Quebec still dominates shipments from Canada, but those from British Columbia have increased. The most important market for Quebec is Chicago and then Detroit. By 2005, however, New York increased in importance. Chicago is also the most important market for British Columbia, followed by Detroit. Shipments from Mexico are mostly to Chicago, followed by Los Angeles and Atlanta. The other markets are of relatively minor importance.

Among the terminating BEAs, the markets with the fastest growth are Houston, followed by Corpus Christi and Dallas, and then Savannah. Each of these increases receipts by over 200%. Chicago, which is the largest container market, increased its receipts by only 131%.

6.4 Trends and Growth in Selected Container Shipments

This section makes a comparison of container shipments to a group of targeted Midwest markets from groups of origins for the years 1995-2005. The Midwest comprises one of the largest geographical markets for containers, so these are analyzed as a group. The Midwest market includes the largest railroad container market, Chicago.

For purposes here, the Midwest is defined in Table 6.4.1. The Midwest market is defined as the Chicago, Kansas City and St. Louis BEAs. The container flows are containers terminating within those BEAs, as reported in the TVA/Surface Transportation Board Master Waybill data set. More specifically, the Midwest market consists of the data in Table 6.4.1.

Table 6.4.1 Definition of Midwest Market by BEA

BEA Code	BEA Name
32	Chicago-Naperville-Michigan City, IL-IN-WI
84	Kansas City-Overland Park-Kansas City, MO-KS
160	St. Louis-St. Charles-Farmington, MO-IL

[6] These data were used to derive container shipping matrixes among U.S. BEAs. Due to confidentiality reasons, the data are not presented.

Figure 6.4.1 illustrates the Midwest railroad container market size. All years, except for 2001, show increases in the volume of railroad containers terminating in the region. The trend line shows a consistent growth pattern throughout the reported period.

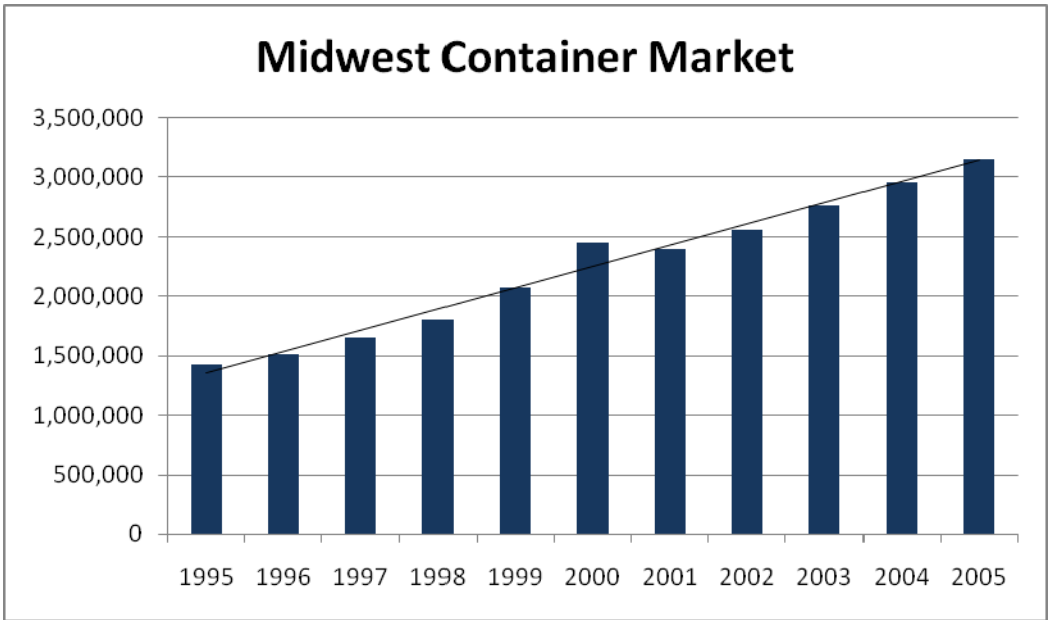


Figure 6.4.1 Midwest Railroad Terminating Container Market Share, 1995 to 2005.

The Midwest share of the U.S. market is shown in Figure 6.4.2. The Midwest makes up 27% of the U.S. market in 2005. From 1995 to 2000, the Midwest market share grows to nearly 29% of the nation's total railroad container market. Since 2000, the Midwest market share stabilizes at the 27% level.

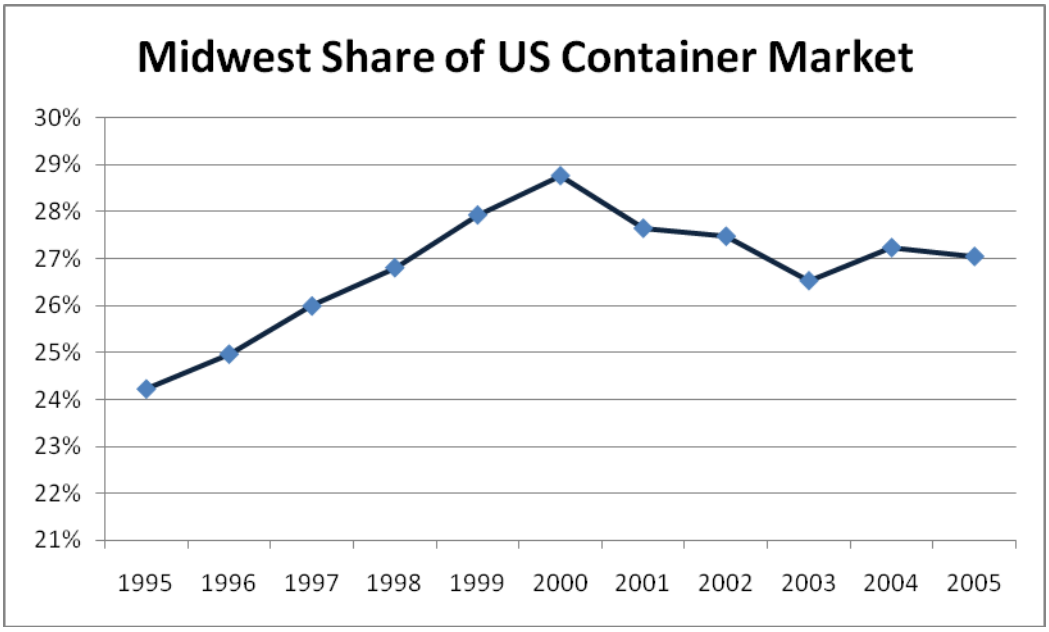


Figure 6.4.2 Midwest Market Share of U.S. Railroad Container Market, 1995 to 2005.

The major suppliers to the Midwest market are from each of the West, East, and Gulf Coasts, and others. These are defined in Table 6.4.2-6.4.4. The East Coast region consists of the following BEAs as defined in the 2004 BEA definitions.

Table 6.4.2 Definition of East Coast Originating Region by BEA

BEA Code	BEA Name	Originating Region
14	Bangor, ME	East Coast
22	Boston-Worcester-Manchester, MA-NH	East Coast
30	Charleston-North Charleston, SC	East Coast
67	Greenville, NC	East Coast
72	Hartford-West Hartford-Willimantic, CT	East Coast
79	Jacksonville, FL	East Coast
106	Miami-Fort Lauderdale-Miami Beach, FL	East Coast
115	Myrtle Beach-Conway-Georgetown, SC	East Coast
118	New York-Newark-Bridgeport, NY-NJ-CT-PA	East Coast
121	Orlando-The Villages, FL	East Coast
127	Philadelphia-Camden-Vineland, PA-NJ-DE-MD	East Coast
130	Portland-Lewiston-South Portland, ME	East Coast
137	Richmond, VA	East Coast
149	Savannah-Hinesville-Fort Stewart, GA	East Coast
173	Virginia Beach-Norfolk-Newport News, VA-NC	East Coast
174	Washington-Baltimore-Northern Virginia, DC-MD-VA-WV	East Coast
204	Nova Scotia	East Coast
207	Quebec	East Coast

The Gulf Coast region consists of the following BEAs as defined in the 2004 BEA definitions:

Table 6.4.3 Definition of Gulf Coast Originating Region by BEA

BEA Code	BEA Name	Originating Region
15	Baton Rouge-Pierre Part, LA	Gulf Coast
41	Corpus Christi-Kingsville, TX	Gulf Coast
69	Gulfport-Biloxi-Pascagoula, MS	Gulf Coast
75	Houston-Baytown-Huntsville, TX	Gulf Coast
104	McAllen-Edinburg-Pharr, TX	Gulf Coast
112	Mobile-Daphne-Fairhope, AL	Gulf Coast
117	New Orleans-Metairie-Bogalusa, LA	Gulf Coast
125	Pensacola-Ferry Pass-Brent, FL	Gulf Coast

The West Coast region consists of the following BEAs as defined in the 2004 BEA definitions.

Table 6.4.4 Definition of West Coast Originating Region by BEA

BEA Code	BEA Name	Originating Region
97	Los Angeles-Long Beach-Riverside, CA	West Coast
131	Portland-Vancouver-Beaverton, OR-WA	West Coast
145	San Diego-Carlsbad-San Marcos, CA	West Coast
146	San Jose-San Francisco-Oakland, CA	West Coast
152	Seattle-Tacoma-Olympia, WA	West Coast
212	British Columbia	West Coast

The Other region aggregates all other BEAs not listed in the tables.

West Coast originating container traffic to the Midwest market is shown in Figure 6.4.3.

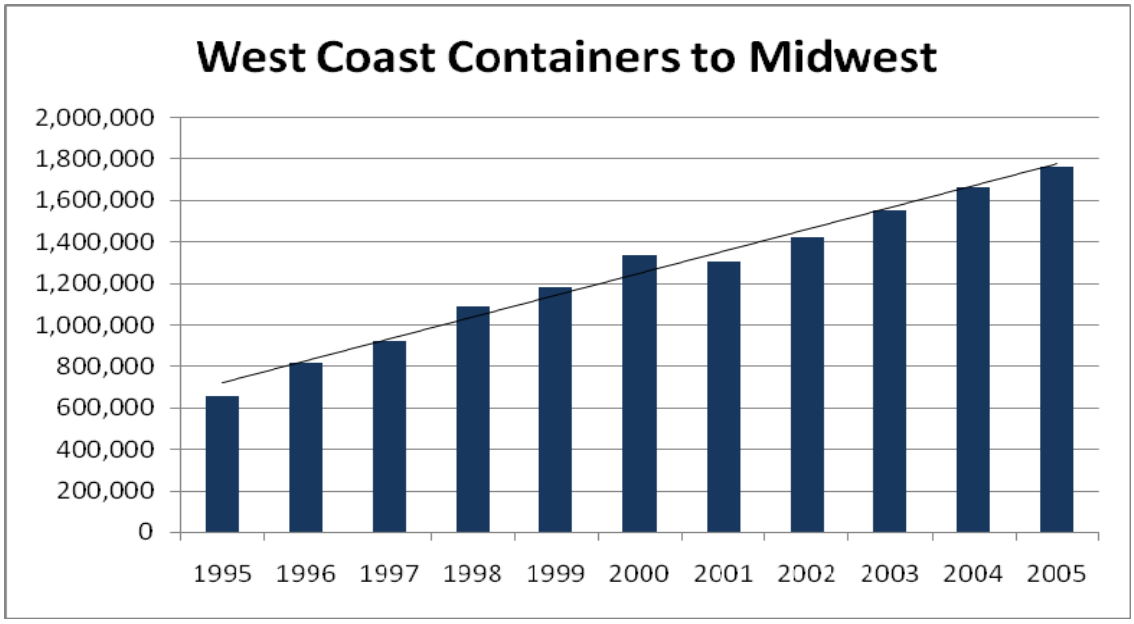


Figure 6.4.3 West Coast Railroad Container Traffic Terminating in Midwest, 1995 to 2005.

The West Coast traffic to the Midwest increases in all years, except for 2001. The trend line in the figure shows a fairly consistent growth pattern throughout the reported period.

Figure 6.4.4 shows the East Coast originating railroad container traffic to the Midwest. When compared to the West Coast originating container traffic volume, the East Coast volume is less than one-half of the West Coast.

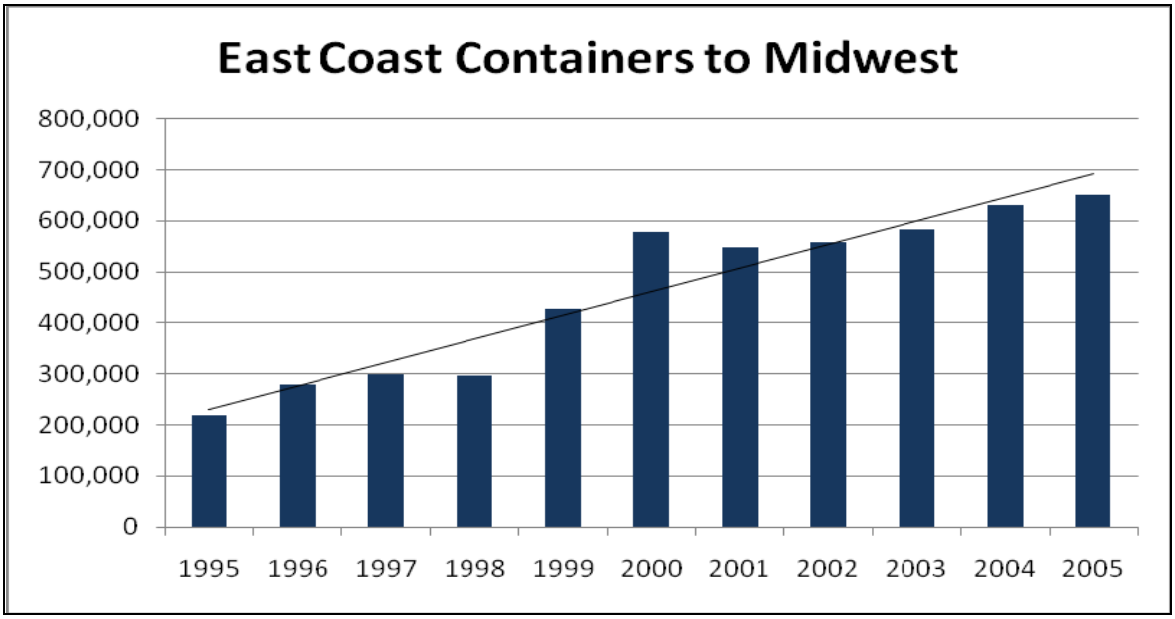


Figure 6.4.4 East Coast Railroad Container Traffic Terminating in Midwest, 1995 to 2005.

Gulf Coast originating container traffic to the Midwest market is shown in Figure 6.4.5.

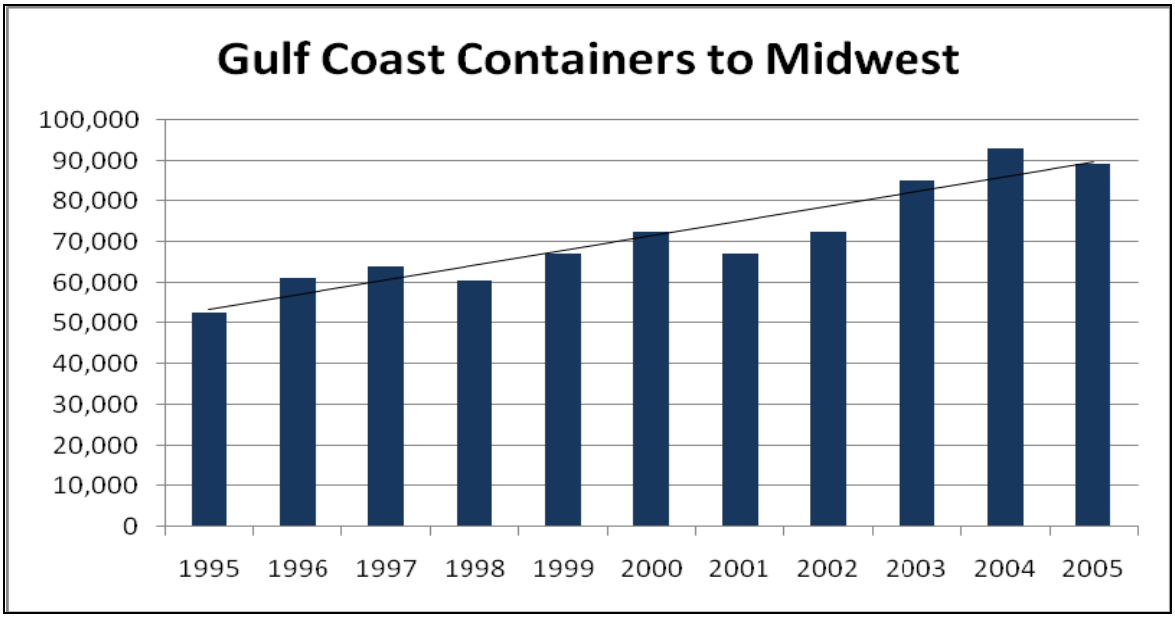


Figure 6.4.5 Gulf Coast Railroad Container Traffic Terminating in Midwest, 1995 to 2005.

Gulf Coast originating railroad container traffic to the Midwest increases in most years but declines in 1998 and 2001. Similarly, the traffic volume in 2002 is less than the year 2000. The trend line illustrates slower overall growth when compared to the other coasts.

Midwest railroad container traffic from the three coastal regions and the rest of the BEAs (Other) is summarized in Table 6.4.5.

Table 6.4.5 Midwest Container Flow Volumes, 1995-2005

Year	Market	Container Origination Region				
		West Coast	East Coast	Gulf Coast	Other	Total
1995	Midwest	653,827	218,048	52,760	505,728	1,430,363
1996	Midwest	816,768	279,936	61,320	356,520	1,514,544
1997	Midwest	920,144	299,132	63,960	371,040	1,654,276
1998	Midwest	1,092,132	296,608	60,440	350,660	1,799,840
1999	Midwest	1,185,520	426,756	67,040	390,372	2,069,688
2000	Midwest	1,335,052	577,520	72,704	467,260	2,452,536
2001	Midwest	1,309,120	549,400	67,040	468,000	2,393,560
2002	Midwest	1,421,492	558,360	72,692	508,278	2,560,822
2003	Midwest	1,553,880	583,880	85,320	543,380	2,766,460
2004	Midwest	1,663,200	631,360	93,200	573,320	2,961,080
2005	Midwest	1,765,320	651,560	89,280	653,300	3,159,460

The results show that these Midwest markets increase in shipments from 1.4 to 3.16 million containers from 1995-2005. Most of this has been from the West Coast, followed by the East Coast, Other and Gulf Coast. The East Coast container traffic nearly triples from 1995 to 2005, and shipments from the West Coast more than double.

Figure 6.4.6 shows the market share of the regions originating railroad container traffic to the Midwest. The West Coast has, by far, the largest market share and increase its market share between 1995 and 2005. Specifically, the West Coast share increases from 46% in 1995 to 56% in 2005. Each of the East and Gulf Coast share now comprises about 20% of the Midwest market.

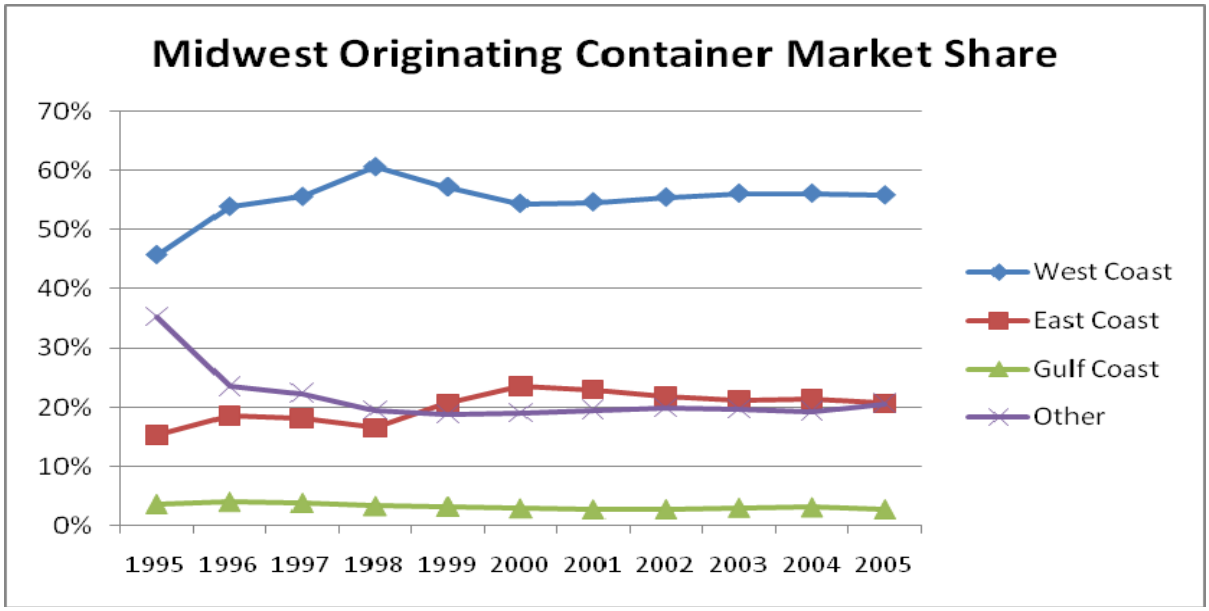


Figure 6.4.6 Midwest Originating Region Railroad Container Market Share, 1995 to 2005.

7. SUMMARY

The specific purpose of this study is to document container flows. Results are presented on world flows and trends in container shipping. Similar results are presented on container shipments within the United States. In addition, this report analyzes the extent that some commodities have evolved or are evolving toward more containerized shipping.

Results from each section are summarized below.

7.1 World Container Flows

Trade in containers is probably one of the most radical changes in world commerce. This is an industry that has been evolving for many years. However, the pace of growth has likely accelerated in the past decade. Highlights from these results of interest are listed below:

- The annual growth rate in global container trade is about 10% per year and seems relatively steady;
- Asia is by far the largest importer and exporter of containers, followed by Europe and then Other and North America;
- Asian trade is growing at about 10%, but, the fastest growth rates are among the group of countries in Other and Latin America and Caribbean;
- Amongst the trade lanes, the fastest growing trade is Far East-Europe, followed by Transpacific. Growth in the Transatlantic shipments is relatively slow.

North America imports more containers than it exports, and this gap is widening over time. Asia is by far the largest source of imports for North America. Finally, the 5-year growth trend for North America is 11%.

Among the world container ports, the largest are Singapore and Hong Kong at 25 and 23 million TEU respectively in 2006, followed by several in China with each in the 12-22 million TEU throughput. The largest ports in the United States are Los Angeles at 8 million TEU/year in 2006 and Long Beach at 7 million TEU. However, the ports with the fastest growth rates are Ningbo, Shenzhen, Shanghai, Qingdao and Tianjin, all in Asia.

Within North America, the ports with the greatest growth are in Mexico, then, Canada and then the United States.

7.2 Containerization of Shipping: Trends by Commodities

Containerized shipments are now of greater significance in terms of value than non-containerized shipments. For imports, there has been an escalation in containerized shipments:
1) Containerization of import shipments increases for every commodity group with a few minor exceptions; 2) There are 20 commodity groups that have an increase in containerized shipments. Most important among these are Food Industry Residues and Waste; Cereals and seven other commodities more than double their percentage of containerized shipments. For exports from the United States, there are increases in containerized shipments for all but three of the top 20 commodities imported. OilSeeds, Wood, Food, Salt and Miscellaneous Chemical Products all have significant increases in containerized shipments. Even bulk cereals increase from 1% to 6% of the total volume.

7.3 U.S. Container Flows

The STB data set is used to analyze characteristics of the U.S. market for container shipments. Highlights from this analysis indicate the following:

- Of 179 BEAs in the U.S., only 90 receive container shipments;
- The largest container markets in 2005 are Chicago and Los Angeles which, by far, dominate the market, followed by Seattle, Dallas, Memphis and then numerous others;
- Trailers comprise about 10% of the market, and their share has been decreasing relative to containers.

Some of the interesting observations from this analysis are:

- Both Chicago and Los Angeles have more than doubled in the past decade;
- Shipments from ports in Canada and Mexico have increased substantially in the past decade, with most terminating in Chicago and Detroit;
- There have been substantial changes in growth among shipments within the United States during the past decade. Houston is the fastest growing market, followed by Corpus Christi, Dallas and Savannah.
- Competition in the Midwest container market dominated by shipments from the West Coast, at about 54% of the market with about 20% coming from the East and Gulf Coast.

REFERENCES

American Asociación Of. Port Authorities, www.aapa-ports.org, Secretaría de Comunicaciones y Transportes, www.sct.gob.mx

Bureau of Economic Analysis, Department of Commerce. http://www.bea.gov/regional/docs/econlist.cfm

Clarkson Research Services, 2007, *Container Intelligence Quarterly*. Fourth Quarter 2007, and other selected issues and the Clarkson CD, London.

IANA, various issues. Intermodal Industry Statistics, Annual Intermodal Volume Figures, 2002-2006, *Intermodal Market Trends & Statistics Report*, http://www.intermodal.org/statistics_files/stats1.shtml Intermodal Association of North America 11785 Beltsville Drive, Suite 1100 Calverton, MD 20705 iana@intermodal.org

LoadMatch, 2007. http://www.loadmatch.com/, LoadMatch Inc., Naperville, IL.

Mongelluzzo, B. 2007. "Cream of the Crop: Grain exports pour into containers as the dollar flops and bulk rates soar." *Journal of Commerce*, pp. 12-15.

National Transportation Atlas Database (NTAD), 2004. Research and Innovative Technology Administration (RITA), U.S. Department of Transportation, 2004. ess: Research and Innovative Technology Administration (RITA) U.S. Department of Transportation (US DOT) 1200 New Jersey Avenue, SE, Washington, DC 20590, RITAInfo@dot.gov

Railway Guide, 2007. *The Official Railway Guide, Freight Service Edition, Port/Intermodal/Warehouse Connection*, Commonwealth Business Media Inc., 400 Windsor Corporate Center, 50 Millstone Road, Suite 200, East Windsor, NJ 08520-1

Surface Transportation Board (STB) Carload Waybill Sample, 1995-2005. Tennessee Valley Authority Container Databank.

U.S. Army Corps of Engineers, 2007. *Navigation Data Center*, http://www.iwr.usace.army.mil/ndc/wcsc/wcsc.htm.

Wilson, William and B. Dahl, 2008a. *Review of Previous Studies on Container Shipping: Infrastructure, Projections and Constraints*, ACE/IWR, NETS, forthcoming.

Wilson, William and D. Benson, 2008b. *Analysis of Container Flows: World Trade, U.S. Waterborne Commerce and Rail Shipments in North American Markets*, ACE/IWR NETS, forthcoming .

Wilson,William and C. Sarmeinto, 2008c. *Container Demand in North American Markets: A Cross-Sectional Spatial Autocorrelation Analysis*, ACE/IWR, NETS, forthcoming.

Wilson, William and B. Dahl, 2008d. *Container Shipping: Rail and Ocean Shipping Rates*, ACE/IWR, NETS, forthcoming.

Wilson, William and E. DeVuyst, 2008e. *Optimization Models of Container Shipments in North America: Spatial Competition and Projections (Methodology)*, ACE/IWR, NETS.

APPENDIX A. WATERBORNE COMMERCE DATABANKS

This appendix provides a description of the process used to access and put the Waterborne Commerce Databanks data on a common basis for analytical comparisons.

Initial Databanks Data Testing Process

The initial data testing involved comparing the results of test SAS programs with the databank queries residing in the MsAccess databanks downloaded from ACE. The testing validated the results from the test SAS programs by comparing them with the results from the Access queries. Specifically:

For the 2005 databank:

- Query1 tested properly with SAS test program: zzzzzquery1
- Query 2 tested properly with SAS test program:zzzzzquery2
- Query 3 tested properly with SAS test program:zzzzzquery3
- Query 4 tested properly with SAS test program:zzzzzquery4

Additional detailed test notes:

- using aalldank data set with statyr = ‘2005’ tested properly
- query sumdollarsandkilos matched exactly sumtons.sas using adbank2005
- using aalldbank (all 1990-2005) data with a subsetting if for 2005 tested properly
- query sumdollarsandkilos Imports matched exactly sumtons.sas using aalldbank (all 1990-2005) data with a subsetting if for 2005
- aNationalSums.sas for 2005 matched exactly query sumdollarsandkilos for the tested 3 fields (val_us_dollar,swt_kilos, and count of dbank2005 records)

Missing Containerized Percentage Information

Four fields in the Waterborne Databank contain information on a shipment's division between containerized and non-containerized shipping. These fields indicate what percent of a shipment's weight and value are or are not containerized. These fields are illustrated in Table A1:

Table A1 Waterborne Databank Percent Containerized Fields

Waterborne Databank Field Name	Waterborne Databank Field Description
PRCNT_VAL_CONT	Percent of containerized value: A 3 position field representing the percentage of value of the merchandise reported as containerized (See Containerization, Appendix B-db)
PRCNT_SWT_CONT	Percent of containerized shipping weight: A 3 position field representing the percentage of shipping weight of the merchandise reported as containerized (See Containerization, Appendix B-db)
PRCNT_VAL_NON_CT	Percent of value not containerized: A 3 position field representing the percentage of value of the merchandise reported as not containerized (See Containerization, Appendix B-db)
PRCNT_SWT_NON_CT	Percent of shipping weight not containerized: A 3 position field representing the percentage of shipping weight of the merchandise reported as not containerized (See Containerization, Appendix B-db)

These percent containerized fields are used to divide a shipment's record of weight and value into containerized or non-containerized traffic.

A number of Waterborne Databank shipment records have all four of the percentage fields equal to 0. This condition precludes separating the shipment record into containerized or non-containerized traffic. The Army Corps of Engineers indicates these values are missing non-zero information because of nonresponsive reporting.

An analysis of the 1990-2005 databank of the number of these records is shown in Table A2.

Table A2 Number and Percent of All Shipments with a 0 value for Percentage Fields

Year	Number of Shipments	Shipments with all Percentage Values = 0	Percent of All Shipments with all Percentage Values = 0
1990	1,012,874	112,266	11.1
1991	1,069,200	126,407	11.8
1992	1,064,855	81,981	7.7
1993	1,124,502	78,462	7.0
1994	1,160,688	138,675	11.9
1995	1,211,785	87,822	7.2
1996	1,401,449	155,909	11.1
1997	1,444,172	94,721	6.6
1998	1,599,980	53,822	3.4
1999	1,352,430	28,380	2.1
2000	1,307,134	15,959	1.2
2001	1,342,772	5,308	0.4
2002	1,378,733	8,067	0.6
2003	1,522,157	7,755	0.5
2004	1,589,518	7,406	0.5
2005	1,729,473	138,387	8.0

The analysis detailed in the table shows that shipment records having 0 values for all four percentage fields range from .5% to 11.9 % of shipment records.

The Army Corps of Engineers acknowledges the presence of these zero percentage records and advises extrapolating usable percentages for these records from shipment records with non-zero values for the four percentage fields.

For this study, an annual mean percentage for these percentage categories is developed from all annual shipment records with non-zero values. These annual mean percentages are substituted into those records missing these values. The mean values are developed and stratified at the six-digit Harmonized System Commodity Classification code level. In a very few cases, the mean percentage values substituted into the four percentage fields with zero values, are calculated from all annual shipments as a whole.

Percentage Fields Not Equaling 100 Percent

The four percentage fields described in Table A2 divide a shipment's weight and value into containerized and non-containerized traffic characteristics. As such, these percentages, taken together, must equal 100%. However, a number of shipment records have percentage values that do not equal 100% when added together. This condition prevents an accurate analysis of aggregated shipment statistics. In particular, using percent splits between container and non-container data records that do not equal 100%, result in erroneous summations and ratios.

Table A3 illustrates the actual percentages in the 2005 Waterborne Databank aggregated to national totals.

Table A3 2005 Waterborne Databank National Percentages

Data Category	Percent of Category	Total Category Percent
Imported Tons Containerized	16.2	97.9
Imported Tons Non-Containerized	81.7	
Exported Tons Containerized	29	93.7
Exported Tons Non-Containerized	64.7	
Imported Dollars Containerized	58.9	93.5
Imported Dollars Non-Containerized	34.6	
Exported Dollars Containerized	65.7	91.4
Exported Dollars Non-Containerized	25.7	

As shown in the table, using these percentages together results in undercounting within the container and non-container categories when compared to not stratifying shipment records and statistics by these percentage fields. Within this context, to avoid undercounting, the containerized percent shipped is assigned the value in the percentage field from the Waterborne Databank and the non-containerized percent shipped is assigned the difference of 100% minus the containerized percentage.

Further, the documentation of the Waterborne Databank contained this explanation of containerized and non-containerized percentages in Appendix B:

Explanation of Containerization

The values for the PERCENT_VAL_CONT, PERCENT_SWT_CONT, PERCENT_VAL_NON_CT, and PERCENT_SWT_NON_CT fields are calculated during the summarization of the detail files. Percent value or weight containerized is the percentage of value or weight of the one or more detail records that are marked as containerized and are summarized to make only one waterborne databank record. Likewise, Percent value or weight *not* containerized is the percentage of value or weight of the one or more detail records that were *not* marked as containerized and were summarized to make only one Waterborne Databank record. Note that records not marked as containerized or not containerized are summarized along with those that are marked. This can result in percentages not adding to 100% when adding the percent containerized and percent not containerized fields in the same record.

The container indicator is based on information supplied by the importer, forwarder, shipper or exporter at the time the import or export record is filed. Container indicators are adjusted by WCSC based on the associated commodity and/or ship type supplied in the record.

APPENDIX B. TVA-STB DATA SET COMPARATIVE ANALYSIS

This appendix provides a brief comparison of the data reported in the STB data set to comparable data reported by the AAR and IANA. Results are summarized briefly.

The results show that trailer and container shipments as reported by the AAR are less than that reported by IANA, and each is less than those reported in the STB data set.

Table B1 AAR Container and Trailer Traffic 1995-2004

Year	Trailers & Containers	Trailers	Containers
1995	7,936,172	3,492,463	4,443,709
1996	8,143,258	3,302,128	4,841,130
1997	8,698,308	3,453,907	5,244,401
1998	8,772,663	3,353,032	5,419,631
1999	8,907,626	3,207,407	5,700,219
2000	9,176,890	2,888,630	6,288,260
2001	8,935,444	2,603,423	6,332,021
2002	9,312,360	2,531,338	6,781,022
2003	9,955,605	2,625,837	7,329,768
2004	10,993,662	2,928,123	8,065,539

Source: Railroad Facts, AAR

The AAR reports container and trailer traffic for Class I railroads but does not include several smaller railroads in its total. For example, beginning in 1995, data is not reported for two Class I railroads, GTW and SOO. Additional smaller railroad's data is not reported in subsequent years.

Table B2 IANA Container and Trailer Traffic 2001-2005

Year	Trailers & Containers	Trailers	Containers
2001	10,335,146	2,413,933	7,921,213
2002	10,934,330	2,345,508	8,588,822
2003	11,896,925	2,424,407	9,472,518
2004	12,923,036	2,639,545	10,283,491
2005	13,641,872	2,584,262	11,057,610

Source: IANA, www.intermodal.org/statistics_files/stats1.shtml

IANA uses the AAR published figures for the earlier years reported on its web site. Since 2001, IANA develops and reports its own figures, which do not have the AAR data exclusions noted above.

Table B3 TVA - STB Container and Trailer Traffic 1995-2005

Year	Trailers & Containers	Trailers	Containers
1995	8,694,942	2,793,468	5,901,474
1996	8,874,949	2,811,086	6,063,863
1997	9,305,869	2,942,908	6,362,961
1998	9,588,311	2,875,853	6,712,458
1999	10,333,140	2,923,768	7,409,372
2000	11,203,160	2,677,600	8,525,560
2001	10,973,060	2,316,840	8,656,220
2002	11,495,834	2,177,424	9,318,410
2003	12,627,527	2,202,456	10,425,071
2004	13,245,752	2,375,600	10,870,152
2005	14,499,784	2,820,660	11,679,124

Source: TVA, STB

The railroad container and trailer data set used in this report was developed by the Tennessee Valley Authority (TVA) from the Surface Transportation Board (STB) Carload Waybill sample. This data set is conceptually very similar to the IANA reported container and trailer traffic volumes. Table B4 and B5 show the comparisons between the IANA and the TVA-STB data sets. The close comparison validated the use of the TVA-STB data set.

Table B4 TVA-STB Container and Trailer Traffic without Canadian Originations and Terminations, 1995-2005

Year	Trailers & Containers	Trailers	Containers
1995	5,532,879	2,020,072	3,512,807
1996	8,667,669	2,785,926	5,881,743
1997	9,056,509	2,911,068	6,145,441
1998	9,364,531	2,853,753	6,510,778
1999	10,106,400	2,902,008	7,204,392
2000	10,819,180	2,637,120	8,182,060
2001	10,423,680	2,253,540	8,170,140
2002	10,886,966	2,123,224	8,763,742
2003	11,606,967	2,134,816	9,472,151
2004	12,674,012	2,349,400	10,324,612
2005	13,947,784	2,800,740	11,147,044

Source: TVA, STB

Table B5 Comparison between TVA-STB Container and Trailer Traffic without Canadian Originations and Terminations and IANA reported traffic, 1995-2005

Year	Trailers & Containers Percent Difference	Trailers Percent Difference	Containers Percent Difference
2001	1	-7	3
2002	0	-10	2
2003	-2	-14	0
2004	-2	-12	0
2005	2	8	1

Source: TVA, STB, IANA