PLAQUEMINES PORT | OCTOBER 2023

HARBOR & TERMINAL DISTRICT

Plaquemines Port Comprehensive Market Study

PREPARED FOR:

Plaquemines Port Harbor and Terminal District (PPHTD)

PREPARED BY:

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The Bridges Group International LLC

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1. Introduction

Louisiana's port system is a vital element of the state and national economy, serving as a gateway for domestic and international commerce and America's trade battleground—the multimodal corridor connecting Canada, the U.S. Midwest, and Mexico. Most significantly, the two largest marine highways in the U.S., the Mississippi River System and the Gulf Intracoastal Waterway (GIWW), meet in Louisiana at the mouth of the Mississippi (e.g. The Mississippi River intersection with the Gulf of Mexico connects the heart of the U.S. to global commerce).

The Plaquemines Port Harbor and Terminal District (PPHTD) is a vital maritime hub located in Louisiana, at the mouth of the Mississippi River, serving as a major gateway for international trade and commerce. PPHTD encompasses 1,691.8 acres, from which 548 acres are developed, and provide a variety of facilities to accommodate various cargo types. With 14 major anchorages and 81 miles of deep draft of at least 50 ft, PPHTD allows large vessels navigation, making it an ideal location for imports and exports, providing water access to more than 20 states. These states benefit from access to freight by barge, a greener and more efficient mode.

The port has specialized cargo-handling infrastructure and berths capable of handling agribulk, breakbulk, drybulk, liquid-bulk, project cargo, and container vessels. In addition to cargo handling, PPHTD plays an important role in servicing the offshore oil and gas industry. It provides considerable support services and infrastructure for offshore drilling, as well as a supply base for equipment, employees, and resources. Overall, the port is a vital engine of regional economic growth and employment, contributing to the local economy through trade and service sectors, while placing a high value on environmental sustainability.

For several years, private commercial entities have approached PPHTD regarding the potential development of port facilities to handle multiple cargo types and commodities. In support of these efforts, PPHTD needs to assess potential markets and ultimately determine the degree of feasibility of any capacity expansions. Hence, it is critical to understand and document aspects such as master planning, multimodal connectivity, potential users, and expected levels of demand. Hence, it is critical for PPHTD and project stakeholders to have an analytical framework that allows them to quantify potential demand levels that could realistically be attracted by PPHTD.

1.1 Objective

The objective of this study is to develop a comprehensive analytical framework that would allow PPHTD to examine national, regional, state, and local conditions for cargo industry needs and projections for each of the major cargo types handled, such as:

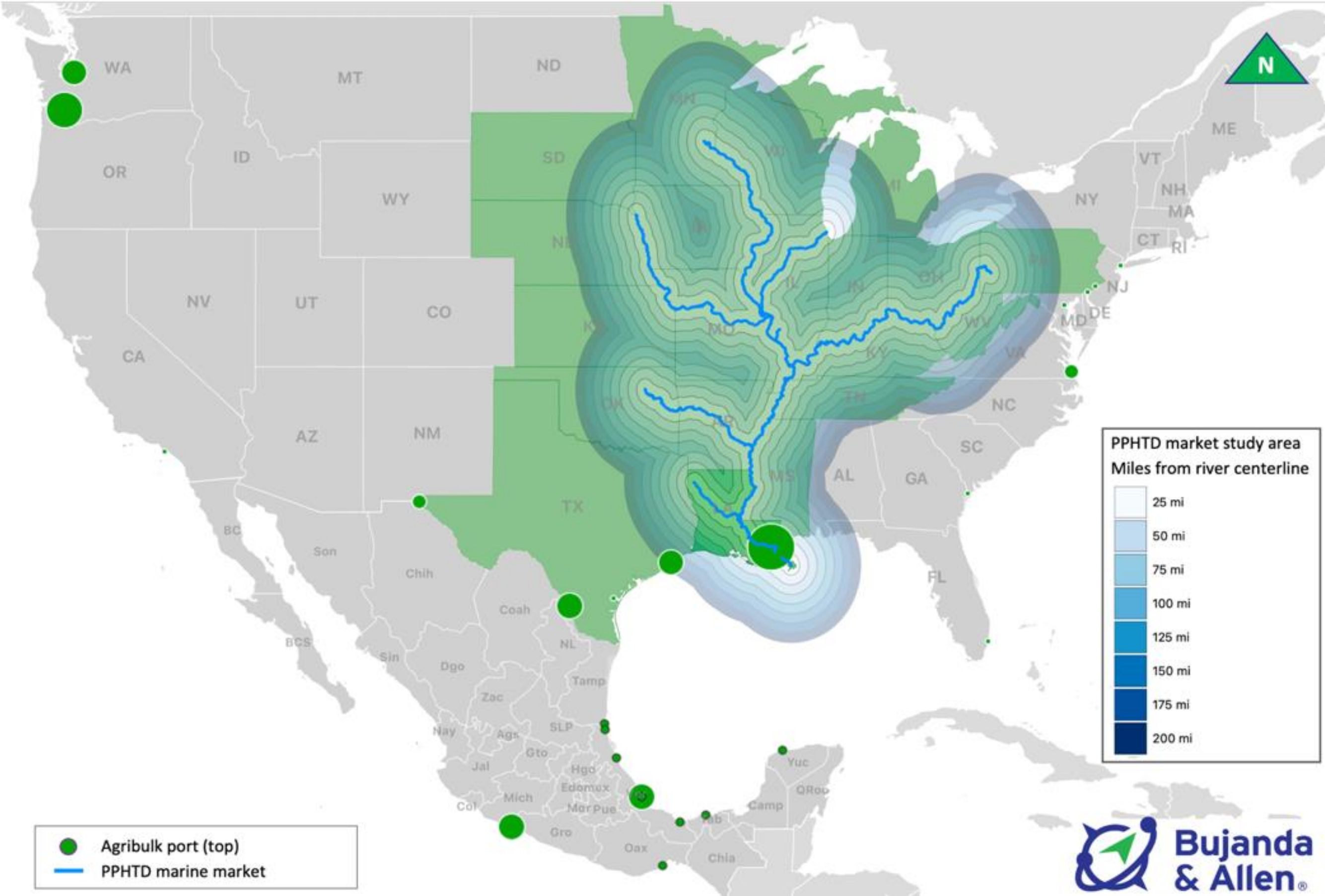
- Containerized freight
- Agribulk
- Breakbulk
- Drybulk
- Liquid-bulk
- Project cargo

This study also includes a competitive analysis of existing port assets in the proposed study area. Furthermore, such analytical framework aims to develop short- and long-term forecasts for non-containerized and containerized freight. These forecasts will help PPHTD identify key strategies that will guide port development based on solid business cases that would make sense to potential investors.

1.2 Study area

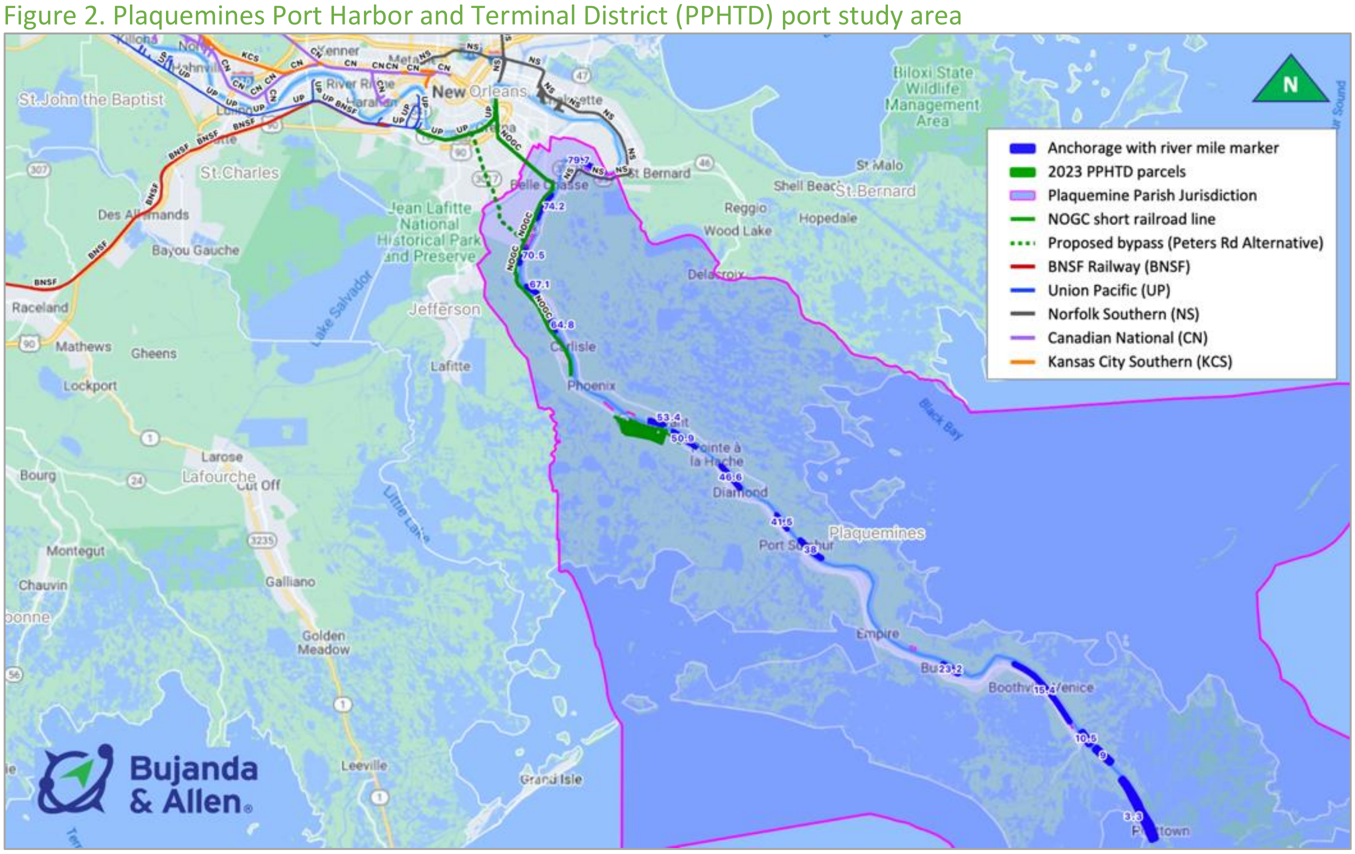
The market study area comprises a 200-mile buffer around the Mississippi River and its main tributary marine highways. This buffer is considered the starting point to evaluate draw areas for potential freight flows entering or exiting through the mouth of the Mississippi River and PPHTD. Our market study area is shown in Figure 1.

Figure 1. Plaquemines Port Harbor and Terminal District (PPHTD) market study area



Source: Bujanda & Allen, 2023.

Figure 2. Plaquemines Port Harbor and Terminal District (PPHTD) port study area



Source: Bujanda & Allen, 2023.

1.3 Report structure

This report is the public version of the study and it is structured in eight sections including this one:

- **Section 1. Introduction** presents the project background, objectives, study area, and report structure**.**
- **Section 2. Freight network serving the Plaquemines Parish Port** provides an overview of the highways, railroads, and waterways utilized for the movement of freight.
- **Section 3. Market analysis** presents an overview of the macroeconomic environment and its impact on freight markets, industries contributing to freight movement in the Plaquemines Parish Port, and analyzes the commodities with greater potential in the short- and long-terms.[1]
- **Section 4. Competitive analysis** presents an analysis of the Plaquemines Parish Port infrastructure and its competitive position; furthermore, it analyses the most recent trends in container shipping.
- **Section 5. Trends in the container shipping industry** analyzes specific developments in the container shipping alliances, as well as recent changes and development of vessel sizes for the largest deep-sea trades. This section also evaluates the major implications for PPTHD competitiveness, in terms of vessels presently and potentially calling PPTHD.
- **Section 6. Route economics and key target markets** presents an analysis of the main target markets for the project and compares key incumbent routes against new, alternatives using the Plaquemines Parish Port, first, for non-containerized and, second, for containerized ones.
- **Section 7. Long-term cargo forecast** presents the results of our econometric models for the commodity groups with the greater potential to be attracted by the port, first, for non-containerized and, second, for containerized ones.
- **Section 8. Conclusions** extracts and document the key takeaways from the overall study.

[1] Throughout the report, "U.S." tons (tons) and metric tons (tonnes) are used. When metric tons (MT) are used, the word "metric" or the abbreviation MT are explicitly included. If omitted, then we are referring to "U.S. tons".

2. Freight network serving the Plaquemines Port

This section presents the state network serving freight movement in the study region, as well as an assessment of PPHTD's connection and accessibility to the freight system in the study area. This section describes the major roadways and Class I railroads used for freight transportation. The section closes with an examination of public and private ports, marine terminals, and docks that facilitate freight transit along waterways.

2.1 Freight networks

The Louisiana Department of Transportation & Development (DOTD) defined the freight network in 2018. This network includes ports, airports, pipelines, intermodal facilities, highways, and rail infrastructure. To be considered in the freight prioritization process for funding, a proposed project must be situated on or near the established freight network. The project and its study area are part of the state's freight network, enjoying access to highways, railroads, and ports at the intersection of two of the most important marine highways in the nation, the Mississippi River (M-35; M-55), and the Gulf Intercoastal Waterway (M-10), as illustrated in Figure 3.

Figure 3. Louisiana's Freight Network System

Source: DOTD 2018 Freight Mobility Plan.

In 2021, Louisiana's freight network system carried more than 1.828 billion tons.[2] Of this cargo, pipelines carried 35% of the total weight of goods moving on the state's transportation system. Trucks rank next, accounting for 28% of goods moved by weight; water for 25%; rail for 9%; and air for less than 3%. By 2050, Louisiana's freight network is projected to carry more than 2.920 billion tons of freight—an increase of nearly 60%.

2.2 Pipelines

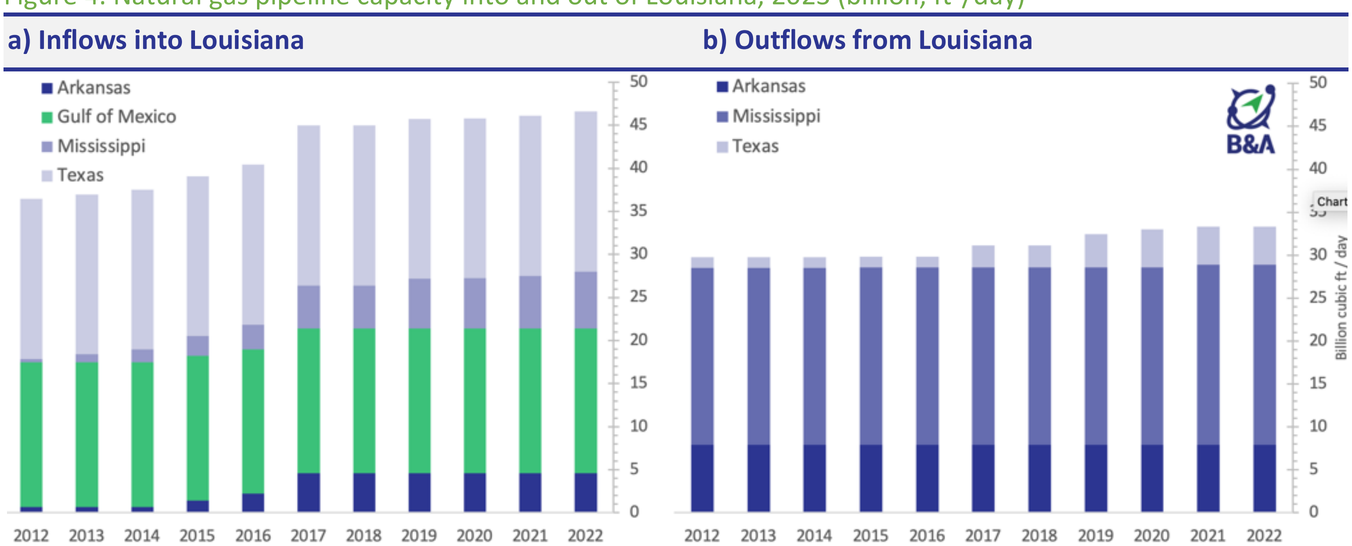
Pipeline is the most prominent mode by weight for moving freight on Louisiana's transportation system. The state is home to a network of nearly 50,000 miles of pipelines, exhibiting its prominent role in the oil and gas industries domestically and internationally. The 19 parishes on or near the Gulf of Mexico, the closest to the main oil and gas production zones, have the most pipeline mileage.[3]

2.2.1 Natural gas

In 2022, Louisiana ranked 3rd in natural gas production in the U.S. with 4,025,154 million cubic feet (MMcf) of gross withdrawals. Louisiana's balance of trade for natural gas was 58% deliveries and 42% receipts in 2021. Deliveries were 5,512,014 MMcf, from which 67% were destined to domestic markets (i.e. Mississippi, Arkansas, and Texas) and 33% to international markets (i.e. Korea, Japan, and China). Receipts were 3,937,408 MMcf, all domestic, from which 46% originated in Texas, 27% in Mississippi, 14% in Arkansas, and other states.

Natural gas is transported primarily by pipeline. Natural gas pipeline capacity data show that most of the natural gas capacity through Louisiana pipelines enters the state from the Gulf of Mexico, passing through and leaving through Arkansas, Texas, and Mississippi. There are three liquid natural gas (LNG) import locations in Louisiana: Lake Charles, Energy Bridge, and Sabine Pass. The three pipelines importing the LNG to these locations have a capacity of 5,200 MMcf per day. Natural gas pipeline capacity into and out of Louisiana is shown in Figure 4.

Figure 4. Natural gas pipeline capacity into and out of Louisiana, 2023 (billion, ft^3/day)

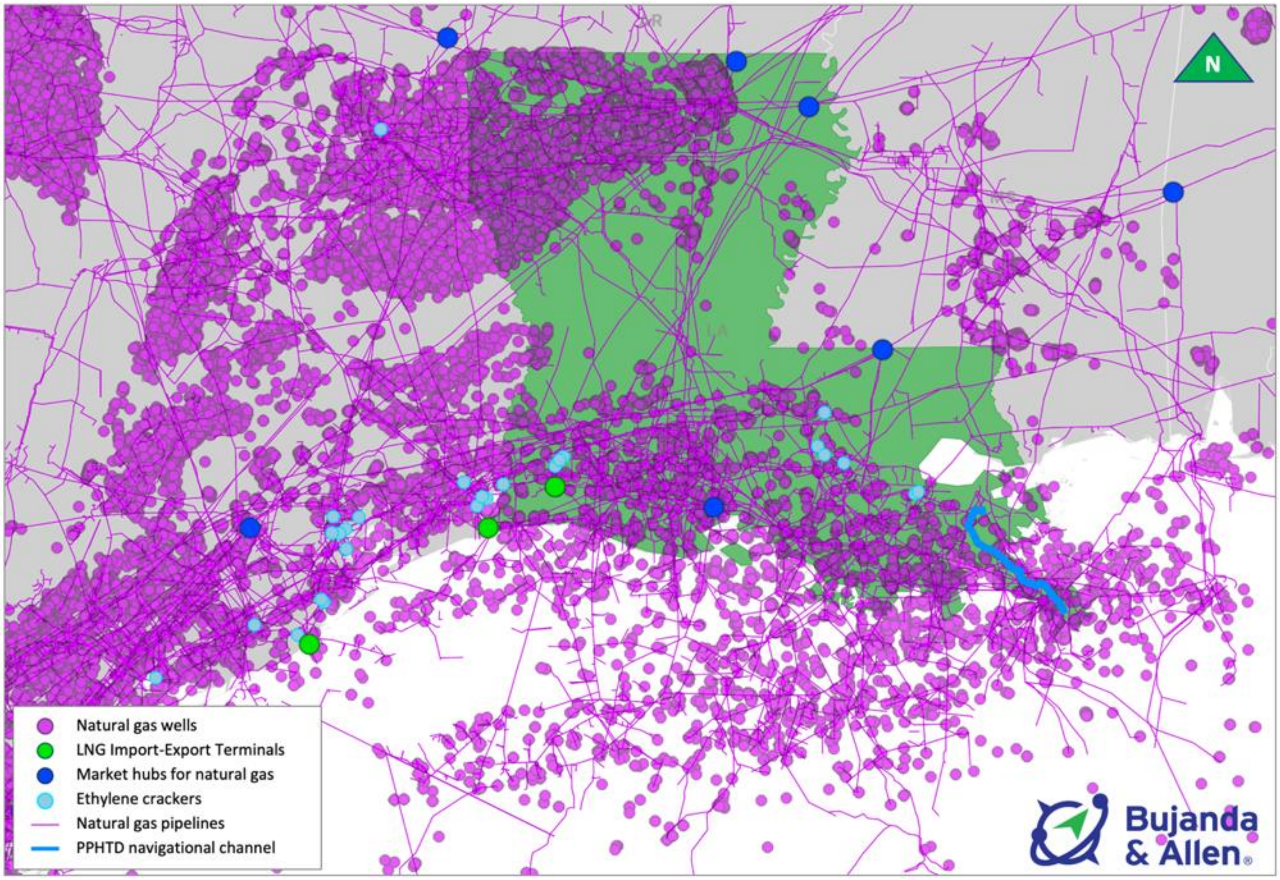


Source: Bujanda & Allen with EIA data, 2023.

The location of natural gas pipelines in Louisiana and near PPHTD port study area are shown in Figure 5 and Figure 6, respectively. Company information for each pipeline operator in the state is available upon request.

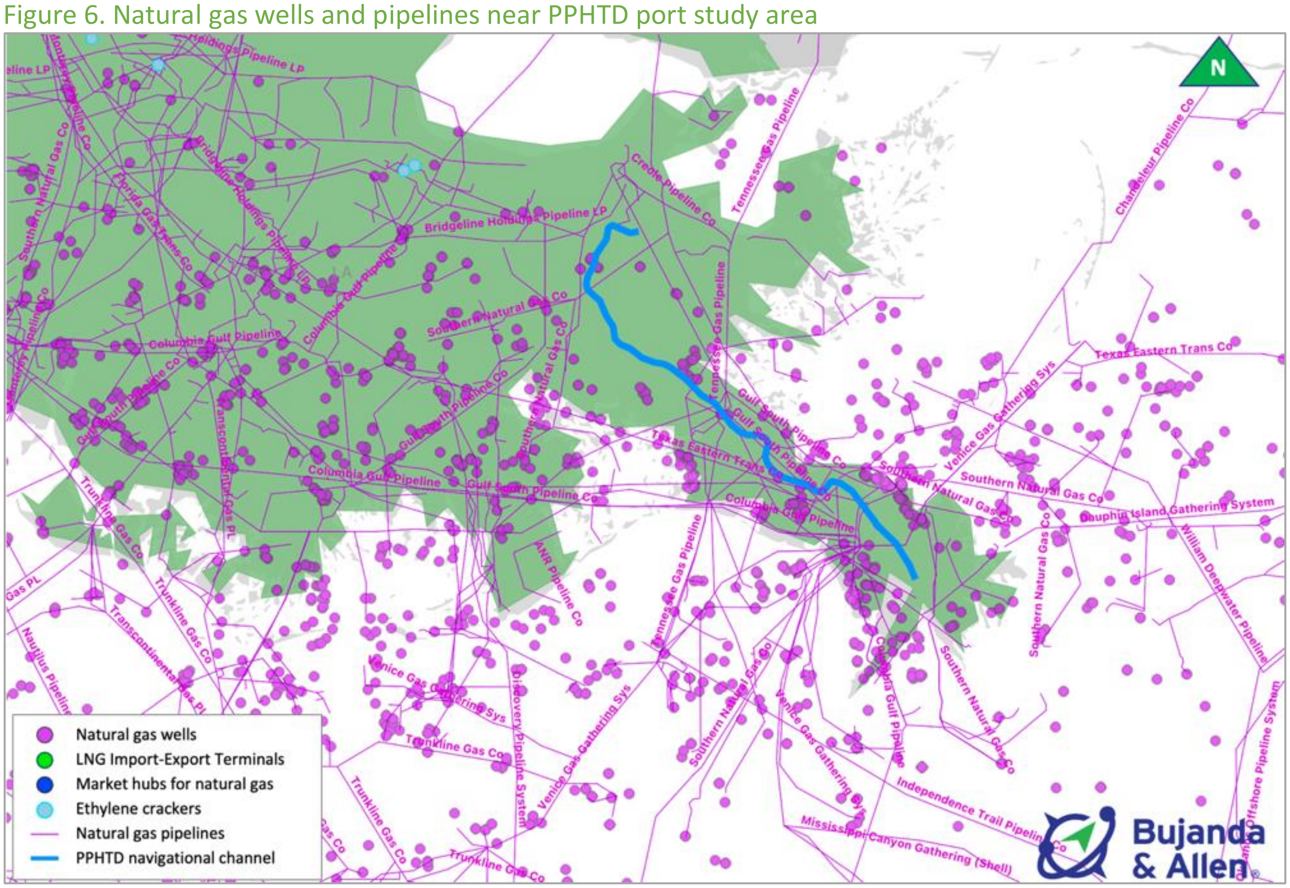
[2] Freight Analysis Framework 5 (FAF5), FHWA, July 6, 2023.
[3] Louisiana Department of Natural Resources (DNR), July 10, 2023.

Figure 5. Natural gas wells and pipelines in Louisiana



Source: Bujanda & Allen, 2023.

Figure 6. Natural gas wells and pipelines near PPHTD port study area

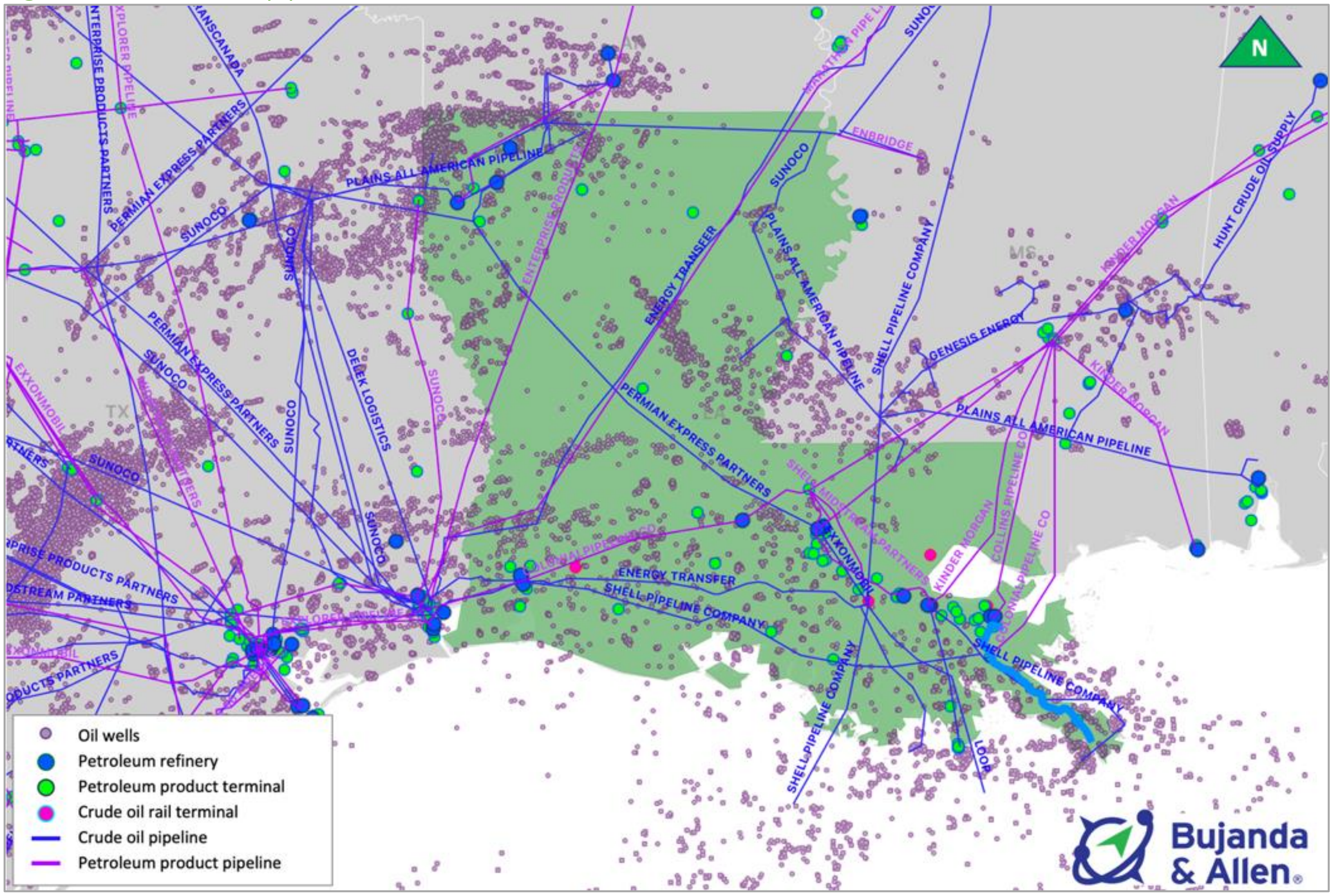


Source: Bujanda & Allen, 2023.

2.2.2 Oil and petroleum products

In 2021, Louisiana ranked 9th in crude oil production in the U.S. with over 34 million barrels produced. More than 623 million barrels, about 15.2% of U.S. crude oil, were produced from wells located offshore in the U.S. federally administered waters of the Gulf of Mexico. In terms of refinery capacity, Louisiana was second only to Texas in 2021 with 15 operating refineries. These refineries serve mainly offshore production, which is 95% of the State's refined production. The oil and liquid product pipelines, as well as the refineries, product terminals, and crude rail terminals in Louisiana, are shown in Figure 7.

Figure 7. Oil wells and pipelines in Louisiana



Source: Bujanda & Allen, 2023.

The Louisiana Offshore Oil Port (LOOP) is the only port in the U.S. that can discharge deep-draft tankers. The port features three offshore locations where oil tankers can discharge, as well as an onshore marine terminal (Clovelly) that is 25 miles inland. Clovelly is used as a temporary holding area for crude transported by pipelines on the Gulf Coast to refineries in Texas and in the U.S. Midwest.

2.3 Highways

Highways are the next most prominent mode by weight for moving freight on Louisiana's transportation system, connecting key industrial and commercial areas, ports, distribution centers, and other logistic hubs. I-49, I-55, and I-59 offer north-south truck freight movements. I-10, I-12, and I-20 provide east-west movement for trucks. Other important freight corridors are US-84 between Natchitoches and Winnfield and US-190 between Baton Rouge and Opelousas.

Truck delays are most critical around urbanized areas and on the Interstate system, with I-10 and I-12 experiencing higher levels because they carry the highest volumes, particularly near Baton Rouge and New Orleans urban footprints. Other corridors in the study area with high delays are LA 1 (City of Plaquemine to Port

Allen), US-90 Business (I-10 to Mississippi River), and US-61 (US-190 to I-12). Louisiana's cargo flows by highway and the segments with high delays are shown in Figure 8.

Figure 8. Louisiana cargo flows by highway

Source: DOTD, 2018.

2.4 Waterways and ports

PPHTD serves as a key gateway for domestic and international commerce and America's trade battlefield—the multimodal corridor connecting Canada, the U.S. Midwest, and Mexico. The country's two largest waterways, the Mississippi River System and the GIWW, meet at one terminus of PPHTD's navigational channel. Hence, PPHTD's market study area covers a 200-mile buffer around the Mississippi River and its tributary marine highways across 20 states. This is used to evaluate draw areas for potential freight flows entering or exiting through the mouth of the Mississippi and PPHTD. This section presents a comprehensive analysis of the marine highways, port authorities, river terminals, and docks within PPHTD's market study area.

2.4.1 Marine highways

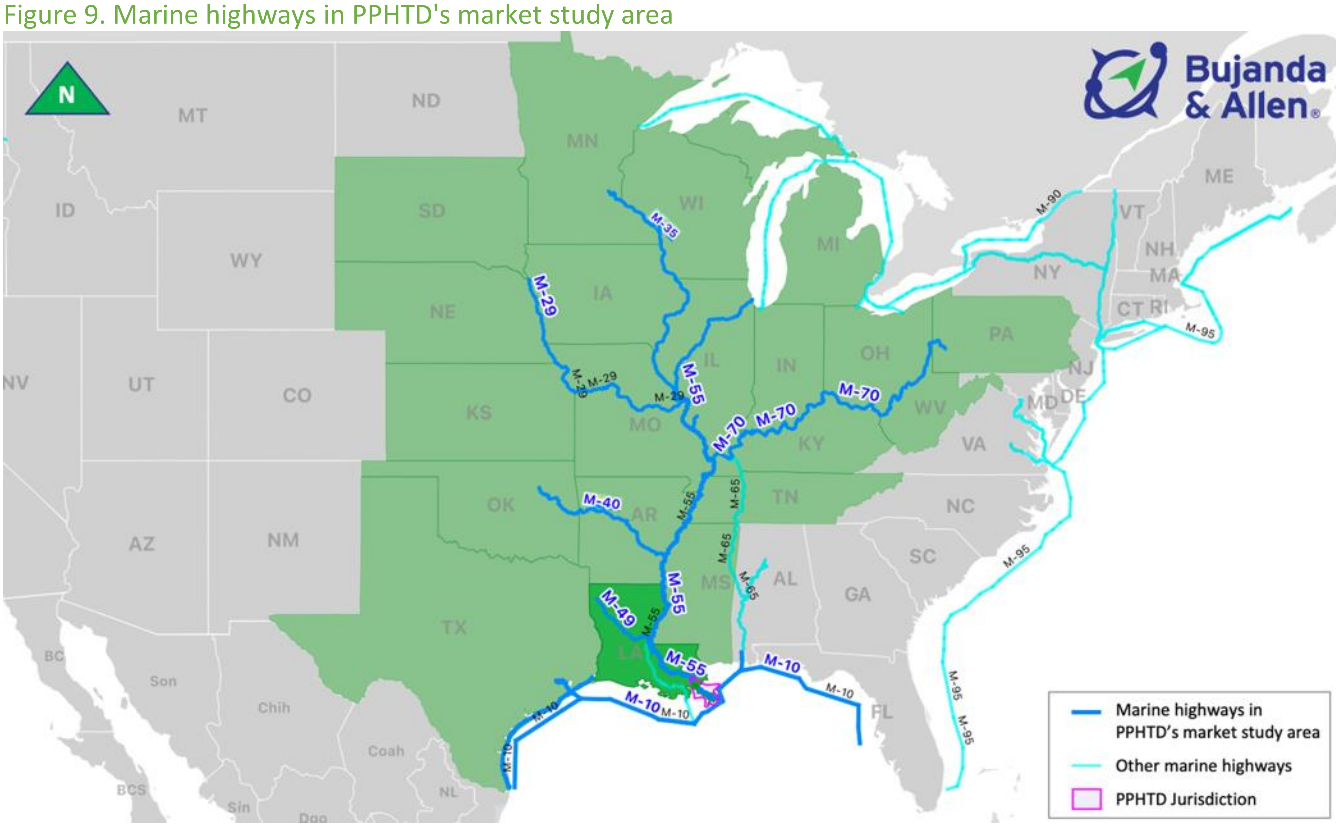
With the intention of shifting cargo from trucks into the more environmentally friendly water mode, the U.S. Department of Transportation (USDOT) designated several marine highways in 2009. Marine highways can receive federal assistance from the Maritime Administration (MARAD). There are six designated marine highways in PPHTD's market study area, with their limits and characteristics described in Table 1.

Table 1. Designated Marine Highways in PPHTD's market study area.

Waterway	Marine highway	From	To	River miles
Upper Mississippi River	M-35	Minneapolis, MN	St. Louis, MO	691
Missouri River	M-29	Kansas City, MO	St. Louis, MO	2,341
Illinois River	M-55	Chicago, IL	St. Louis, MO	273
Ohio River	M-70	Pittsburg, PA	Cairo, IL	980
McClellan-Kerr-Arkansas River	M-40	Catoosa, Ok	Napoleon, AR	444
Red River	M-49	Shreveport, LA	Morgan City, LA	229
Mississippi River	M-55	St. Louis, MO	Plaquemines, LA	1,134

Source: Bujanda & Allen with information from MARAD and the USACE, 2022.

Figure 9. Marine highways in PPHTD's market study area



Source: Bujanda & Allen, 2023.

M-49 covers approximately 229 miles of the Red River from the J. Bennett Johnston Waterway, near Shreveport, Louisiana, to the vicinity of Mobile City, LA, crossing through the Central Louisiana Regional Port in Alexandria and near Pineville, LA. In 4Q22, Maersk entered a Letter of Intent with SunGas Renewables, a division of GTI Energy. SunGas announced a potential $1.8 billion investment to establish low-carbon methanol production near Pineville, LA. The company projects its Pineville facility to manufacture nearly 400,000 metric tons.

2.4.2 Inland ports and terminals

Public port authorities

Minnesota has four port authorities on the Mississippi River: St. Paul, Red Wing, Winona, and Savage, and four more on Lake Superior: Duluth-Superior, Two Harbors, Silver Bay Harbor, and Taconite Harbor. *Wisconsin* has two, the Port of La Crosse and the port Prairie du Chien. *Iowa* currently has only one port authority, the Southeast Iowa Regional Economic & Port Authority (SIREPA) made up of Lee County and the cities of Fort Madison and Keokuk.[4] *Missouri* has 15 public port authorities, as of early 2021, classified as active or developing according to their 2022 Freight Plan; four of them in the Mississippi River. *Illinois* has seven port districts along the Mississippi and seven along the Illinois River (from 19 districts). *Indiana* has three ports in Evansville, Jeffersonville, and Mount Vernon. *Kentucky* has the Louisville and Owensboro riverport authorities. The port authorities and districts in the study area are in Table 2.

Table 2. Public port authorities and districts along the Mississippi, Illinois, Ohio, and Missouri rivers.

RM*	ST	Bank	Name	Main cargo	Rail
Mississippi River					
866	MN	East	St Paul Port Authority	Agribulk	BNSF and UP
855	MN	South	Savage	Agribulk	BNSF and UP
790	MN	South	Red Wing	Agribulk	BNSF
727	MN	West	Winona	Agribulk	BNSF and CN
697	WI	East	La Crosse	Liquid-bulk	BNSF
585	IL	East	Upper Mississippi River International	Agribulk	BNSF and CN
420	IL	East	Mid-America Intermodal	Agribulk	BNSF, KCS, NS. KJRY, BJRY.
382	IA	East	SE Iowa Regional Economic Port Authority	Drybulk	BNSF
350	MO	West	Lewis County Port Authority	Agribulk	BNSF
326	MO	West	Marion County Port Authority	n.a.	BNSF, NS
294	MO	West	Pike/Lincoln Port Authority	n.a.	BNSF
190	IL	East	Americas Central	Agribulk	UP, NS, KCS, BNSF, CN, CSXT. TRRA, PHRR.
185	IL	East	Southwest Regional	Agribulk	KCS, NS, UP, CSXT. TRRA.
182	MO	West	St. Louis Port Authority	Liquid-bulk	UP, NS, KCS, BNSF, CN, CSXT. TRRA, PHRR.
Illinois River					
225	IL	Both	Illinois Valley Regional Port District	Liquid-bulk	BNSF and NS
160	IL	Both	Heart of Illinois Regional Port District	Agribulk	UP, CN, BNSF, NS. TPW, TZPR, KJRY, IMRR, and IAIS.
116	IL	East	Havana Regional Port District	Drybulk	IMRR
0-85	IL	East	Mid-America Intermodal Port District	Agribulk	BNSF, KCS, NS, KJRY, BJRY.
Ohio River					
835	IN	North	Mount Vernon	Drybulk	EVWR, NS, CSXT, UP, CN, BNSF
790	IN	North	Evansville	Drybulk	EVWR, NS, CSXT, UP, CN, BNSF
755	KY	South	Owensboro Riverport Authority	Liquid-bulk	NS, CSXT
605	KY	North	Louisville	Drybulk	NS, CSXT, LIRC
602	IN	North	Jeffersonville	Agribulk	NS, CSXT, MGRI
490	KY	South	Northern Kentucky	Liquid-bulk	NS, CSXT, PAL
490	OH	North	Cincinnati	Drybulk	NS, CSXT, IORY
320	WV	South	Huntington-Tristate	Drybulk	NS, CSXT
0	PA	Both	Pittsburgh	Drybulk	NS, CSXT, CN
Missouri River (planned)					
190	MO	South	Howard Cooper County Port Authority	Agribulk	UP
135	MO	South	Heartland Port Authority	Agribulk	UP

Source: Bujanda & Allen, 2023. *River miles (RM) are used for each river, as defined by the USACE.

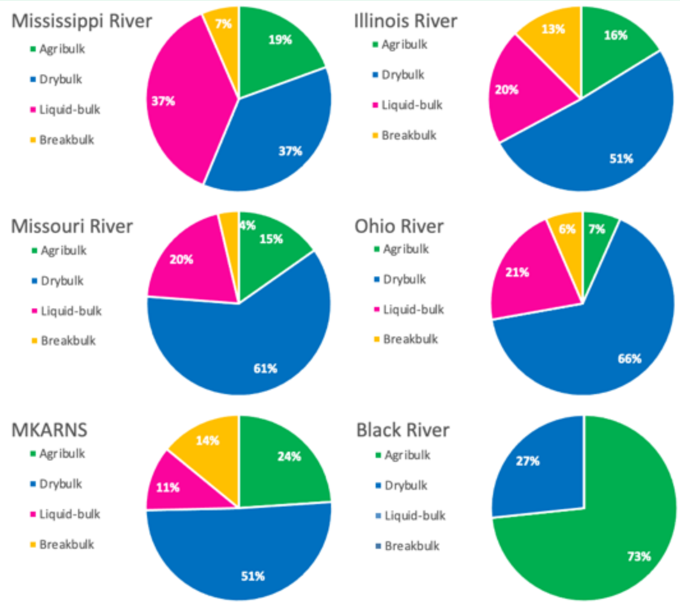
[4] River Barge Directory, Iowa DOT, 2011, https://iowadot.gov/pdf_files/river_barge_directory.pdf

2.4.3 Shallow-draft river terminals and docks

Bujanda & Allen identified 3,035 river terminals and cargo docks within PPHTD's market study area, from which 1,717 are inland and 1,318 are in the GIWW. From the 1,717 inland, 581 are in the Mississippi River, 271 in the Illinois River, 164 in the Missouri River, 615 in the Ohio River, 71 in the McClellan-Kerr Arkansas River Navigation System (MKARNS), and 15 in the Black River. We also identified that 52.1% of the 1,717 inland river terminals and docks handle drybulk as their primary cargo, 25.8% liquid-bulk, 14.6% agribulk, and 7.5% breakbulk. The breakdown of each terminal by cargo type, river, and state is illustrated in Table 3. The location of each river terminals and docks within the study area are illustrated in Figure 10.

Table 3. Shallow-draft river terminals and docks within PPHTD's market study area.

Terminals by river and state	Agribulk	Drybulk	Liquid-bulk	Breakbulk	Total
Mississippi River					
Upper Mississippi River	53	143	34	9	**239**
Lower Mississippi River	60	71	182	29	**342**
Total Mississippi River	**113**	**214**	**216**	**38**	**581**
Illinois River					
Total Illinois River	**44**	**138**	**55**	**34**	**271**
Missouri River					
Upper Missouri River	1	8	1	3	13
Lower Missouri River	24	92	32	3	151
Total Missouri River	**25**	**100**	**33**	**6**	**164**
Ohio River					
Total Ohio River	**41**	**403**	**131**	**40**	**615**
McClellan-Kerr Arkansas River Navigation System (MKARNS)					
Total MKARNS	**17**	**36**	**8**	**10**	**71**
Black River					
Total Black River	**11**	**4**	**0**	**0**	**15**
TOTAL	**251**	**895**	**443**	**128**	**1717**
% by cargo type	14.6%	52.1%	25.8%	7.5%	100.0%



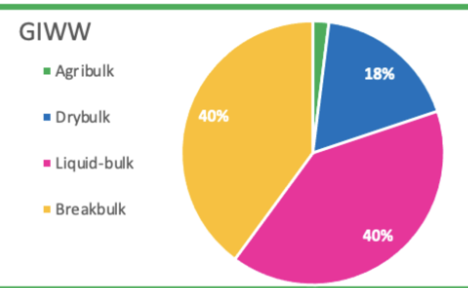
Source: Bujanda & Allen,2023.

2.4.4 Coastal terminals and docks

From the 1,318 in the GIWW, 604 are in Texas, 410, in Louisiana, 46 in Mississippi, 123 in Alabama, and 135 in Florida. We also identified that 40.2% of the GIWW terminals handle liquid-bulk as their primary cargo, followed by 39.9% breakbulk, 17.9% drybulk, and only 2% agribulk. The breakdown of each terminal by cargo type and state is illustrated in Table 4.

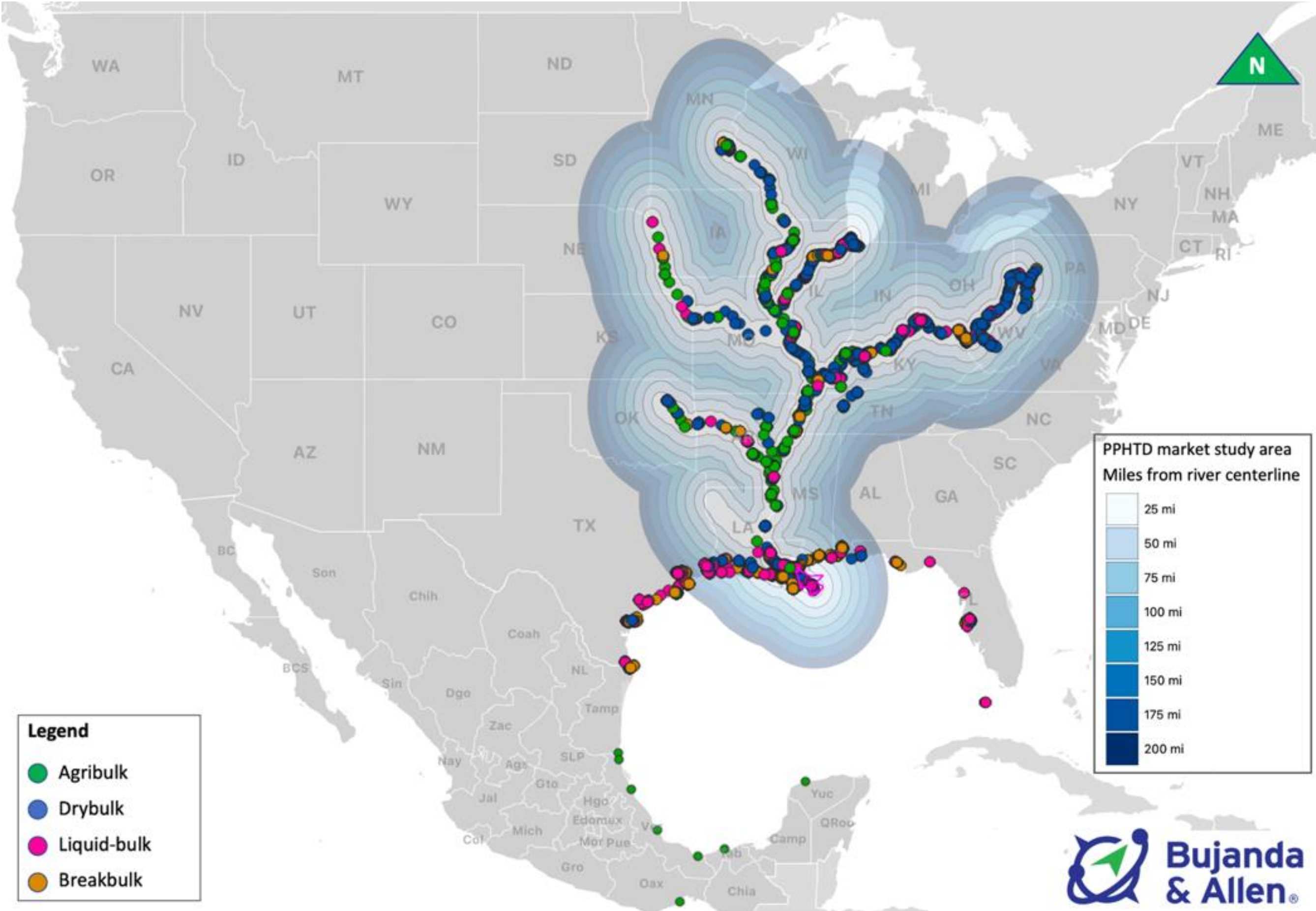
Table 4. Shallow-draft river terminals and docks in the Gulf Intercoastal Waterway (GIWW).

GIWW terminals by state	Agribulk	Drybulk	Liquid-bulk	Breakbulk	Total
Texas	16	92	343	153	**604**
Louisiana	3	65	107	235	**410**
Mississippi	1	12	9	24	**46**
Alabama	3	32	24	64	**123**
Florida	3	35	47	50	**135**
Total	**26**	**236**	**530**	**526**	**1318**
% by cargo type	2.0%	17.9%	40.2%	39.9%	100.0%



Source: Bujanda & Allen, 2023.

Figure 10. River terminals and docks on the Mississippi, Illinois, and Missouri rivers in the market study area



Source: Bujanda & Allen, 2023.

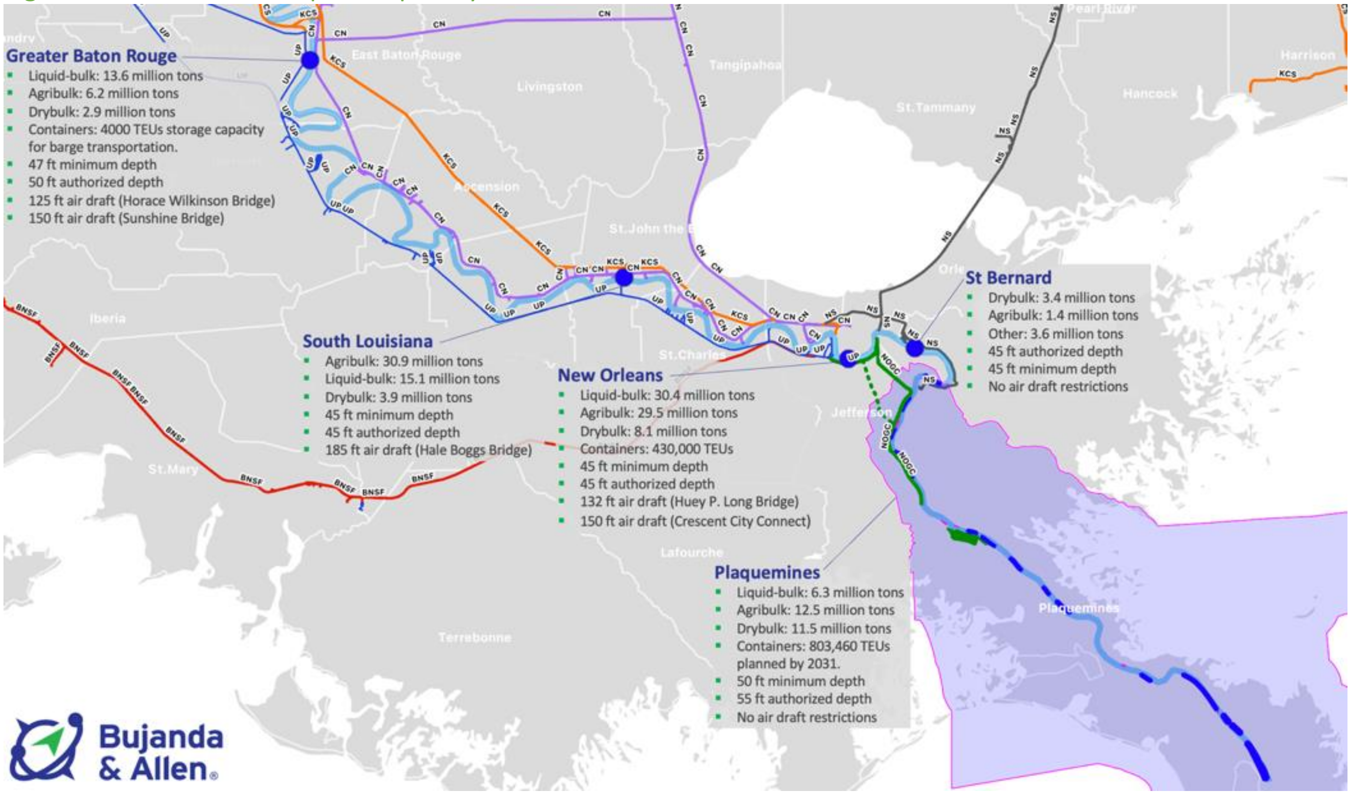
2.4.5 Deep-draft ports

Louisiana has seven deep-draft ports. In terms of tonnage, the five deep-draft public ports, along the Mississippi River segment from Baton Rouge to Head of Passes, rank among the biggest in the country. The Calcasieu Ship Channel is home to the sixth deep-draft port (outside PPHTD's study area). The Louisiana Offshore Oil Port, which is situated 18 nautical miles off the coast of the State of Louisiana, is the seventh deep-draft port. The five deep-draft public ports along the Mississippi River are shown in Figure 11.

Louisiana port synergies create a unique competitive advantage with its five deep water ports making up the largest port region by tonnage. Those synergies extend beyond traffic handled by the ports into traffic via the Mississippi River, railroads, and trucks; furthermore, ocean going traffic via the major ports in the GIWW. The GIWW runs 1,100 miles from St. Marks, Florida, to the southernmost tip of Brownsville, Texas. Factors such as geographic location, infrastructure and facilities, storage and throughput capacity, importance on the regional economy, as well as trade and market trends have a significant impact on the degree of competitiveness of a port.

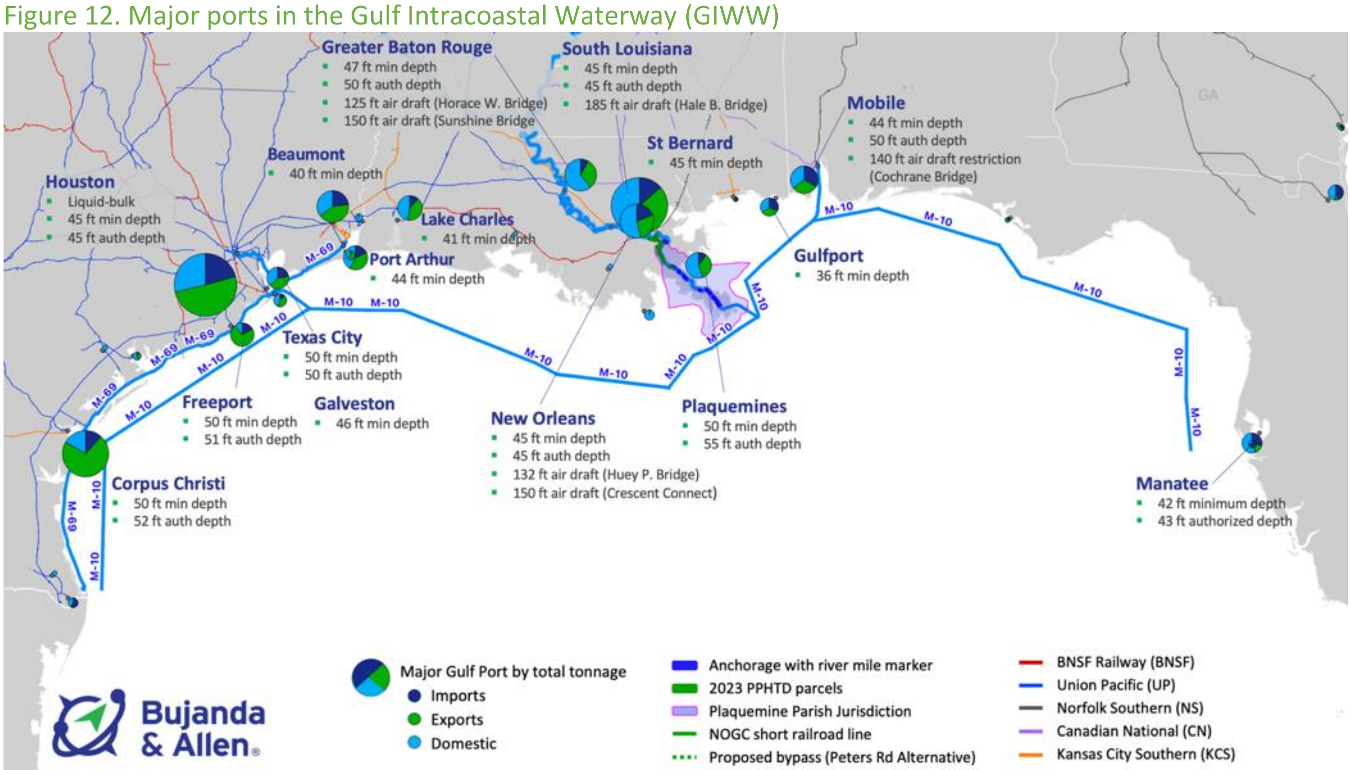
A detailed competitive analysis for the most relevant characteristics is presented in Section 5. Major ports in the GIWW competing for ocean going traffic are shown in Figure 12.

Figure 11. Louisiana's deep-draft port system



Source: Bujanda & Allen, 2003. TEU = 20-foot equivalent units (containers).

Figure 12. Major ports in the Gulf Intracoastal Waterway (GIWW)



Source: Bujanda & Allen, 2003.

2.5 Rail

Rail is the fourth predominant freight transportation mode in Louisiana, next to waterborne freight. Louisiana's rail system comprises nearly on 3,435 route miles, when leases and trackage rights are considered. In 2021, Louisiana's rail freight system carried 9%, about 156.2 million tons of the freight moved in, out, and through the state. By 2050, Louisiana's freight by rail is projected to increase more than 15% to 179 million tons.

The Louisiana freight rail system is operated by six large Class I railroads and 14 smaller local, switching, and terminal railroads. The six Class I railroads operate in 2,583 route miles, when leases and trackage rights are considered: (i) Union Pacific (UP), (ii) Kansas City Southern Railway (KCS), (iii) BNSF, (iv) Canadian National Railway (CN), (v) Norfolk Southern (NS), and (vi) CSX.

The top-4 Class I (UP, KCS, BNSF, and CN) own and control 95% of the total Class I route miles. KCS and CSX own and control the remaining 5%, which lies on two routes between New Orleans and Mississippi. The 14 short-line railroads operating in the state own the remaining 411 route miles in Louisiana. The route miles operated for each of the six Class I railroads and the 14 smaller local, switching, and terminal railroads are shown in Figure 13.

Figure 13. Louisiana Rail System: route miles operated

		Route miles operated				Owned
Railroad	Symbol	Owned	Leased	Track rights	Total	(not operated)
Class 1 Railroad						
Union Pacific	UP	1,321	-	56	1,377	22
Kansas City Southern	KCS	673	2	62	737	173
BNSF Railway	BNSF	240	-	111	351	-
Canadian National	CN	239	-	-	239	-
Norfolk Southern	NS	72	-	4	76	-
CSX Transportation	CSXT	35	-	8	43	-
Joint trackage rights (no double counting)	BNSF-UP	(240)	-	-	(240)	-
Total Class 1s		**2,340**	**2**	**241**	**2,583**	**195**
Local, switching railroads						
Louisiana & Delta Railroad	LDRR	120	-	178	298	-
Louisiana Southern Railroad	LAS	-	157	-	157	-
Acadiana Railway	AKDN	68	5	21	94	-
Delta Southern Railroad	DSRR	28	15	-	43	-
Geaux Geaux Railroad	GOGR	39	-	-	39	-
Arkansas Louisiana & Mississippi Railroac	ALM	39	-	-	39	-
Louisiana and North West Railroad	LNW	38	-	-	38	-
New Orleans and Gulf Coast Railway	NOGC	24	13	-	37	-
Bogalusa Bayou Railroad	BBRR	26	-	-	26	-
New Orleans Public Belt Railroad	NOPB	26	-	-	26	-
Timbewr Rock Railroad	TIBR	22	-	-	22	-
North Louisiana & Arkansas Railroad	NLA	-	16	2	18	-
Port Rail (Lake Charles Harbor)	LCH	13	-	-	13	-
Baton Rouge Southern Railroad	BRS	-	2	-	2	-
Total Local & switching railroads		**443**	**208**	**201**	**852**	**-**
Total miles		**2,783**	**210**	**442**	**3,435**	**195**

Source: Bujanda & Allen with information from LA DOTD, 2023.

There are 25 intermodal facilities integrating rail primarily with truck and barge modes, providing more alternatives for different segments of supply chains mainly near four primary locations: New Orleans, Baton Rouge, Pineville Junction, and Shreveport.

Rail connectivity to and from PPHTD is provided by the New Orleans & Gulf Coast Railway Company (NOGC). NOGC is a 32-mile short-line capable of handling railcars of 286,000 lb, interchanging with the UP in Westwego, LA. The railroad serves over 20 switching and industrial customers and is the only railroad operating east of Avondale on the Westbank of the Mississippi River. Through NOGC, PPHTD enjoys rail connectivity to/from major freight markets and entry/exit gateways (e.g. about 1,000 miles from Chicago, the largest rail hub in the U.S., 1,900 miles from the West Coast, the largest intermodal port gateway, 900 miles from Kansas City, 600 miles from Dallas Forth-Worth, and 700 miles from Laredo).

The main rail corridors serving the movement of freight in the port study area include:

- **North-South:** UP dominates north-south connectivity, in addition to trackage rights in the state. UP provides connectivity between New Orleans and St. Louis, MO (parallel to the Mississippi River), passing through Baton Rouge (parallel to I-10) and Alexandria. St. Louis is a key interchange point for Class I lines, and a significant loading point for barge-to-rail freight. This is one of the main corridors competing against barge traffic via the Mississippi River. Another important corridor, KCS's corridor between Shreveport and Lake Charles ranks next based on tonnage. Shreveport acts as a gateway for freight from the Midwest and northern regions into Louisiana, Texas, and the Gulf Coast.
- **East-West**: KCS provides connectivity between Vicksburg, MS and Shreveport, LA, which passes through important towns and junctions, such as Tallulah, Monroe, Gibsland, and Doyline in the north part of the state. In the south part of the state, the UP I-10 corridor connects Baton Rouge with the western parts of the state and the U.S. (via KCS north of Lake Charles). The southernmost corridor providing east-west connectivity is BNSF's corridor between New Orleans and Lake Charles, which passes through Raceland and Morgan City and connects with the I-10 corridor at Lafayette en-route to Lake Charles, the state line near Orange, TX, and the rest of the western U.S.

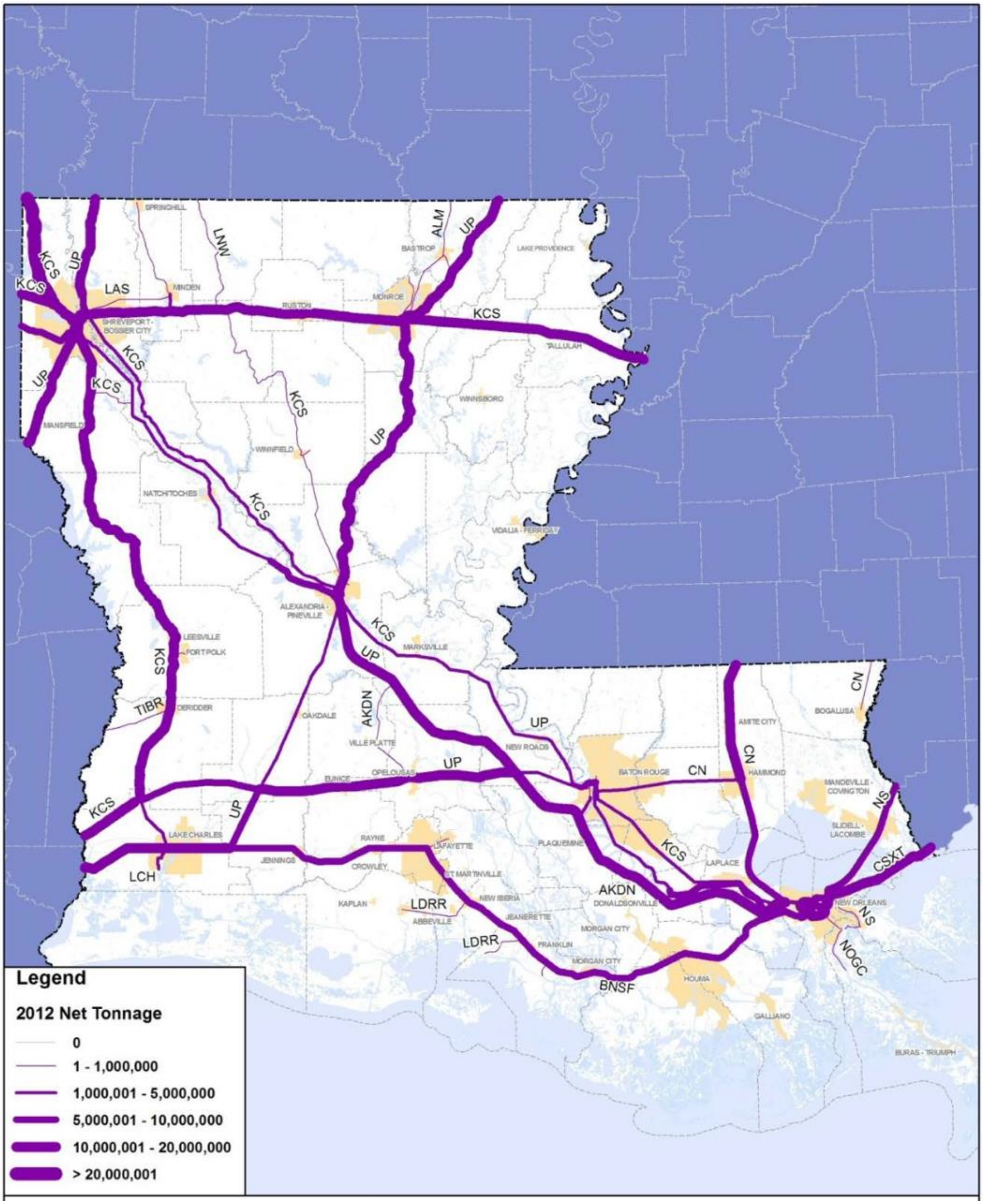
Several regional and short-line railroads have antiquated restrictions to the 263,000 lb railcar standard. This prevents shippers from capitalizing on the economies of scale generated by packing more product onto a single, more modern, 286,000 lb railcar. Because of this, occasional congestion points and inefficiencies are generated where the Class I railroads and short-lines and regional roads cross paths. To improve bottlenecks, the DOTD has identified the need for at least four major relation projects:[5]

- **NOGC**—extend to PPHTD, relocate west of Gretna, and extend to the Kinder Morgan Coal Terminal.
- **New Orleans Rail Gateway**—antiquated control systems and switches, grade crossings, Huey P Long bridge, and expand rail capacity.
- **Louisiana Southern Railroad**—modernize to 286,000 lb railcar weight limit.
- **Delta Southern Railroad**—modernize to 286,000 lb railcar weight limit.
- **Timber Rock Railroad**—modernize to 286,000 lb railcar weight limit.

Louisiana's rail corridors with major freight flows are shown in Figure 14 and NOGC is shown in Figure 15.

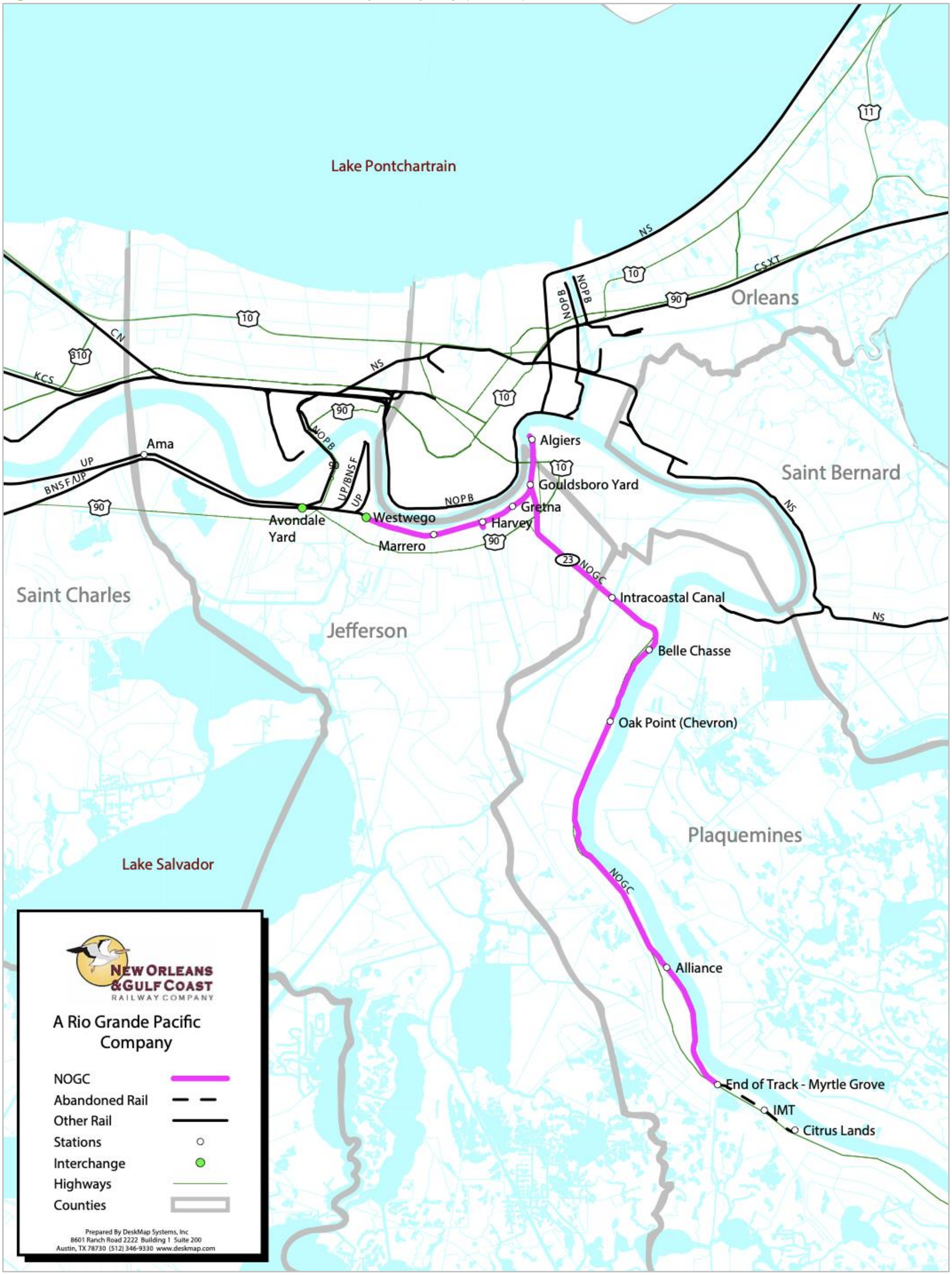
[5] Louisiana DOTD, 2018 Louisiana Freight Mobility Plan, Freight Rail Bottlenecks and Relocation Projects 6-22, February 2018.

Figure 14. Rail corridors with major freight flows in Louisiana



Source: DOTD, 2018.

Figure 15. New Orleans & Gulf Coast Railway Company (NOGC)



Source: Rio Grande Pacific Corporation (RGPC), 2023.

2.6 Air

Louisiana has seven commercial airports that accommodate freight, plus a Naval Air Station (NAS):

- Louis Armstrong New Orleans International
- Shreveport Regional
- Lafayette Regional
- Lake Charles Regional
- Joint Base Belle Chasse NAS
- Monroe Regional
- Baton Rouge Metropolitan
- Alexandria International

To achieve economies of scale on important long-haul routes, air cargo operators are gradually choosing larger aircraft sizes. This has led to freight jams at important airports that handle substantial volumes of cargo. For example, Lafayette, Baton Rouge, Alexandria, and Lake Charles already need larger hangars, while Shreveport Regional needs a runway extension to 6,500 ft. Air cargo companies have already discussed the possibility of landing bigger aircraft, like Airbus A300s, at these airports.

Additionally, there are bottlenecks on the roads that connect to important freight markets outside of the airports:

- **New Orleans International Airport [MSY]**—cargo operations rely on a congested highway without direct access to the interstate, affecting freight flows.
- **Lake Charles Regional Airport [LCH]**—requires trucks to use surface streets for access, and efforts for a direct link to the interstate are in the conceptual phase.
- **Lafayette Regional Airport [LFT]**—highway access is an emerging issue, and plans for a 5.5-mile extension of I-49 from I-10 to the airport are being considered.
- **Acadiana Regional Airport [ARA]**—faces limited access points due to a nearby rail line, posing a risk for trucks getting stuck.

Airports included in the NPIAS are eligible for federal funding; however, 13 of Louisiana's airports are not included. Louisiana's commercial and general aviation airports are shown in Figure 16.

2.6.1 Joint Base Belle Chasse

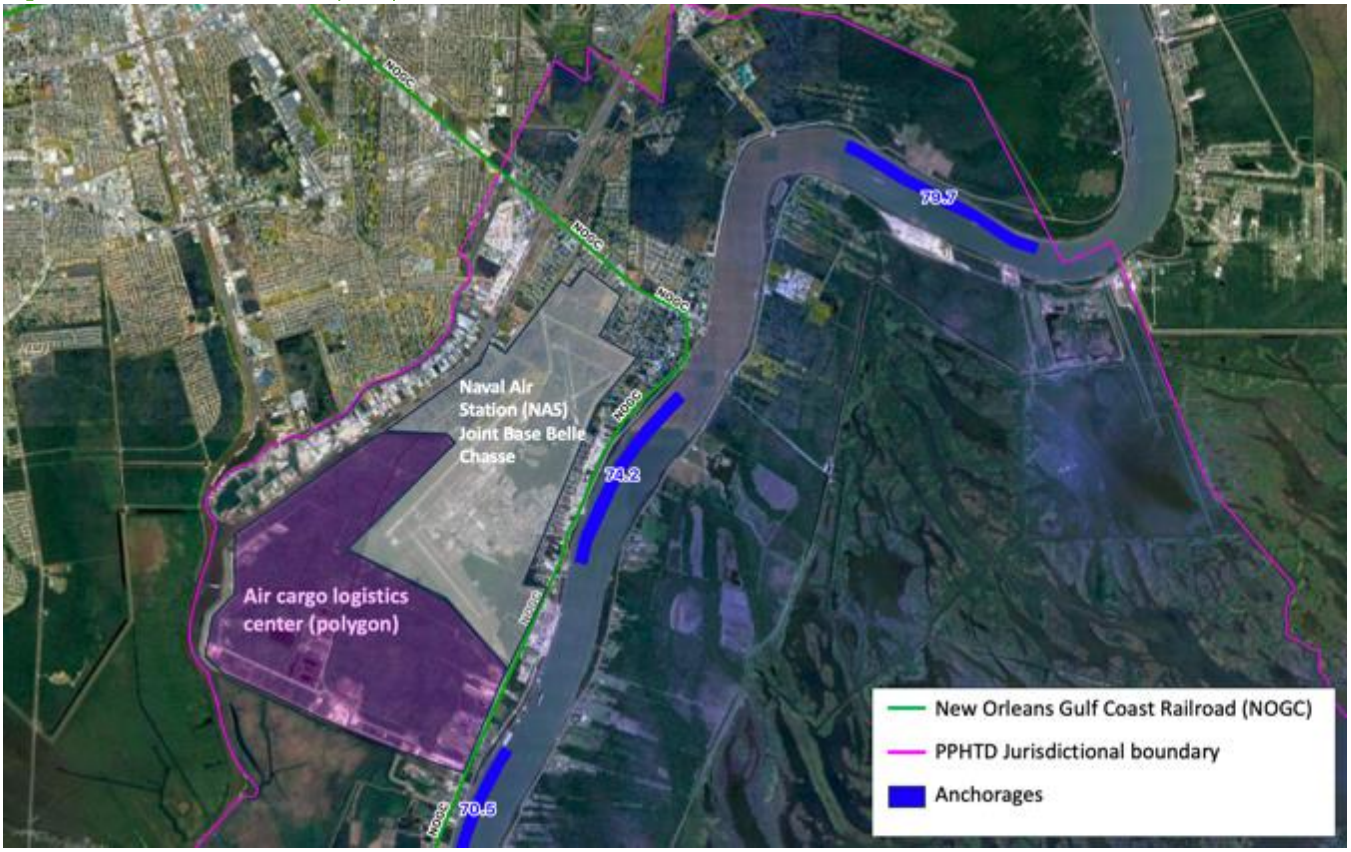
The Joint Base Belle Chasse NAS is located within the boundaries of PPHTD and adjacent to a future planned rail bypass connection. PPHTD's Executive Team has a partnering relationship with the Base Commander. This bypass will be operated by NOGC and connects directly to the UP railroad in Harvey, LA.

The Joint Base Belle Chasse is the home of active-duty NAS and reserve components of all armed services and already enjoys both a 6,000 ft and 10,000 ft runway capable of handling large air freighters. PPHTD and its rail partners identified the adjacent property as a strategic location for a UP rail classification yard. The opportunity exists to create a future dual use asset for strategic deployments and redeployments and an air cargo terminal. This strategic location is eligible for Federal Grants. The Joint Base Belle Chase is shown in Figure 17.

Figure 16. Air assets in Louisiana

Source: DOTD, 2018.

Figure 17. Naval Air Station (NAS) Joint Base Belle Chase



Source: Bujanda & Allen, 2023.

3. Market analysis

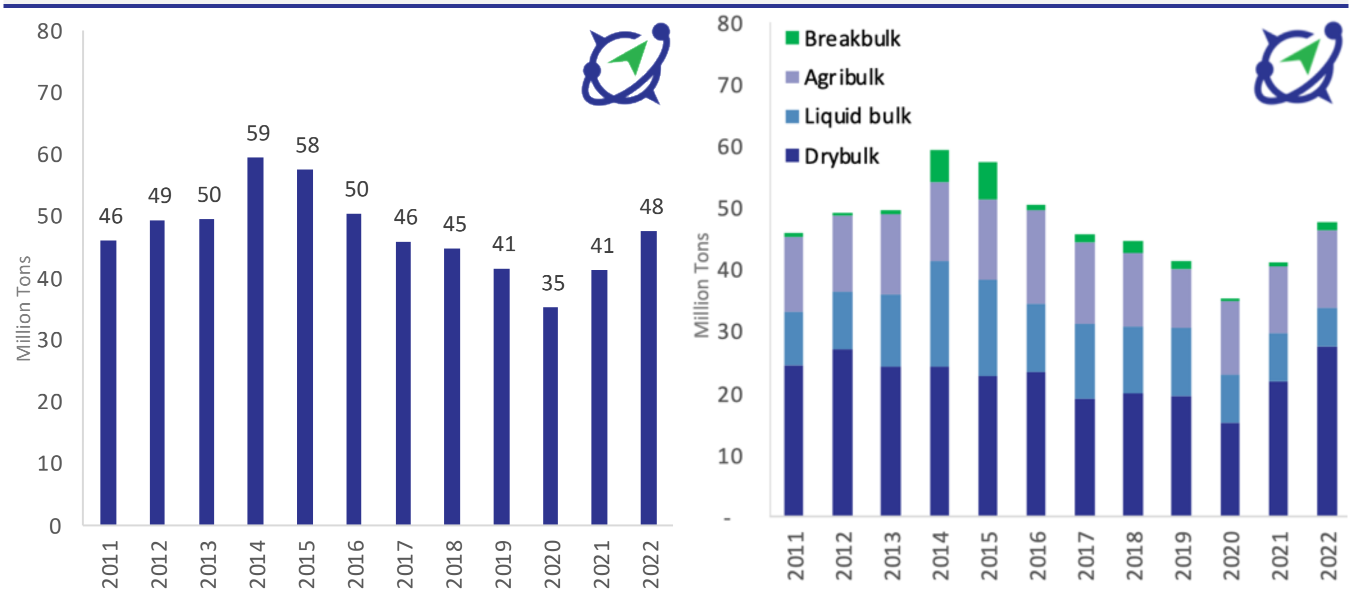
This section begins with an analysis of throughput volumes via PPHTD to identify incumbent markets and top commodities. Bujanda & Allen analyzed the key macroeconomic factors and drivers behind freight demand in North America and their historical trends, as well as global events, such as the COVID-19 recession and its recovery, trends in international trade, protectionism, and nearshoring. We analyzed headhaul volumes for imports and exports for non-containerized and containerized freight. We analyzed coastal shares for each of the U.S. Pacific, Atlantic, and Gulf coasts, as well as market shares for ports in the U.S. Gulf.

3.1 Plaquemines Parish Port traffic

PPHTD has historically served mainly **drybulk markets**, with a **2011-2022 average of 48%** of the total volume, composed primarily of **Coal, Pet Coke, Pig Iron, Limestone,** and **Fertilizers**. **Agribulk ranks next with 26%** of the cargo, followed by **breakbulk** with **3%**. **Liquid-bulk** commodities represent **23%** of the total volume, broken down in **Oil & Fuels** with 12%, **Gases** with 2%, and **Other Liquids** with 9%. PPHTD's volume peaked in 2014 at **59 million tons** and bottomed in 2020 at the onset of the COVID-19 pandemic. In 2022, volumes have recovered to pre-pandemic levels. PPHTD's total volumes and their breakdown by cargo type are shown in Figure 18.

Figure 18. Plaquemines Port Harbor and Terminal District (PPHTD) throughput volumes 2011-2022

a) Total volumes (million tons) **b) Breakdown by cargo type**

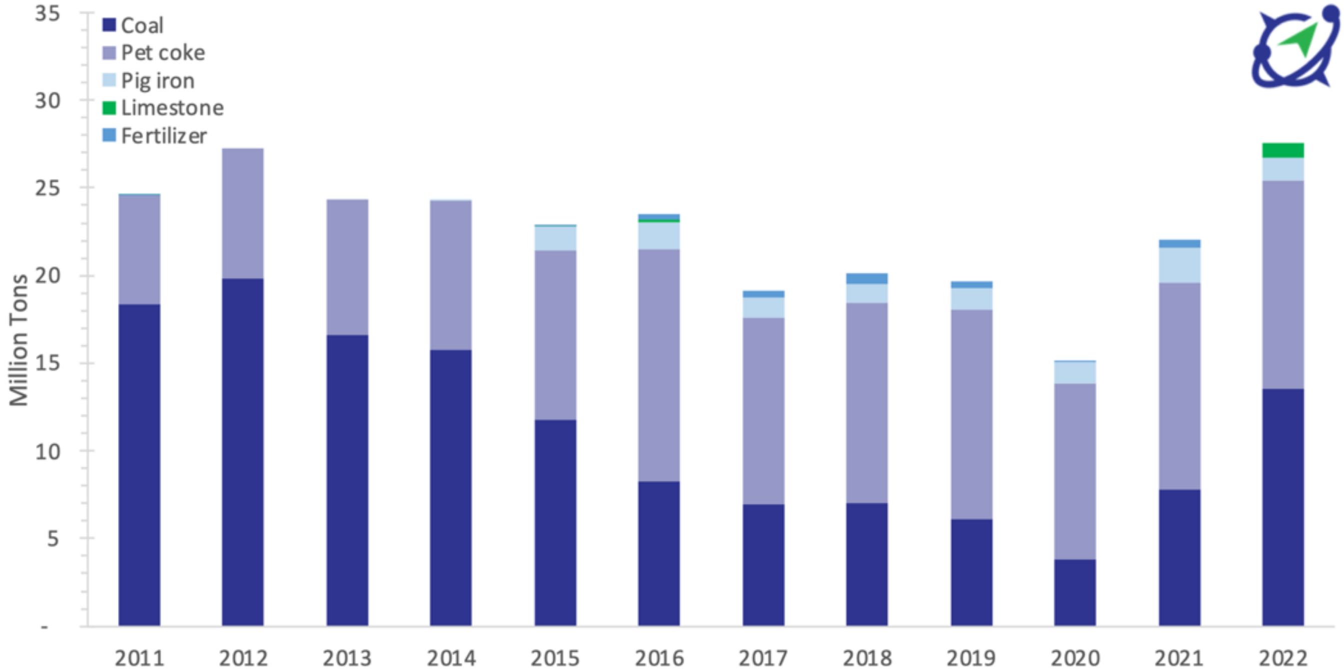


Source: Bujanda & Allen, 2023 with data from PPHTD. Tonnage for some commodity groups were estimated from barrels for 2014 and 2015 due to lack of reported data in tons format.

3.1.1 Drybulk

Drybulk markets at PPHTD have faced ups and downs during the last decade. With a **2011-2022 average** of **11.3 million tons**, **Coal represents about 50%** of the drybulk market during the same period; followed by **Pet Coke with 44%**, **Pig Iron with 4%**, **Limestone with 1%**, and **Fertilizer with 1%**. Coal shipments have been more volatile due to regulatory changes introduced in 2015 pushing for cleaner energy choices. This led to less demand for coal, affecting exports via PPHTD, until late 2018 when some of the previous regulatory restrictions were rolled back. In early 2022, the European Union's commitment in the Versailles Declaration to phase out Russian fossil fuel imports translated into rising imports of alternative energy sources, such as coal, from alternative suppliers, such as the U.S. To mitigate the volatility of coal markets, the port had to adjust by exploring new cargo options, such as Pet Coke which has gained momentum mainly after 2016. PPHTD's drybulk market is shown in Figure 19.

Figure 19. PPHTD Drybulk throughput volumes by commodity 2011-2022

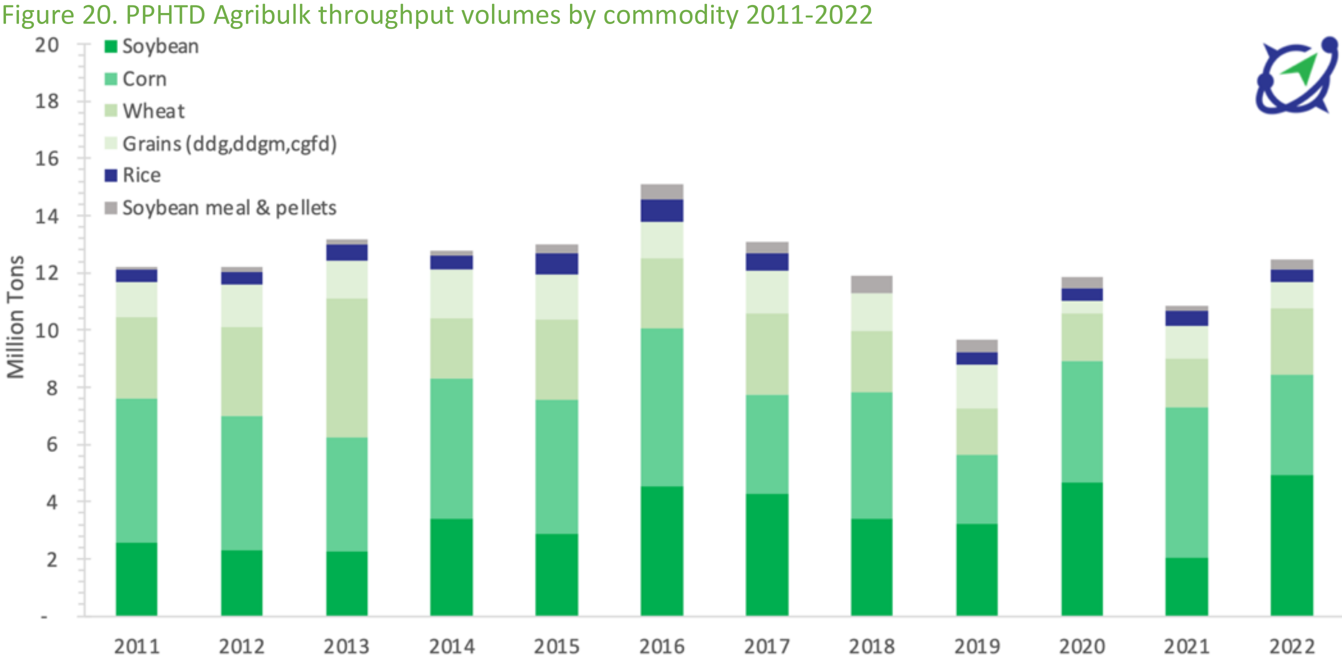


Source: Bujanda & Allen, 2023.

3.1.2 Agribulk

Agribulk markets at PPHTD have faced ups and downs during the last decade. With an annual 2011-2022 average of **12.4 million tons**, **Corn represents about 35%** of the agribulk market volume; followed by **Soybeans with 27%**, **Wheat with 21%, Dried Distillers Grains (DDGs) with 10%**, **Rice with 4%**, and **Soybean Meal & Pellets with 3%**. While there have been some fluctuations due to factors like weather and global trade tensions, PPHTD has experienced a steady volume of agribulk shipments, as shown in Figure 20.

Figure 20. PPHTD Agribulk throughput volumes by commodity 2011-2022

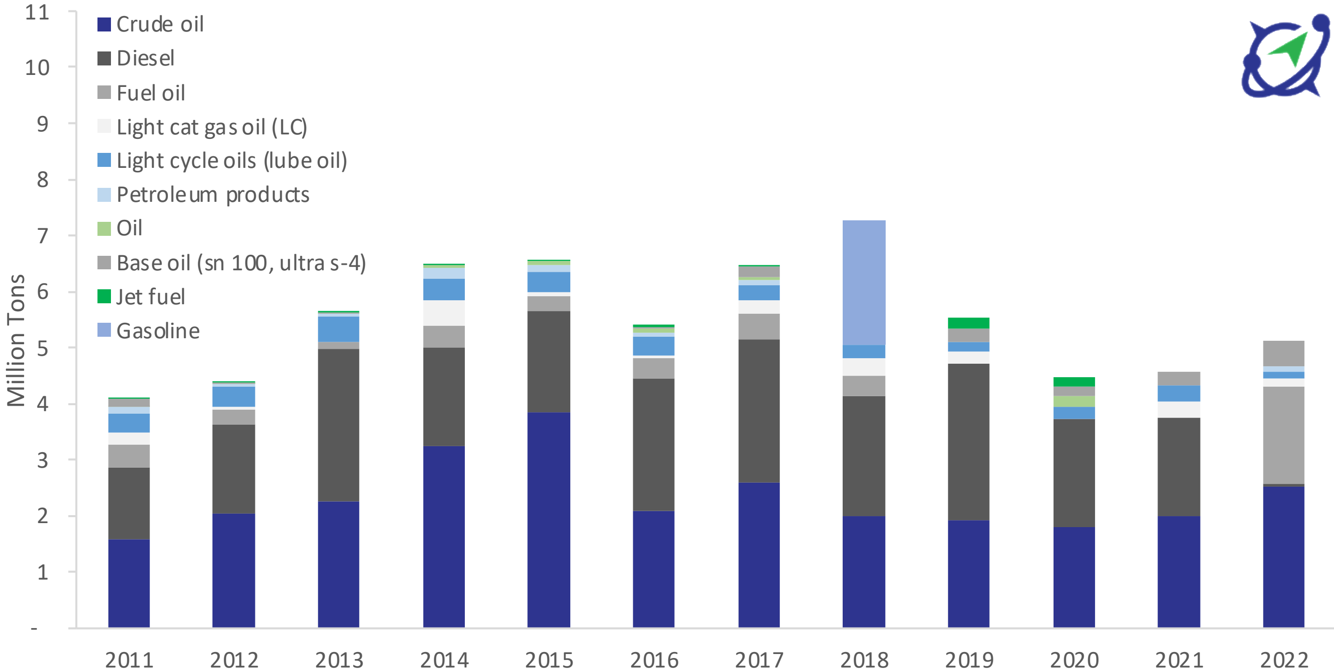


Source: Bujanda & Allen, 2023.

3.1.3 Liquid-bulk and gases

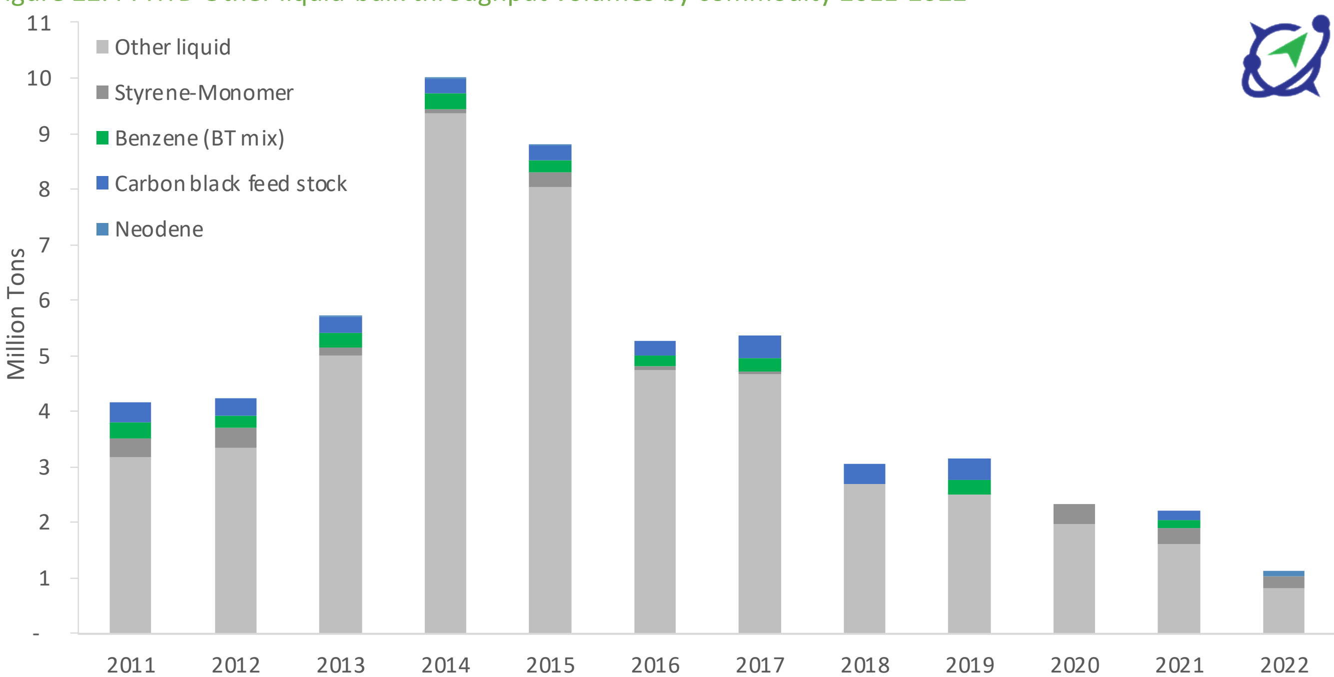
PPHTD liquid-bulk and gas markets comprise a wide range of raw and refined products, which we grouped in three categories: **(i)** Oil & Fuels, **(ii)** Other Liquids, and **(iii)** Gases. With a 2011-2022 average of **2.3 million tons**, **Crude Oil** is **31%** of the Oil & Fuels market; followed by **Gasoline** with **30%**, **Diesel** with **25%**, **Fuel Oil** with **5%**, **Light Cycle Oils** with **4%**, as well as Base Oil (SN 100, Ultra S-4), Light Cat Gas Oil, Jet Fuel, and Other Petroleum Products each with about **1%**. PPHTD saw increased movement of crude from 2011 to 2015, ahead of the lifting of U.S. crude oil export restrictions in 2015. Despite market fluctuations, PPHTD has adapted, facilitating significant crude and diesel shipments, establishing as a key player in the changing landscape of energy trade. Liquid-bulk throughput volumes are shown for Oils & Fuels in Figure 21 and Other Liquids in Figure 22.

Figure 21. PPHTD Oils & Fuels throughput volumes by commodity 2011-2022



Source: Bujanda & Allen, 2023.

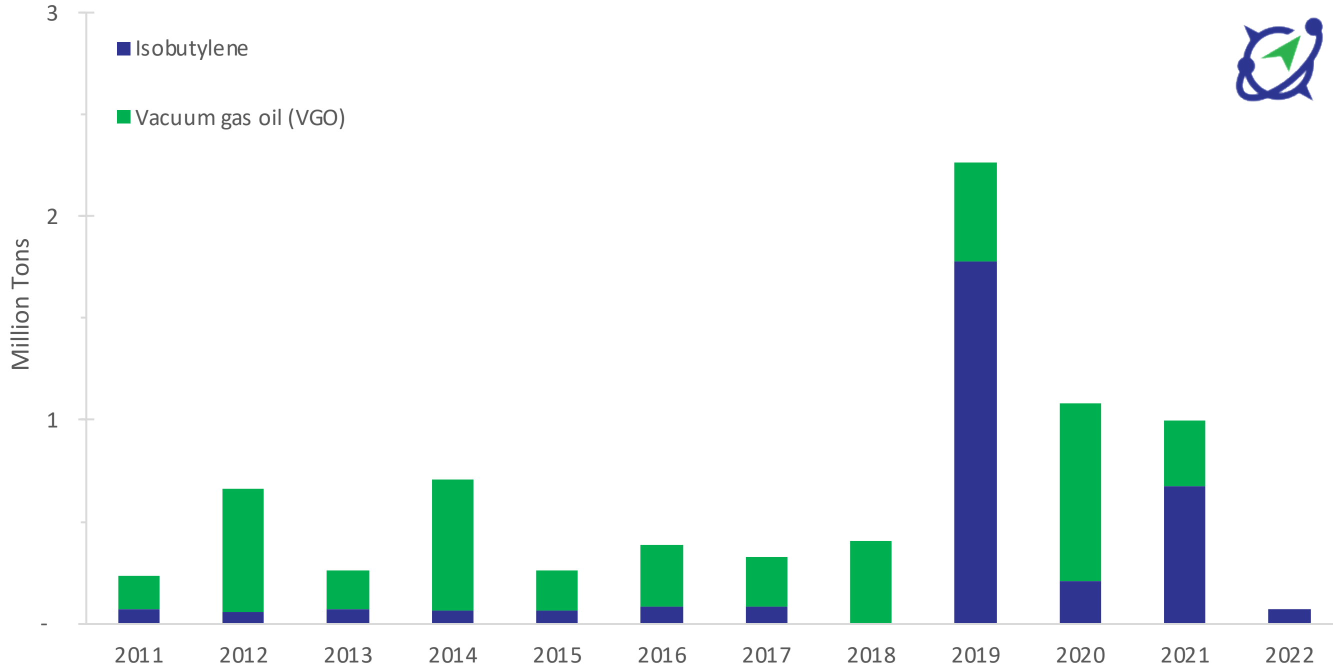
Figure 22. PPHTD Other liquid-bulk throughput volumes by commodity 2011-2022



Source: Bujanda & Allen, 2023.

The throughput volume of Gases at PPHTD is relatively lower when compared to the Oil & Fuels and Other Liquids commodities, with an annual **2011-2022 average of 0.63 million tons**. **Vacuum Gas Oil (VGO) represents about 3.4% on average** of the gas markets, followed by **Isobutylene also with 2.5%.** VGO has a diverse range of uses in the petrochemical industry. It can be processed in catalytic cracking units to produce gasoline and other high value lighter products. VGO is often imported, exported, and processed within the local refineries and petrochemical plants. Isobutylene is used in the production of polymers, fuel additives, refrigeration, and other applications. PPHTD throughput gas volumes by commodity are shown in Figure 23.

Figure 23. PPHTD Gases (liquid-bulk) throughput volumes by commodity 2011-2022

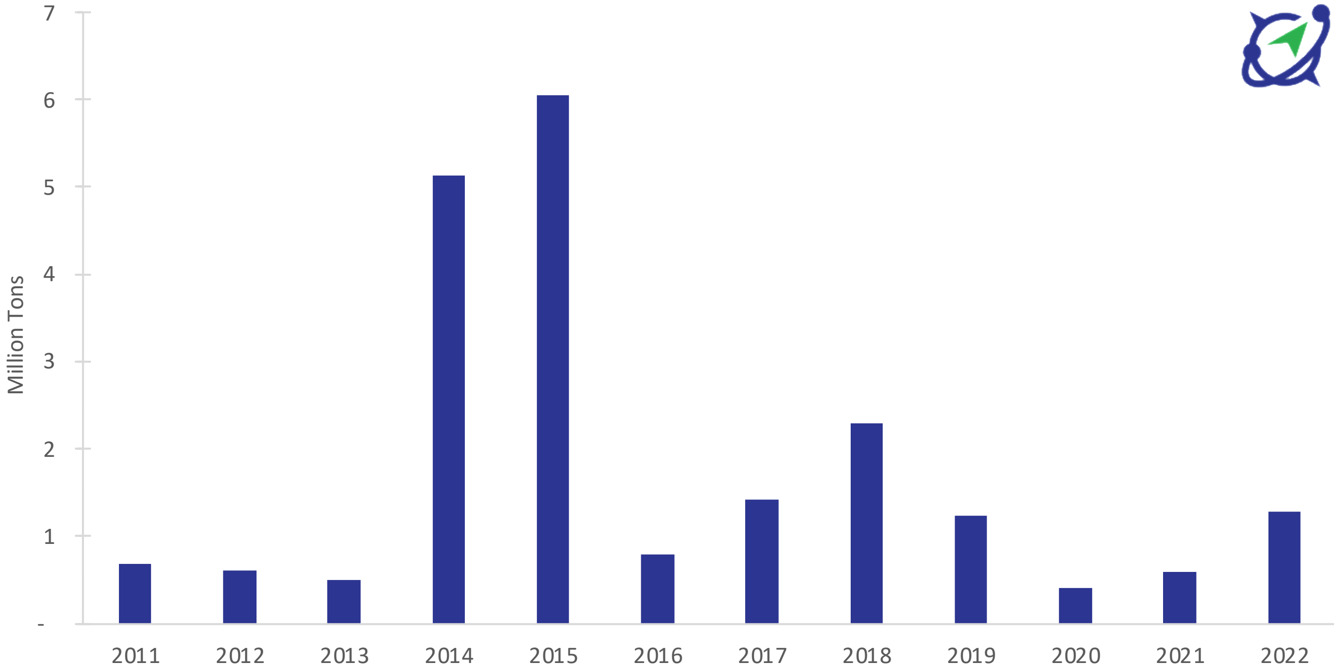


Source: Bujanda & Allen, 2023.

3.1.4 Breakbulk

Breakbulk markets at PPHTD peaked in 2015, with strong years in 2014 and 2018. During the last 5 years, this category comprises super sacs of raw cement, stone, sand, and construction raw materials. Although these volumes slowed down after 2019, volumes have started to recover. PPHTD boasts a range of terminals, berths, and storage facilities equipped to handle breakbulk and project cargoes of different sizes, shapes, and weights. These facilities are designed to accommodate specialized equipment needed for loading and unloading. This sector represents a potential opportunity given historical precedent. Break-bulk throughput volumes are shown in Figure 24.

Figure 24. PPHTD breakbulk throughput volumes 2011-2022



Source: Bujanda & Allen, 2023.

3.2 Macroeconomic overview

To anticipate future transportation needs, it is necessary to anticipate freight demand in the U.S. using a variety of indicators and data sources. These indicators can aid in understanding trends, foreseeing demand changes, and assisting in decision-making for transportation economists and planners. Indicators that are frequently used to project freight demand include: real gross domestic product (GDP), employment, wages, consumer sentiment, personal consumption expenditures (PCE), as well as trends in durable and non-durable goods.

3.2.1 Real GDP and freight demand

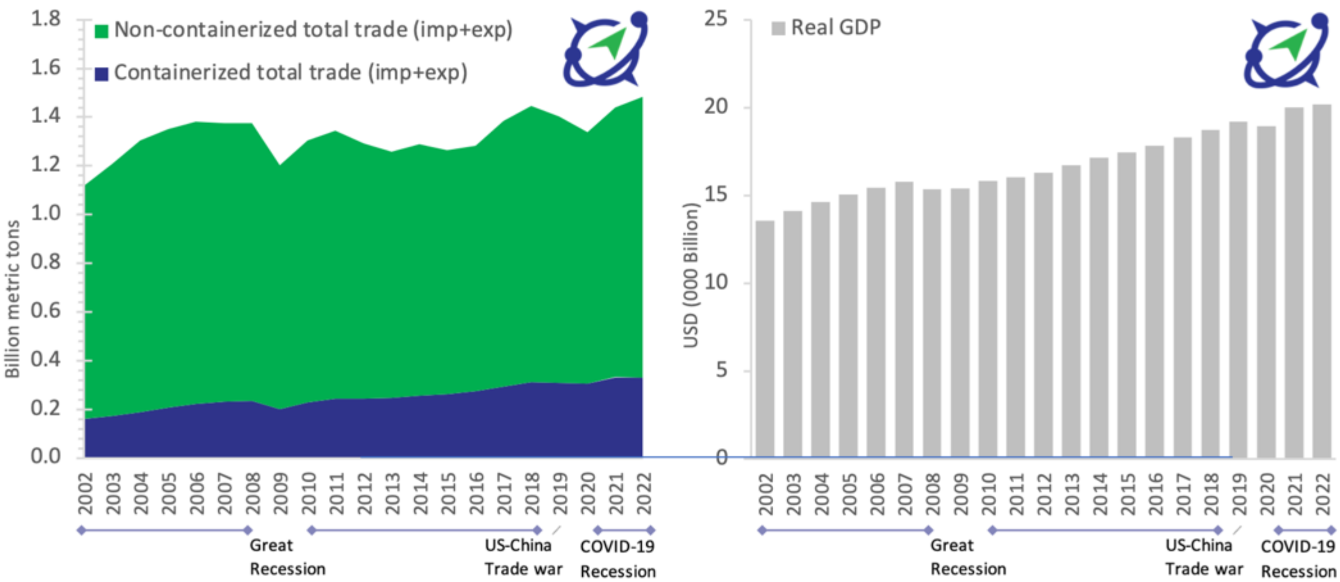
Significant global economic events have impacted the structural relationship between freight and real GDP:

- **1994**—The passage of the North American Free Trade Agreement (NAFTA) boosted trade between the U.S., Canada, and Mexico.
- **1995**—The establishment of the World Trade Organization (WTO) led to stronger imports from Asia and moving across borders, increasing the need for freight transportation in the U.S.
- **2001**—The Dot-com bubble burst and China's entry into the WTO altered industries worldwide, increased exports, affected freight imports, and fueled GDP growth.
- **2008**—The Great Recession led to a decline in trade and GDP driven by credit concerns and decreased demand.
- **2018**—U.S.-China Trade War and tit-for-tat tariffs wars.
- **2020**—The COVID-19 pandemic disrupted supply networks, reduced consumer demand, and significantly reduced real GDP.

Events like these demonstrate the strong link between movements of non-containerized and containerized freight and economic cycles, which are more clearly visualized side by side, as shown in Figure 25.

Figure 25. Total trade by vessel and its relationship to Real Gross Domestic Product (GDP)

a) Non-containerized trade and containerized trade **b) U.S. Real GDP**



CAGR	2002-08	2010-18	2002-18
Containerized trade	6.5%	4.0%	4.2%
Non-containerized trade	2.9%	0.6%	1.1%
Total trade by vessel	**3.5%**	**1.3%**	**1.6%**

CAGR	2002-08	2010-18	2002-18
Real GDP	2.1%	2.1%	2.0%
Containerized trade multiplier	3.0	1.9	2.0
Non-containerized trade multiplier	1.4	0.3	0.5

Source: Bujanda & Allen, 2023.

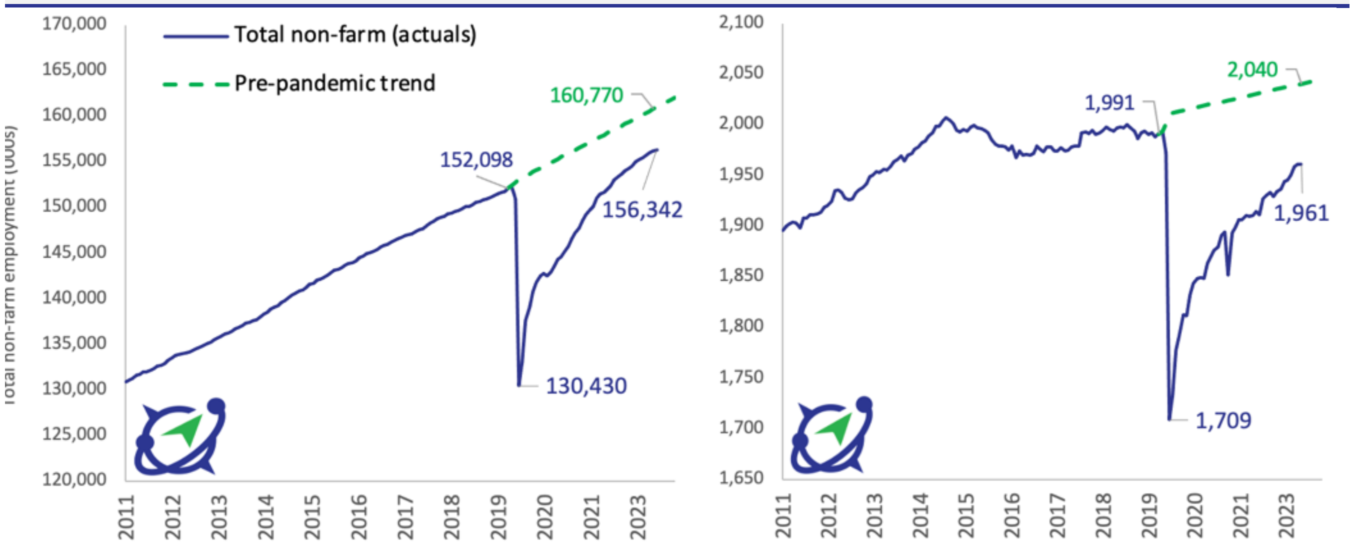
The GDP Multiplier Ratio it is widely used when evaluating freight and commodity markets. This ratio expresses the relationship between the growth rate of GDP and the growth rate of its trade (e.g. commodity, cargo type, mode, trade flow, etc). The GDP Multiplier Ratio for containerized freight climbed from 2.4 in the 1994–2000 period (prior to the burst of the Dot-com Bubble) to 3.0 in the 2002–2008 period (prior to the Great Recession) then decreased to 1.9 in the 2010–2018 period (prior to the U.S.-China Trade War and COVID-19 Recession). For non-containerized, the ratio decreased from 1.4 in 2002–2008, then decreased to 0.3 in 2010–2018.

3.2.2 Employment

In early 2020, the COVID-19 pandemic brought an unprecedented downturn in non-farm employment and the labor participation rate. Lockdowns, restrictions, and economic uncertainties led to widespread job losses across industries, resulting in a historic decline in employment to 130.4 million jobs, an impressive loss of 21.6 million jobs at the national level and more 282 thousand in Louisiana. When compared to pre-pandemic trends, the U.S. is still 4.6 million and Louisiana about 79 thousand lower than the pre-pandemic trend, as shown in Figure 26.

Figure 26. Total non-farm employment for the U.S. and Louisiana

a) United States (000s) **b) Louisiana (000s)**



Source: Bujanda & Allen, 2023.

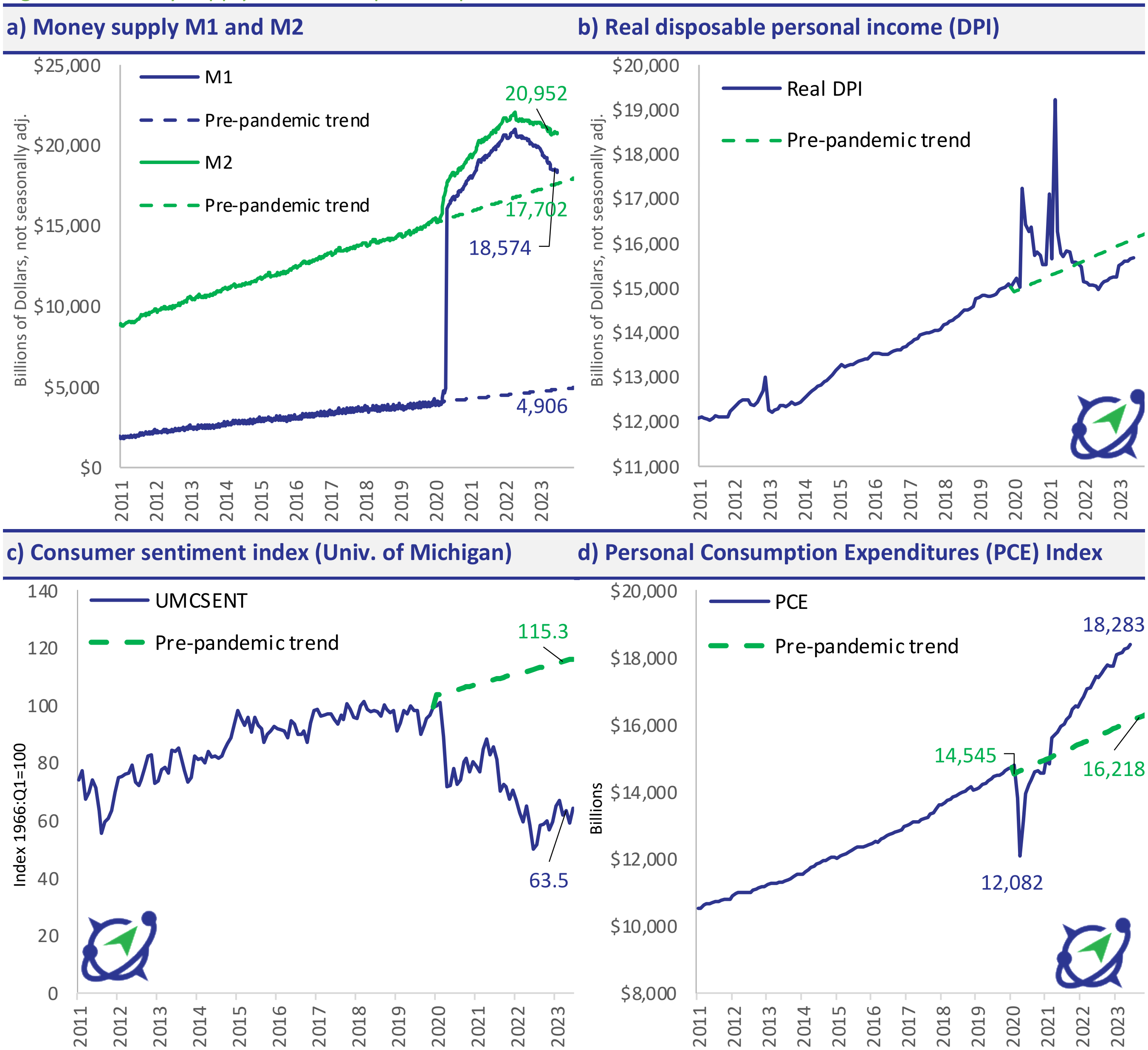
3.2.3 Money supply, disposable income, and consumer demand

The COVID-19 pandemic brought an unprecedented increase in the money supply, as measured by M1 and M2 from the Federal Reserve, which ensured that credit flowed to firms and households to prevent disturbances in the financial markets from escalating economic harm.

M1, which includes currency demand, savings, and other liquid deposits, remains 278% above a hypothetical pre-pandemic trend. M2, which includes cash, checking, and other types of deposits readily convertible to cash such as CDs, remains 18.4% above the pre-pandemic trend. This was followed by an increase in disposable personal income (DPI), which in turn increased consumption and freight demand. The money supply and disposable income are shown in Figure 27 (a) and (b).

Stimulus measures can also have a positive impact on consumer confidence. When people feel more secure about their financial situation due to stimulus support, they may be more willing to make more significant purchases, such as durable goods (in addition to non-durable). The University of Michigan consumer sentiment index and the personal consumption expenditures (PCE) price index are shown in Figure 27 (c) and (d).

Figure 27. Money supply and real disposable personal income



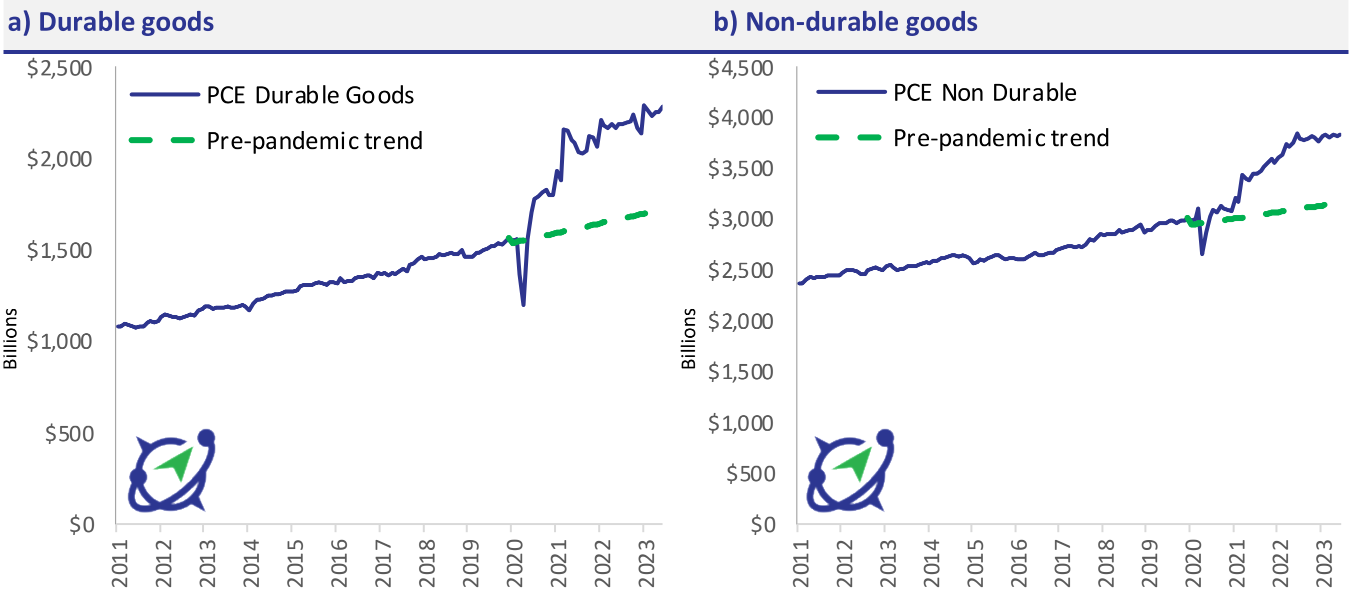
Source: Bujanda & Allen, 2023.

3.2.4 Durable and non-durable goods

COVID-19 stimulus measures—such as direct payments to individuals, expanded unemployment benefits, and tax cuts—lead to increased disposable income for consumers. When consumers have more money to spend, they are more likely to purchase durable goods, such as appliances, electronics, vehicles, and other big-ticket items. During the lockdowns, consumers delayed purchases of durable goods, which were exacerbated by the supply chain disruptions. However, once restrictions were lifted, stimulus measures helped to unleash pent-up demand, leading to a surge in consumer spending on durable goods.

Non-durable goods include items like food, clothing, gasoline, and fuels. Spending on both durable and non-durable consumer items is tightly correlated with income, and often rise and fall together. The impact of stimulus on PCE nondurable goods can be brief or longer lasting, depending on factors such as the duration of stimulus measures and the broader economy. Durable and non-durable goods are shown in Figure 28.

Figure 28. Durable and non-durable goods



Source: Bujanda & Allen, 2023.

3.2.5 Trends in international trade

International trade for the U.S. has seen several significant trends in recent years, shaping the nation's economic interactions with the world. These trends highlight key aspects of trade patterns and their implications for the U.S. economy. The U.S. has been reevaluating its trade relationships and agreements, with a focus on addressing perceived imbalances. This includes renegotiating trade deals and imposing tariffs to protect domestic industries and jobs.

- **China trade dynamics.** Trade tensions between the U.S. and China have been a central theme, leading to tariff escalations and affecting the flow of goods between the two economic giants. This has sparked discussions on reshoring and diversifying supply chains.
- **Technology and services trade.** The U.S. has been increasingly engaged in trade related to technology and services, such as digital products, software, and professional services. These sectors are playing a growing role in the U.S. trade portfolio.
- **Energy export growth.** The U.S. has become a major exporter of energy products, particularly liquefied natural gas (LNG) and crude oil. This development has impacted global energy markets and trade relationships.
- **Trade imbalances and deficits.** The U.S. has grappled with trade imbalances, particularly with certain trading partners. Addressing trade deficits and fostering more balanced trade has been a focus of policy discussions.
- **Supply chain resilience.** The COVID-19 pandemic highlighted vulnerabilities in global supply chains, prompting discussions about enhancing supply chain resilience, domestic manufacturing, and reducing dependence on single sources.
- **E-commerce expansion**. The growth of e-commerce has led to increased cross-border trade in goods and services. The U.S. has been a significant player in this trend, with American companies selling products to consumers around the world.

- **Environmental and labor standards**. Trade discussions increasingly involve considerations of environmental protection and labor standards. Trade agreements are being crafted to address these concerns and promote sustainable practices.
- **Trade and geopolitics.** Geopolitical factors, such as diplomatic relations and security concerns, have influenced trade decisions and strategies. Sanctions and export controls have been used as tools of foreign policy.

These trends highlight the evolving landscape of international trade for the U.S., encompassing economic, technological, and geopolitical factors. Navigating these trends requires a delicate balance between promoting economic growth, addressing domestic concerns, and engaging in a complex global marketplace.

3.2.6 COVID-19 recession and impacts on freight

As countries implemented lockdowns, travel restrictions, and social distancing measures to contain the virus, economic activity was severely disrupted, leading to a sharp contraction in various sectors of the economy. This recession had significant impacts on freight demand and the transportation industry.

- **Supply chain disruptions.** Because of lockdowns and factory closures, it became hard to get things from one place to another.
- **Changing shopping preferences.** People started buying more groceries and things for their homes, but they bought fewer other items.
- **Less factories.** Many factories closed or made fewer things, so there was less need to move materials and products.
- **Less air travel.** Airplanes were flying less, which made it harder to move things by air.
- **Different impacts across freight transportation modes.** Some ways of moving goods were affected more than others, like trucks and ships.
- **Global trade issues.** The way countries traded with each other changed, affecting how goods crossed borders.
- **Government stimulus measures.** Governments gave money to businesses and people, which also influenced what and how things were moved.
- **Recovery.** Over time, as things got better, more goods started moving again, but some industries recovered faster than others.

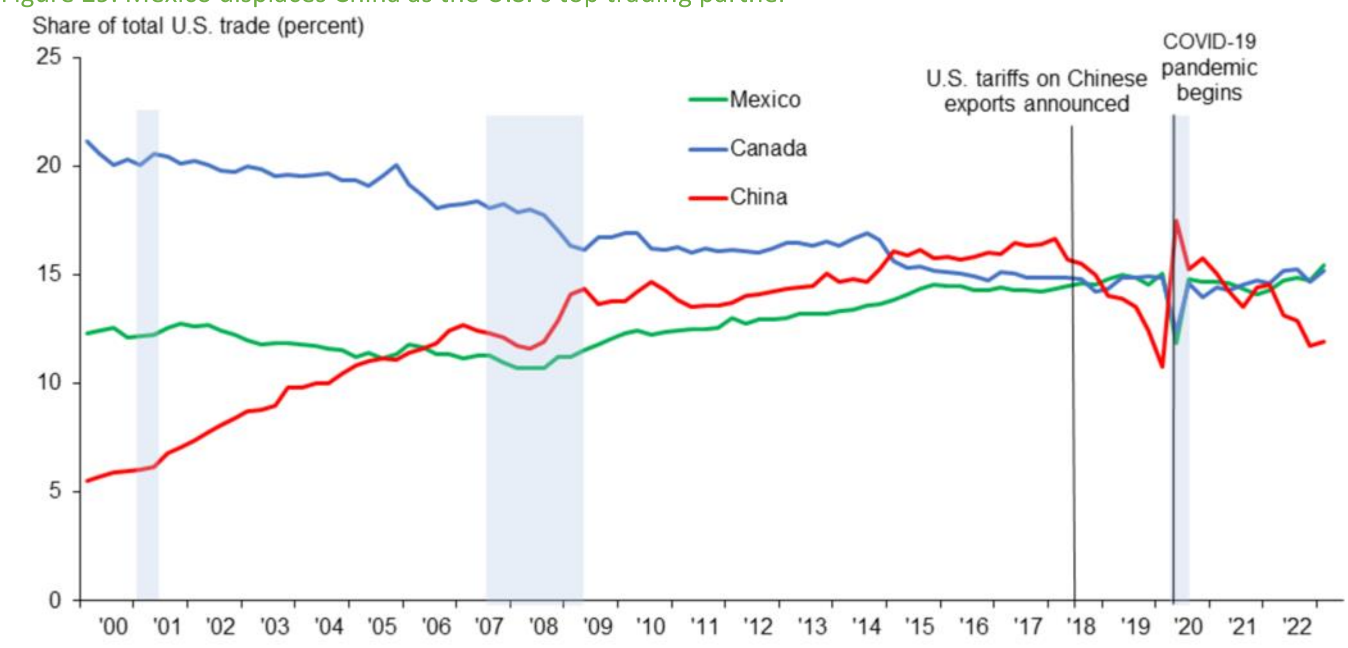
3.2.7 Protectionism and nearshoring

During the last decade, the U.S. implemented some key protectionist measures, most of which directly impacted the movement of containerized and non-containerized freight imports from China, as well as imports and exports between the U.S. and the rest of the world.

- **Section 232 tariffs on steel and aluminum (2018).** The U.S. imposed tariffs of 25% on steel and 10% on aluminum imports, citing national security concerns under Section 232 of the Trade Expansion Act. The tariffs were applied globally, affecting trading partners like Canada, Mexico, and the European Union.
- **Section 301 tariffs on China (2018-2020).** The U.S. initiated a series of tariffs on Chinese goods, amounting to hundreds of billions of dollars, in response to concerns about intellectual property theft, forced technology transfer, and unfair trade practices. This led to a significant trade dispute between the two countries.

- **USMCA Renegotiation (2018).** The U.S. renegotiated the North American Free Trade Agreement (NAFTA) into the U.S.-Mexico-Canada Agreement (USMCA), with provisions aimed at protecting U.S. industries, particularly in the automotive sector.
- **Trade remedies for solar panels and washing machines (2018).** Under Section 201 of the Trade Act of 1974, the U.S. imposed tariffs and quotas on imports of solar panels and washing machines to protect domestic manufacturers.
- **"Buy American" Executive Order (2017, 2021).** Executive orders were issued to strengthen the "Buy American" requirements for federal procurement, aiming to prioritize domestic products in government contracts.
- **Investment screening and CFIUS reform (2018).** The Committee on Foreign Investment in the United States (CFIUS) underwent reform to scrutinize and regulate foreign investments more closely, particularly those in critical industries.
- **Section 201 safeguards on solar products (2018).** The U.S. imposed safeguard tariffs on imported solar cells and modules, asserting that increased imports were causing serious injury to domestic manufacturers.
- **COVID-19 export restrictions (2020).** In response to the pandemic, the U.S. temporarily restricted the export of certain medical supplies and personal protective equipment (PPE) to ensure domestic availability.
- **Mexico displaces China as the U.S.'s top trading partner (2023).** During the first four months of 2023, U.S. trade with Mexico represented 15.4%, followed by trade with Canada at 15.2%, and with China at 12%. Mexico displaced Canada as U.S.'s top trading partners since 2015, as shown in Figure 29.

Figure 29. Mexico displaces China as the U.S.'s top trading partner



NOTES: Data are seasonally adjusted and quarterly. Figures also include April 2023. Shaded area denotes a recession. Total trade is the sum of exports and imports.

Source: Luis Torres, Federal Reserve Bank of Dallas, 2023.

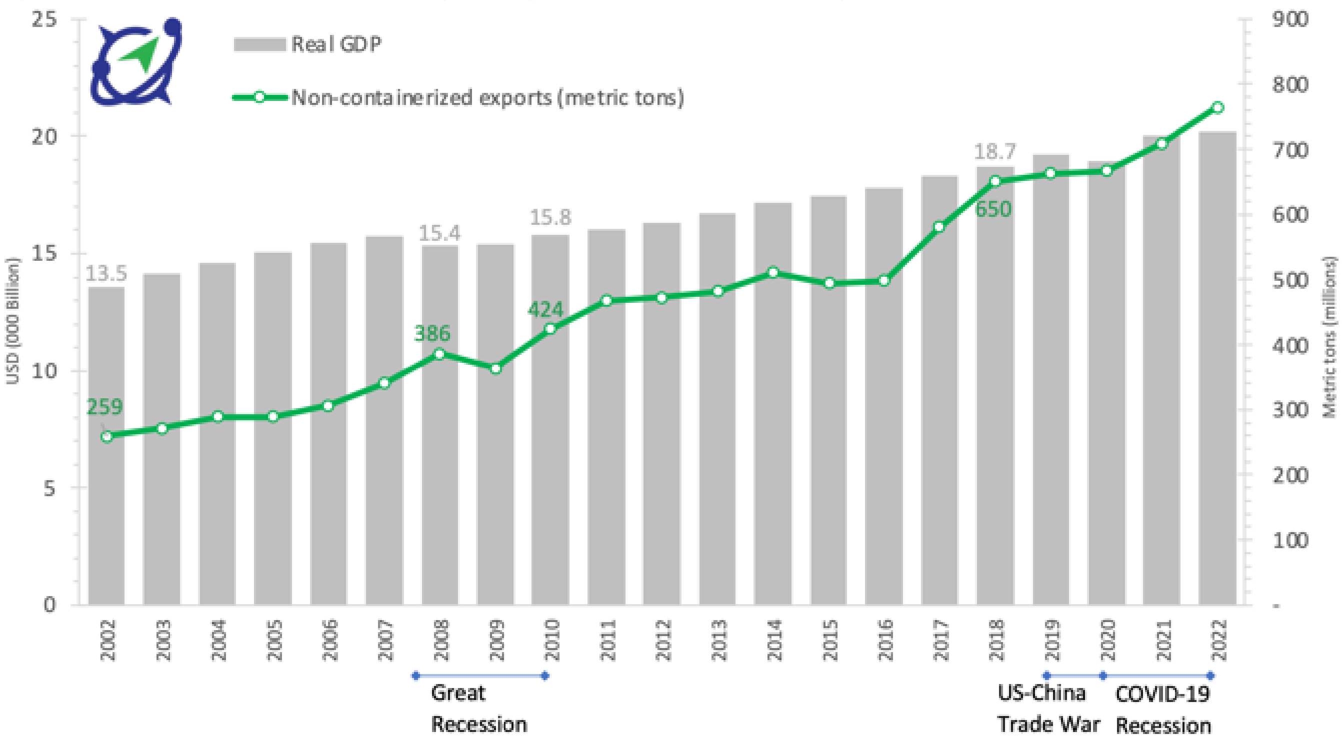
FDI in Mexico increased 41% over the first seven months of 2023, with China being a major stakeholder as Chinese factories relocate to Mexico. China is now Mexico's 2nd largest trading partner, behind the U.S.

3.3 Market demand for **non-containerized** cargoes

3.3.1 Non-containerized cargo 2002-2022

When analyzing the statistical behavior of headhaul volumes for non-containerized exports against Real GDP growth, the intricate relationship between the economy and shipping activity becomes evident. Non-containerized exports soared during periods of strong economic boom to meet global demand, which were fueled by increasing consumer spending, investment, and government spending. On the other hand, economic downturns produced declines in headhaul volumes for shipments because of weaker global demand. This underscores the bulk shipping industry susceptibility to macroeconomic shocks and shifts in trade patterns. Non-containerized exports by vessel and their relationship to Real GDP are shown in Figure 30.

Figure 30. Total non-containerized exports by vessel and its relationship to Real Gross Domestic Product



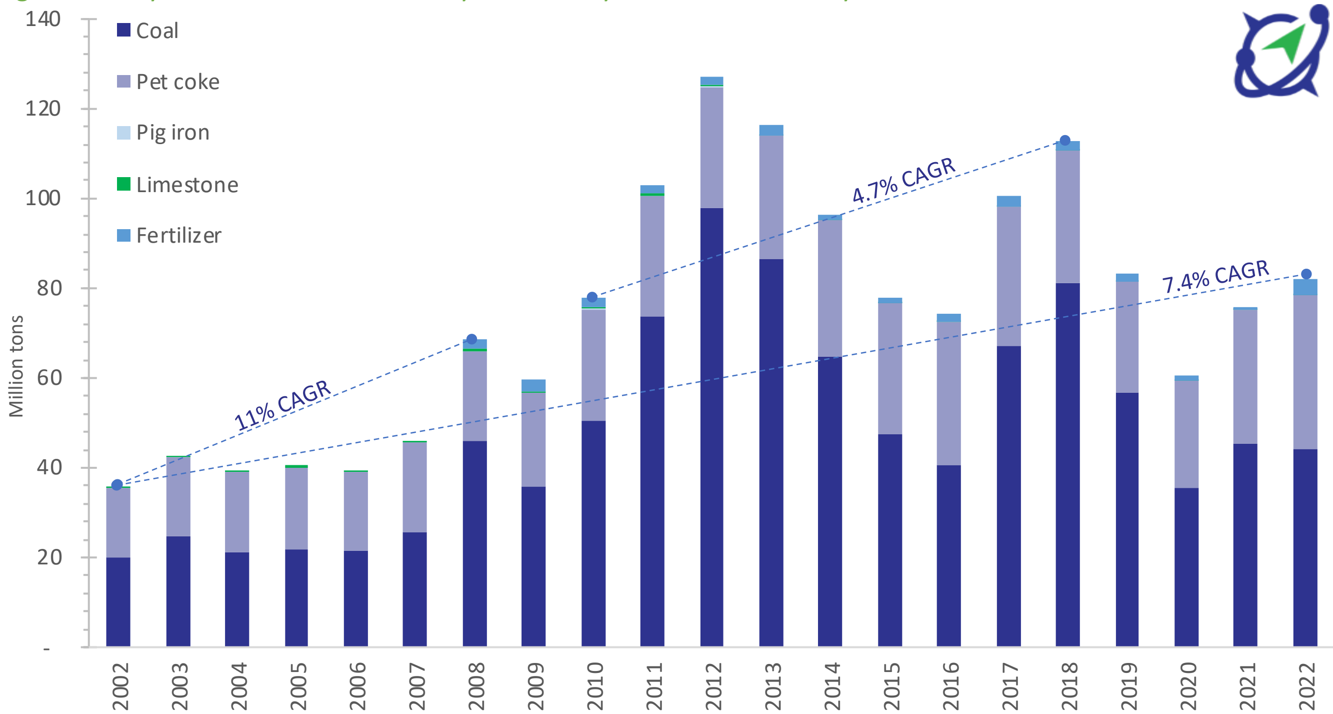
Metric	CAGR 2002-08	2010-18	2002-18
Real GDP growth	2.1%	2.1%	2.0%
Non-containerized exports growth	7.3%	5.5%	6.0%
Non-containerized exports multiplier	3.4x	2.6x	2.9x

Source: Bujanda & Allen, 2023.

3.3.2 *Drybulk*—historical volumes and trends in the market study area

PPHTD has played an important role exporting metallurgic coal for steel production and thermal coal for power generation. Destinations include Asia, Europe, and South America. Market fluctuations, changes in global demand, and evolving policies have influenced the dynamics of coal exports. Pet Coke, a solid byproduct of oil refining, ranks next, with similar market dynamics as the coal markets. Pig Iron follows directed mainly to steel-producing nations like China, India, Brazil, and various European countries. Limestone ranks next and is exported for use mainly in construction, agriculture, and industrial applications. Fertilizer exports is next destined mainly to Latin America and Africa. Overall, drybulk exports from the market study area grew at a CAGR of 11% in the 2002-2008 expansion cycle, interrupted by the Global Recession, and at 4.7% in the 2010-2018 cycle, interrupted in 2019 by the tariff wars and COVID-19, as shown in Figure 31.

Figure 31. Drybulk headhaul volumes by commodity in the market study area 2002-2022



Metric	CAGR 2002-08	2010-18	2002-18
Real GDP growth (CAGR)	2.1%	2.1%	2.0%
Drybulk headhaul volumes growth (CAGR)	11%	4.7%	7.4%
Drybulk headhaul multiplier (times: *x*)	5.5*x*	2.3*x*	3.7*x*

Source: Bujanda & Allen, 2023.

The tradelane to Europe has historically accounted for 39% of the total drybulk headhaul exports from the market study area in the U.S. on average, growing at CAGR of 2.4% in the 2010-2018 expansion cycle. Asia ranks next with 28% of the exports growing at an impressive 11.1%. North America follows with 14% slightly declining. South & Central America is next with 13% growing at 3.7%. Africa ranks next with a 6% market share, growing at an impressive 13.2% annually—the fastest growing trade of all, as shown in Table 5.

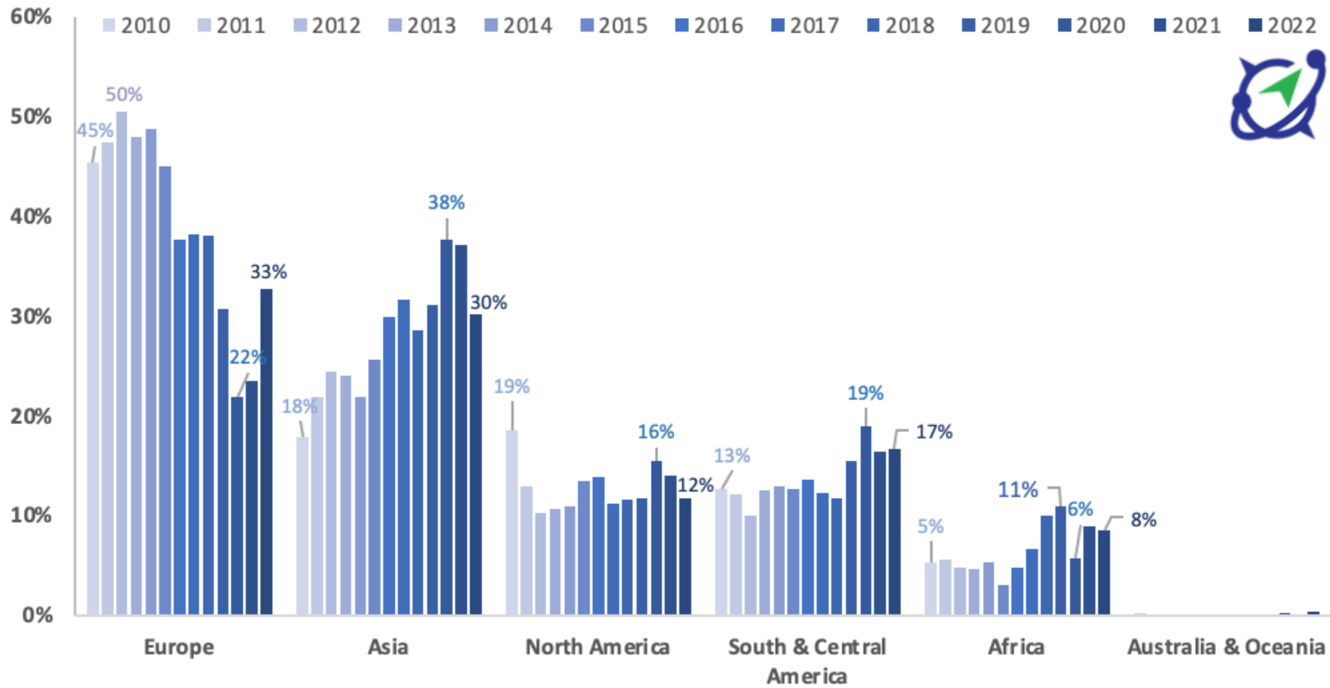
Table 5. ***Drybulk headhaul exports*** by tradelane to all countries from the market study area (**million tons**)

Tradelanes	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2010-18 CAGR
Europe	35.5	48.9	64.2	55.8	46.9	35.1	28.0	38.4	42.9	25.6	13.3	17.8	26.8	**2.4%**
Asia	13.9	22.6	31.1	28.0	21.1	20.0	22.3	31.8	32.3	25.9	22.9	28.1	24.7	**11.1%**
North America	14.5	13.3	13.1	12.4	10.6	10.5	10.3	11.3	13.1	9.8	9.4	10.6	9.6	**-1.2%**
South & Central America	9.9	12.5	12.7	14.6	12.5	9.9	10.1	12.3	13.2	12.8	11.5	12.4	13.7	**3.7%**
Africa	4.1	5.8	6.1	5.3	5.1	2.4	3.5	6.7	11.2	9.1	3.4	6.8	6.9	**13.2%**
Australia & Oceania	0.1	0.0	0.0	0.2	0.1	0.0	0.1	0.1	0.1	0.0	0.1	0.1	0.3	**-3.8%**
Total (world)	**78.0**	**103.0**	**127.2**	**116.3**	**96.3**	**78.0**	**74.4**	**100.6**	**112.8**	**83.2**	**60.6**	**75.8**	**82.0**	**4.7%**

Source: Bujanda & Allen, 2023.

Although Europe has historically accounted for 39% of the total drybulk headhaul exports from the market study area, this was not always the case. In 2010, Europe had a 45% market share of drybulk exports, which peaked at 50% in 2012 before start declining almost every year until 2020 when they bottomed at 22%. During a similar period, drybulk exports to Asia increased from an 18% market share in 2010 to a peak of 38% in 2020 becoming one of the most prominent markets for exports from the U.S. Midwest. Exports from the U.S. Midwest to Europe show a dramatic increase in 2022, as the European Union curtailed Russian fossil fuel imports due to Russia's invasion of Ukraine. This translated into rising imports of alternative energy sources, including coal from alternative suppliers such as the U.S. Showing also positive trends, South & Central America and Africa continue to gain more relevance, as shown in Figure 32.

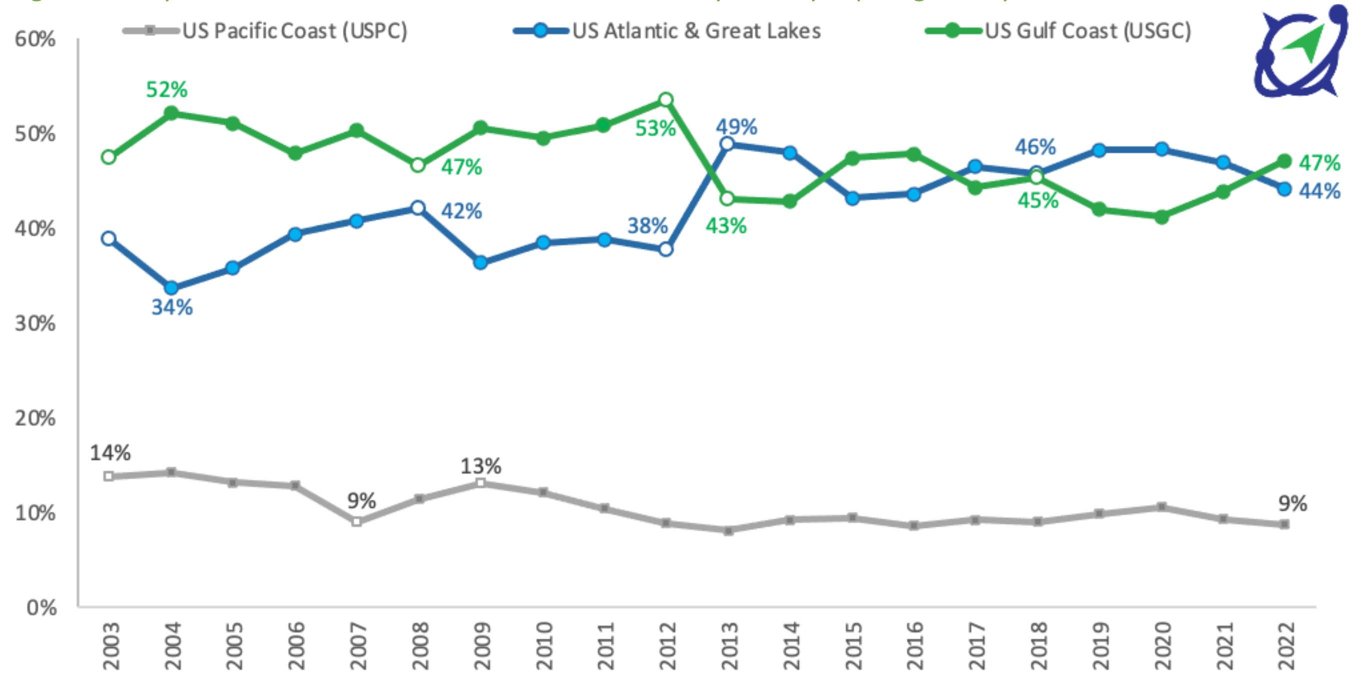
Figure 32. Evolution of shares by tradelane of ***drybulk headhaul exports*** from market study area 2010-2022



Source: Bujanda & Allen, 2023.

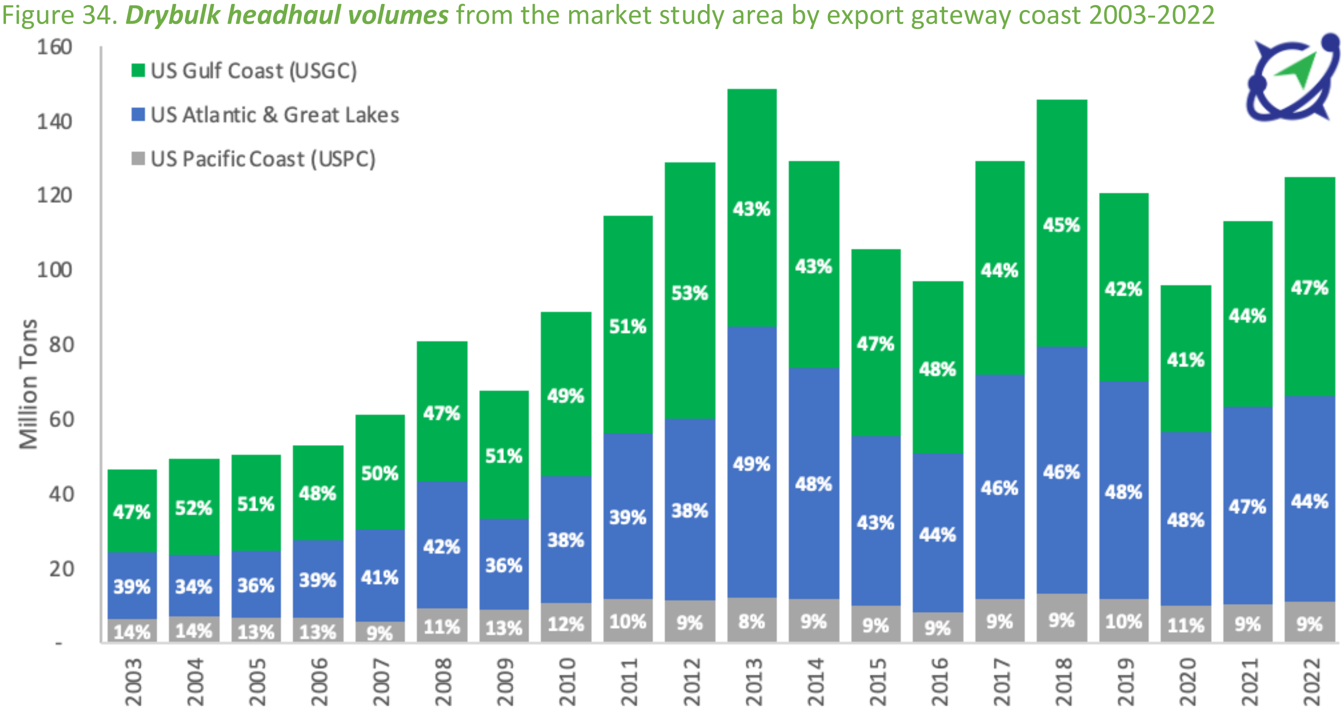
In terms of coastal export outlets for drybulk headhaul exports, the U.S. Gulf Coast (USGC) has had an average market share of 47% between 2003-2022; closely followed by the U.S. Atlantic Coast & the Great Lakes Area with 43% market share. The U.S. Pacific Coast (USPC) has held an average market share of 10% of the export volumes during the same period. Although the USGC was the outlet of choice for U.S. exports until 2012, the next year, the U.S. Atlantic Coast & the Great Lakes outlet overtook more market share surpassing the USGC for more than 15%. This trend remained until 2022 when the USGC start recouping some of the lost market share to the U.S. Atlantic Coast & the Great Lakes area. This trends are shown by market share in Figure 33 and by volume in Figure 34.

Figure 33. Drybulk headhaul volumes from the market study area by export gateway coast



Source: Bujanda & Allen, 2023.

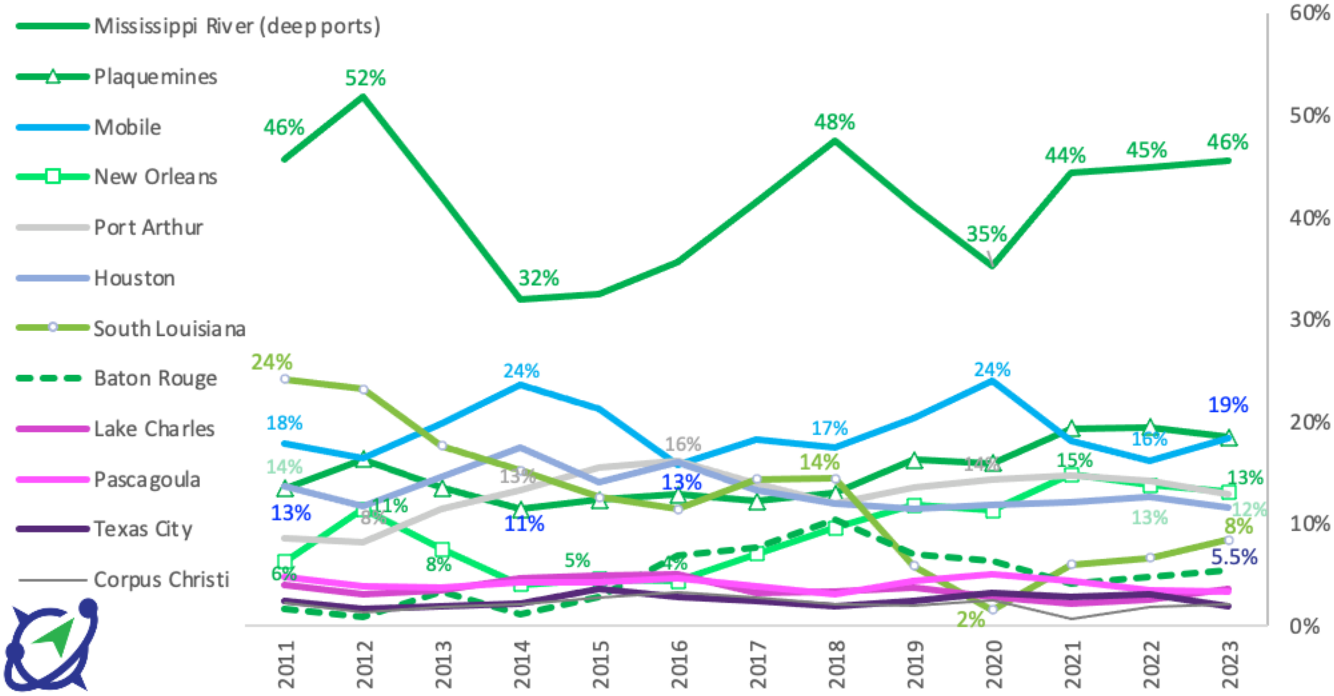
Figure 34. ***Drybulk headhaul volumes*** from the market study area by export gateway coast 2003-2022



Source: Bujanda & Allen, 2023.

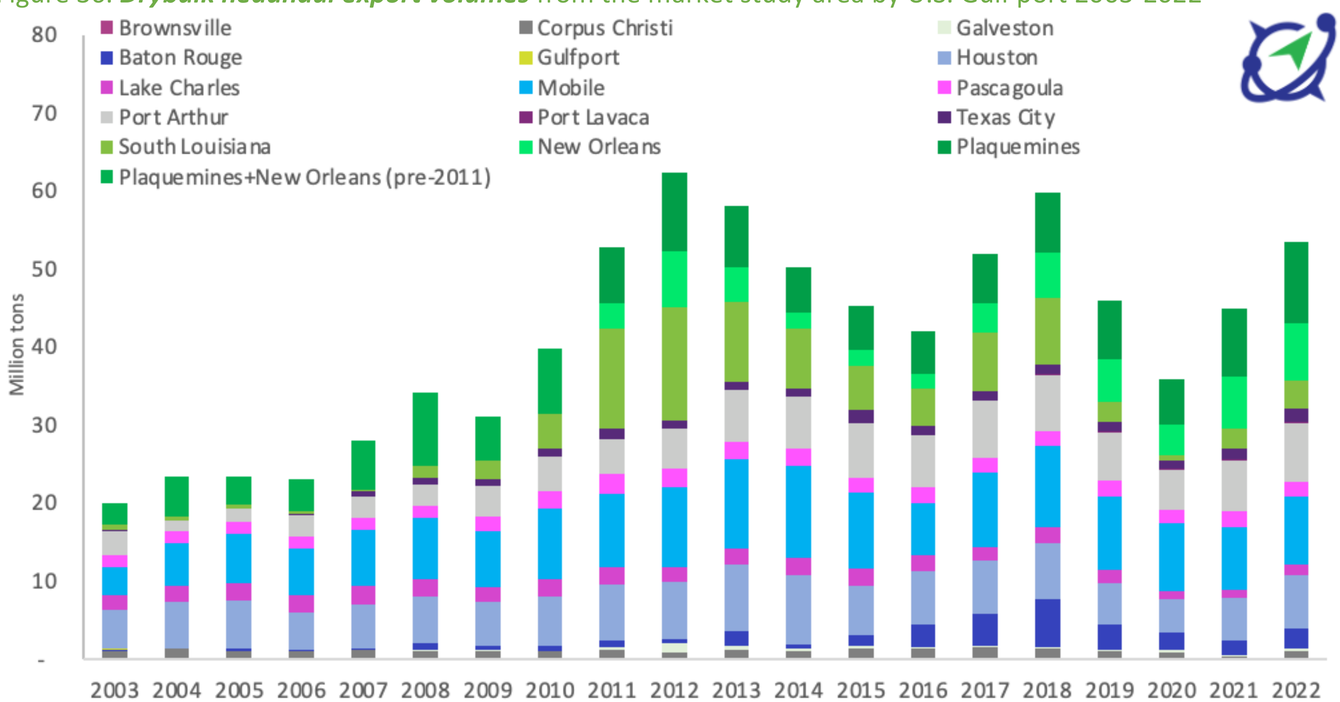
By analyzing the ports in the USGC, the deep ports in the Mississippi River have been the dominating outlet compared to the rest of the USGC, handling 41% of the drybulk headhaul exports based on the 2003-2022 average (45% on 2022 and 46% on 2023). When analyzed individually, PPHTD surpassed South Louisiana for the first time in 2015 and more visible after 2018, reaching 19% of the USGC market share. Mobile ranks next with 19% of the USGC share, followed by Port Arthur with 14%, Houston with 12%, and South Louisiana with 8% for the top 5. Other relevant ports for drybulk exports in the USGC include Pascagoula, Lake Charles, Texas City, and Corpus Christi, in relevant order, as illustrated by market share in Figure 35 and by volume in Figure 36.

Figure 35. Market share by U.S. Gulf port for ***drybulk headhaul exports*** from the market study area



Source: Bujanda & Allen, 2023.

Figure 36. ***Drybulk headhaul export volumes*** from the market study area by U.S. Gulf port 2003-2022



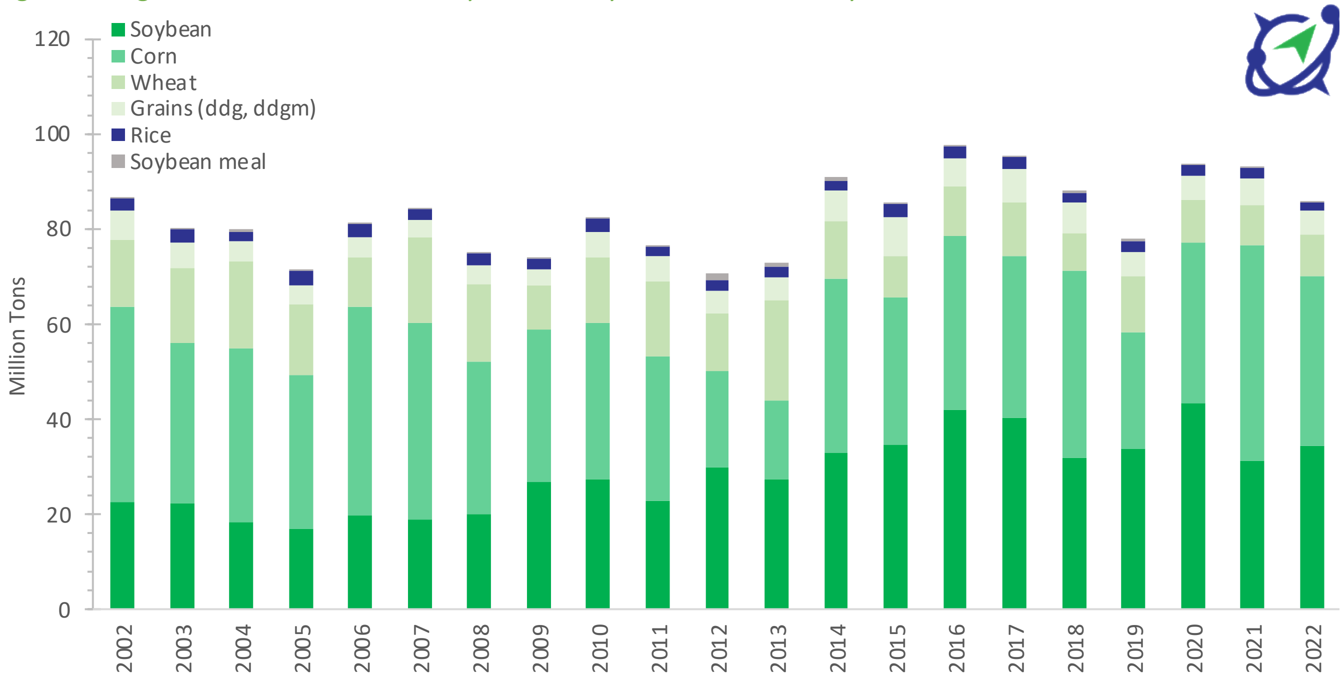
Source: Bujanda & Allen, 2023. Data constraints prevent us from analyzing Plaquemines separate from New Orleans Customs District, as reported by the U.S. Census, prior to 2011. Hence, Bujanda & Allen assumed the U.S. Census reports Plaquemines and New Orleans combined under the "New Orleans Port Customs District" label. After 2011, Bujanda & Allen estimated the breakdown between the New Orleans Customs District and Plaquemines by subtracting the volumes reported by PPHTD from the total volumes reported by U.S. Census.

3.3.3 *Agribulk*—historical volumes and trends in the market study area

PPHTD also plays a key role as a gateway for agribulk exports from the market study area, mainly to Asian markets. Soybean and Corn have historically represented about 80% of the total agribulk exports from the market study area. Business cycles for agribulk products are not as clearly defined as for other commodities because their trade gets impacted by externalities such as draughts, fertilizer availability and cost, harvest yields, in addition to tariffs and similar events.

Soybeans have grown at a CAGR of 7.4% between 2011-2020. **Corn ranks next with a CAGR of 13.3%** between 2013-2021, followed by DDGS which have gained more prominence during the last decade. Wheat, Rice, and Soybean Meal move at a smaller proportion. **All combined, agribulk exports** from the market study area grew at a **CAGR of 3.6%** in the 2012-2020 period, as shown in Figure 37.

Figure 37. Agribulk headhaul volumes by commodity in the market study area 2002-2022



Source: Bujanda & Allen, 2023.

The tradelane to Asia has historically accounted for 49% of the total agribulk exports from the market study area, on average; growing at a CAGR of 2.8% in the 2008-2021 period and 4.2% when the bottom-to-peak period is considered. South & Central America ranks next with a market share of 22% of the total agribulk exports growing at 2.7% 2010-2021 CAGR and at a notable 14.8% bottom-to-peak. North America ranks next with a 11% share growing at 4.9% 2010-2021 CAGR and at 8.7% bottom-to-peak. Europe ranks next with 10% growing at 1.5% and at 13.3% bottom-to-peak. Africa ranks next with a 9% market share decreasing 3.5% during 2010-2021 but growing at an aggressive 21.1% when the bottom-to-peak period is considered. Lastly, Australia & Oceania have the smallest market share with less than 1%; however, it is the fastest growing trade of all, as shown in Table 6.

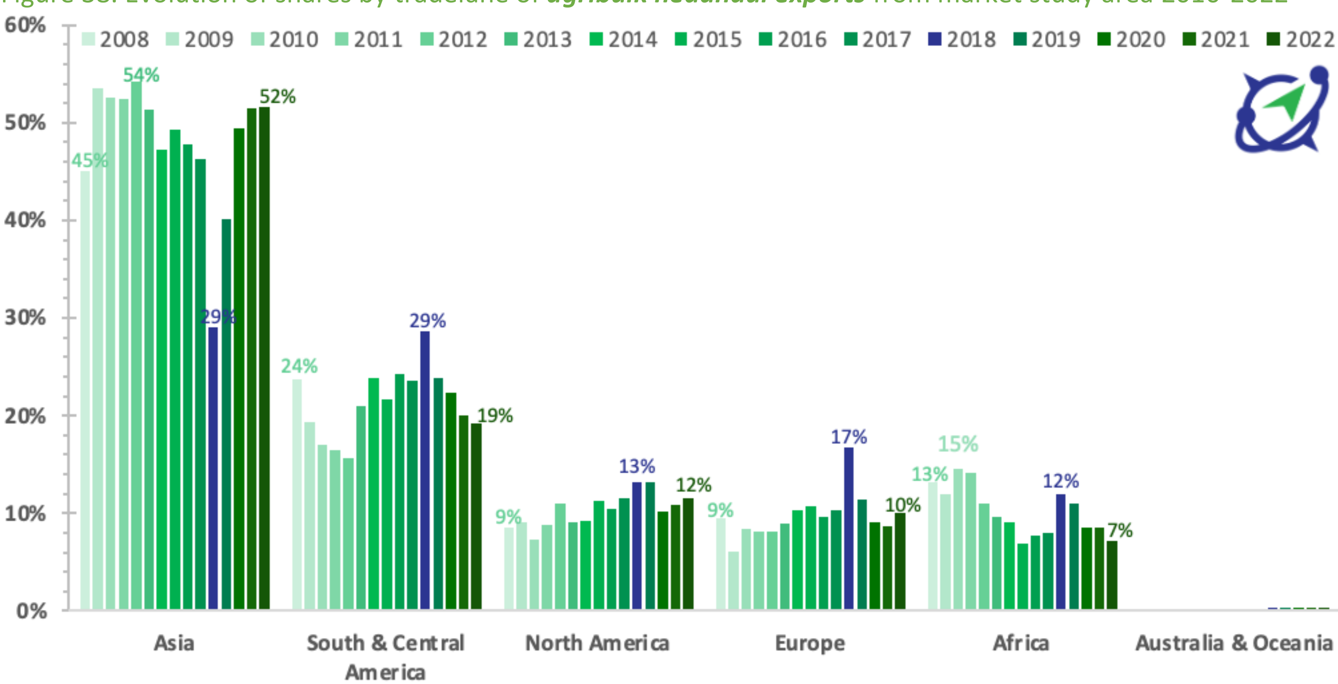
Table 6. ***Agribulk headhaul exports*** by tradelane to all countries from the market study area (**million tons**)

Tradelanes	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2010-21 CAGR	Bottom-to-Peak CAGR
Asia*	33.6	39.1	42.7	39.9	38.0	37.1	43.0	42.2	46.8	44.2	25.6	31.3	46.3	47.9	44.3	**2.8%**	**4.2%**
South & Central America	17.7	14.1	13.8	12.5	11.0	15.2	21.8	18.5	23.7	22.5	25.2	18.6	20.9	18.6	16.5	**2.7%**	**14.8%**
North America	6.4	6.6	6.0	6.7	7.7	6.6	8.4	9.7	10.3	11.1	11.7	10.3	9.5	10.1	9.9	**4.9%**	**8.7%**
Europe	7.0	4.4	6.9	6.1	5.7	6.5	9.3	9.2	9.4	9.8	14.8	8.9	8.6	8.1	8.7	**1.5%**	**13.3%**
Africa	9.9	8.7	11.8	10.8	7.8	6.9	8.3	6.0	7.6	7.7	10.6	8.6	8.0	8.0	6.1	**-3.5%**	**21.1%**
Australia & Oceania	0.00	0.03	0.00	0.00	0.00	0.00	0.15	0.10	0.10	0.11	0.29	0.30	0.37	0.34	0.30	**90.7%**	**130.8%**
Total (world)*	**74.5**	**73.0**	**81.2**	**76.0**	**70.2**	**72.4**	**90.9**	**85.6**	**97.8**	**95.5**	**88.2**	**78.0**	**93.7**	**93.1**	**85.8**	1.7%	8.6%

Source: Bujanda & Allen, 2023. CAGR 2008-2021.

Agribulk exports to Asia bottomed in 2018, the same year that the trade tensions between the U.S. and China peaked when both countries-imposed tariffs on each other's exports. During that same year exports to South & Central America, North America, Europe, and Africa peaked as U.S. exporters pursued alternative markets. After 2018, the share of agribulk exports for the major tradelanes reverted closer to the historical averages (i.e. Asia 49%, South & Central America 22%, North America 11%, Europe 10%, and Africa 9%), as shown in Figure 38.

Figure 38. Evolution of shares by tradelane of ***agribulk headhaul exports*** from market study area 2010-2022

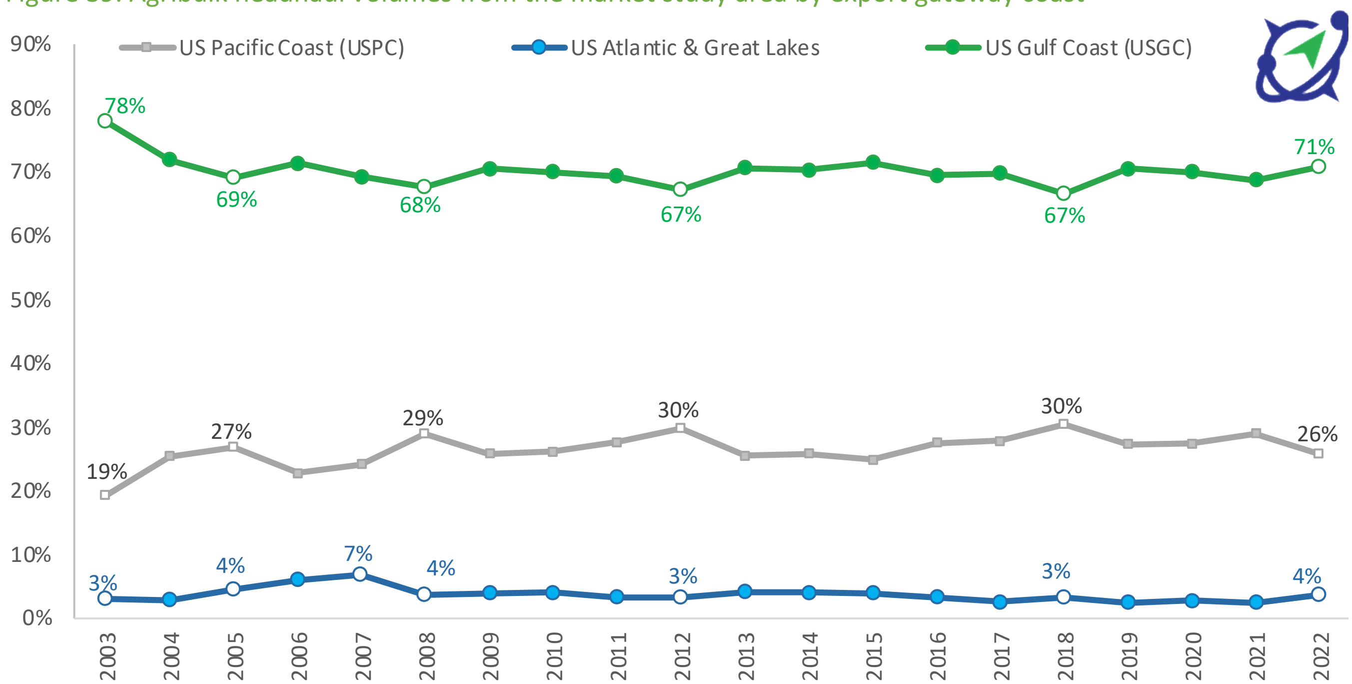


Source: Bujanda & Allen, 2023.

Regarding soybeans, China has consistently been the top destination for exports from the market study area, followed by Mexico, Japan, Indonesia, Taiwan, and the European Union. Regarding corn, top markets include, China, Mexico, Japan, South Korea, Taiwan, and Colombia, among others. Brazil and Argentina, major soybean and corn producers, have been competitors to the U.S. in the global markets. South American crops have continued to grow, influencing global supply dynamics, primarily due to increases in the use of fertilizers, better technology, and in cases such as Brazil due to the increase on the amount of arable land.

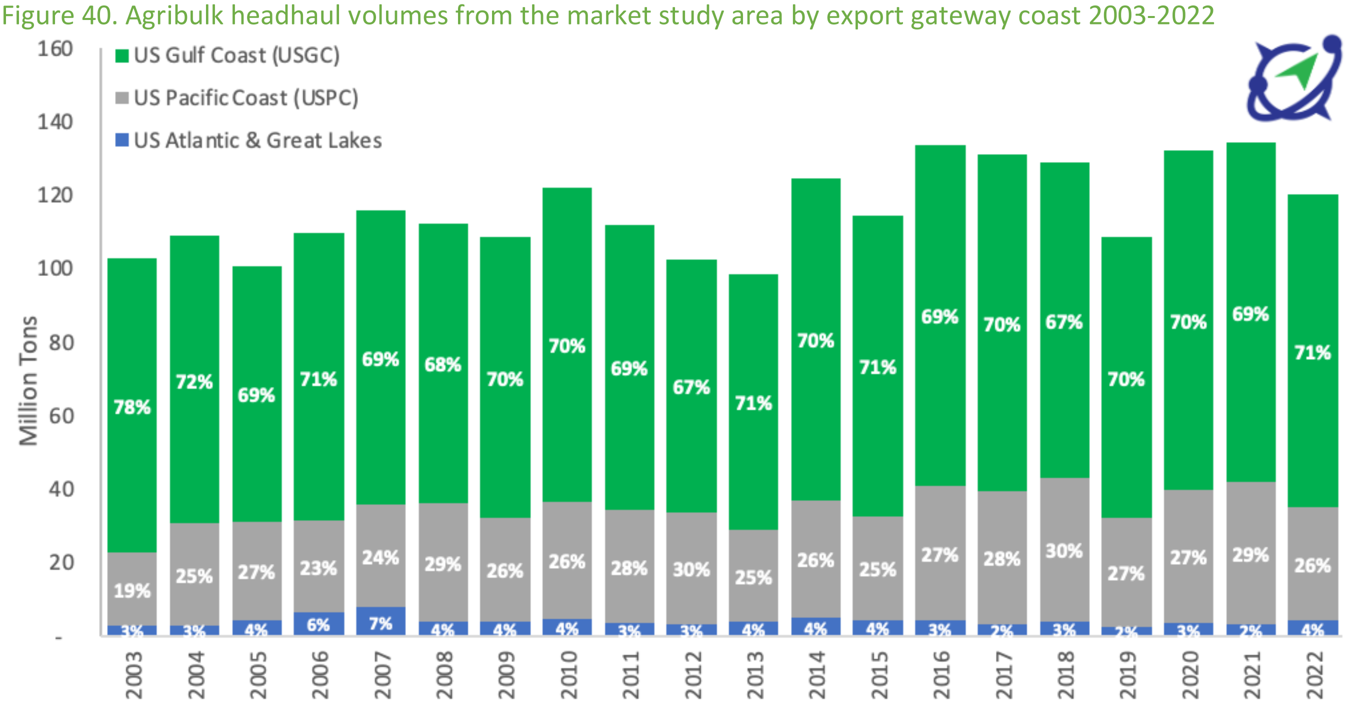
In terms of coastal shares for agribulk exports, the USGC had an average share of 70% between 2003-2022; followed by the U.S. Pacific with 26%. The U.S. Atlantic Coast & the Great Lakes handled an average of 4%. Competition for grain exports between ports in the USGC, particularly PPHTD and ports in New Orleans, and in the USPC is influenced by ocean shipping routes, inland transportation networks, and infrastructure investments. The Mississippi River system supports barge traffic, a more economical way to transport bulk freight from the heartland to export gateways. Although Pacific ports have an ocean shipping and geographic advantage to Asian markets being closer, often this is offset by lengthier and more expensive inland rail hauling. These competitive dynamics are shown by market share in Figure 39 and by volume in Figure 40.

Figure 39. Agribulk headhaul volumes from the market study area by export gateway coast



Source: Bujanda & Allen, 2023.

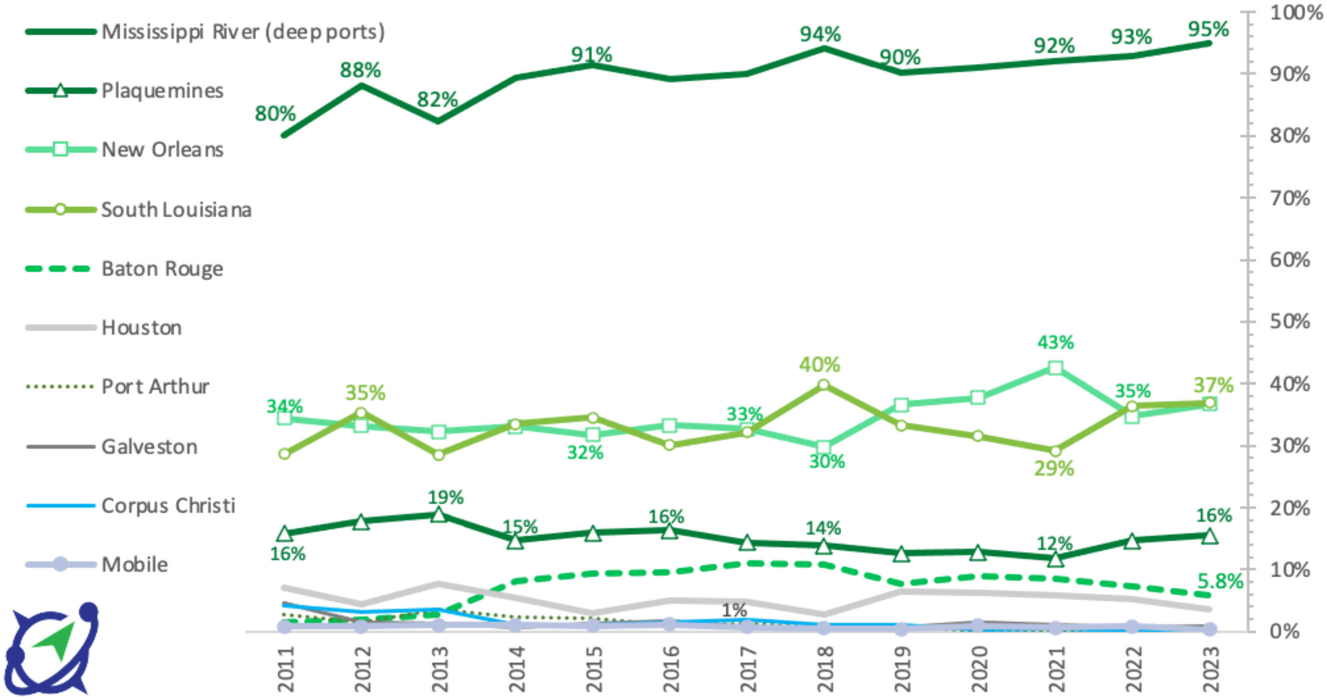
Figure 40. Agribulk headhaul volumes from the market study area by export gateway coast 2003-2022



Source: Bujanda & Allen, 2023.

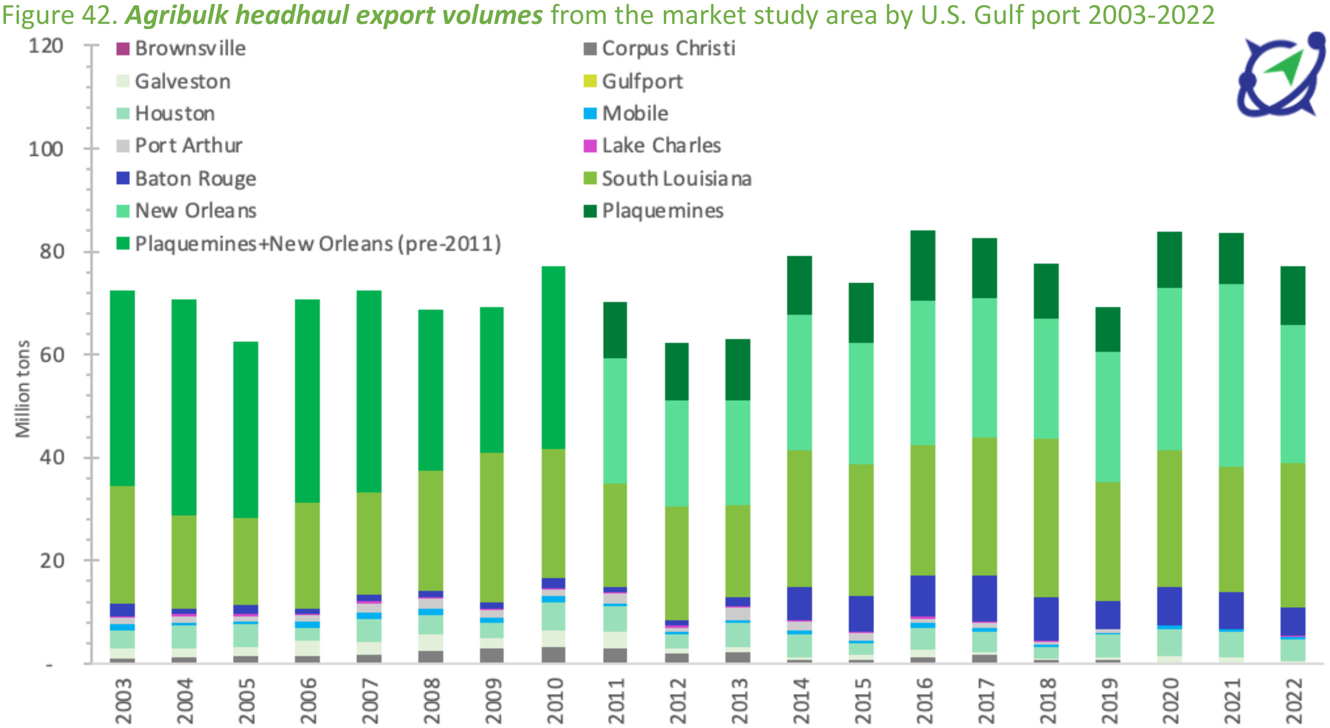
By analyzing the ports in the USGC, the deep ports in the Mississippi River have been the dominating outlet compared to the rest of the USGC, handling 88% of the drybulk headhaul exports based on the 2003-2022 average, and 93% on 2022 alone. South Louisiana and New Orleans rank next with 37% each of the USGC share, followed by PPHTD with 16%, Baton Rouge almost 6%, and Houston 5% for the top 5. Other relevant ports include Port Arthur, Galveston, Corpus Christi, and Mobile, as shown in Figure 41 and by volume in Figure 42.

Figure 41. Market share by U.S. Gulf port for ***agribulk headhaul exports*** from the market study area



Source: Bujanda & Allen, 2023.

Figure 42. ***Agribulk headhaul export volumes*** from the market study area by U.S. Gulf port 2003-2022



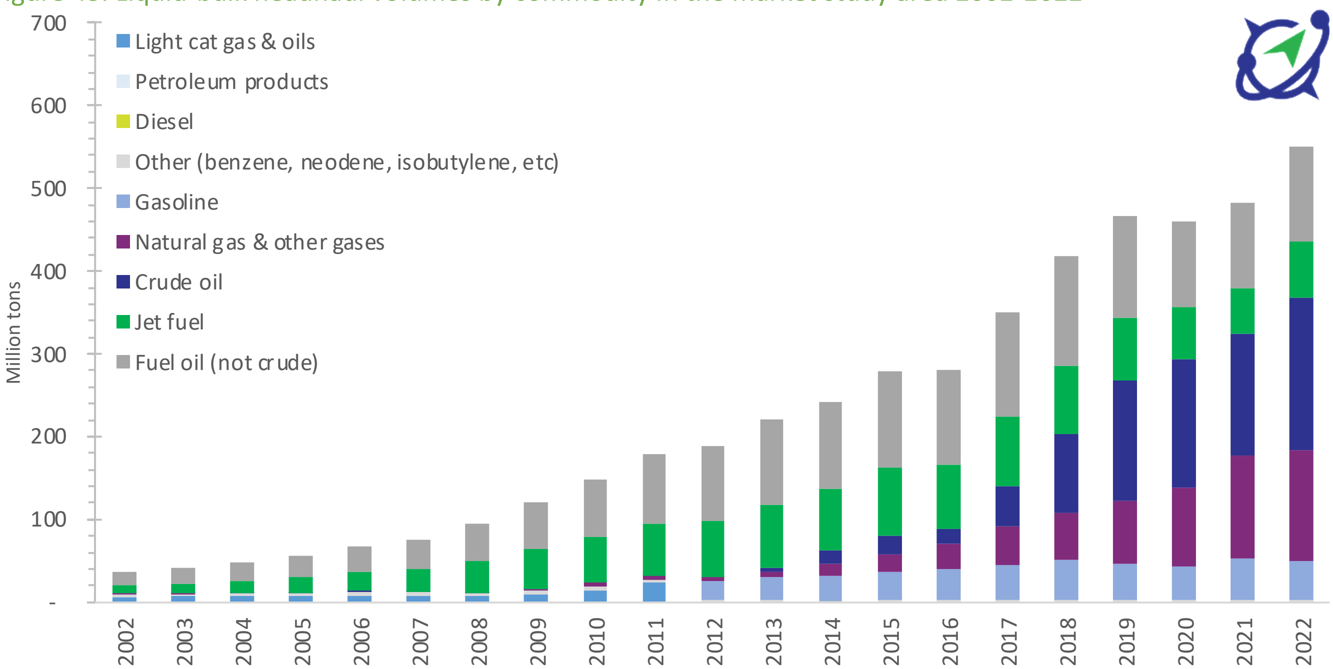
Source: Bujanda & Allen, 2023. Data constraints prevent us from analyzing Plaquemines separate from New Orleans Customs District, as reported by the U.S. Census, prior to 2011. Hence, Bujanda & Allen assumed the U.S. Census reports Plaquemines and New Orleans combined under the "New Orleans Port Customs District" label. After 2011, Bujanda & Allen estimated the breakdown between the New Orleans Customs District and Plaquemines by subtracting the volumes reported by PPHTD from the total volumes by the U.S. Census.

3.3.4 *Liquid-bulk*—historical volumes and trends in the market study area

PPHTD liquid-bulk markets have consistently allowed significant Crude Oil and Diesel shipments, establishing itself as a key player in the changing landscape of energy trade. Fuel oils (not crude), Jet Fuel, Crude Oil, and more recently Natural Gas have represented more than 70% of the total oil and fuel exports from PPHTD and more than 85% of the exports from the market study area. Business cycles for liquid-bulk products move in line with the economic cycles, but also impacted by supply dynamics from major producing groups such as OPEC, OPEC+, and U.S. Shale Regions.

Fuel oils (not crude) grew at a **CAGR of 10% 2002-2022.** Jet Fuel ranks next also with a **CAGR of 10%** in the same period. **Crude Oil** grew at an impressive **CAGR of 56%**, accelerating particularly after the U.S. lifted restrictions on crude oil exports on December 2015. **Natural Gas** grew at an impressive **CAGR of 27%**, also accelerating after a regulatory shift allowed LNG exports in early 2016. Cheniere Energy's Sabine Pass LNG in Louisiana began exporting LNG in 2016—the first export terminal in the Lower 48. **Gasoline** had a 2002-2022 **CAGR of 8%**. Combined, the Other (benzene, neodene, isobutylene) category also represents a prominent volume with growth. Liquid-bulk export volumes by major commodity group are shown in Figure 43.

Figure 43. Liquid-bulk headhaul volumes by commodity in the market study area 2002-2022



Source: Bujanda & Allen, 2023.

The tradelane to South & Central America has historically accounted for 38% of the total liquid-bulk exports from the market study area, on average; growing at a CAGR of 10.8% during 2008-2021. Asia ranks next with an market share of 18% of the total liquid-bulk exports, which in recent years climbed above 30%, growing at a CAGR of 19.7% during 2008-2021. Europe and North America rank next each with 21% of the export market, growing at 14% and 12.1%, respectively. Africa has about 3% market share, growing at 8%. Lastly, Australia & Oceania has the smallest market share with less than 1%; however, it is the fastest growing trade of all, as shown in Table 7.

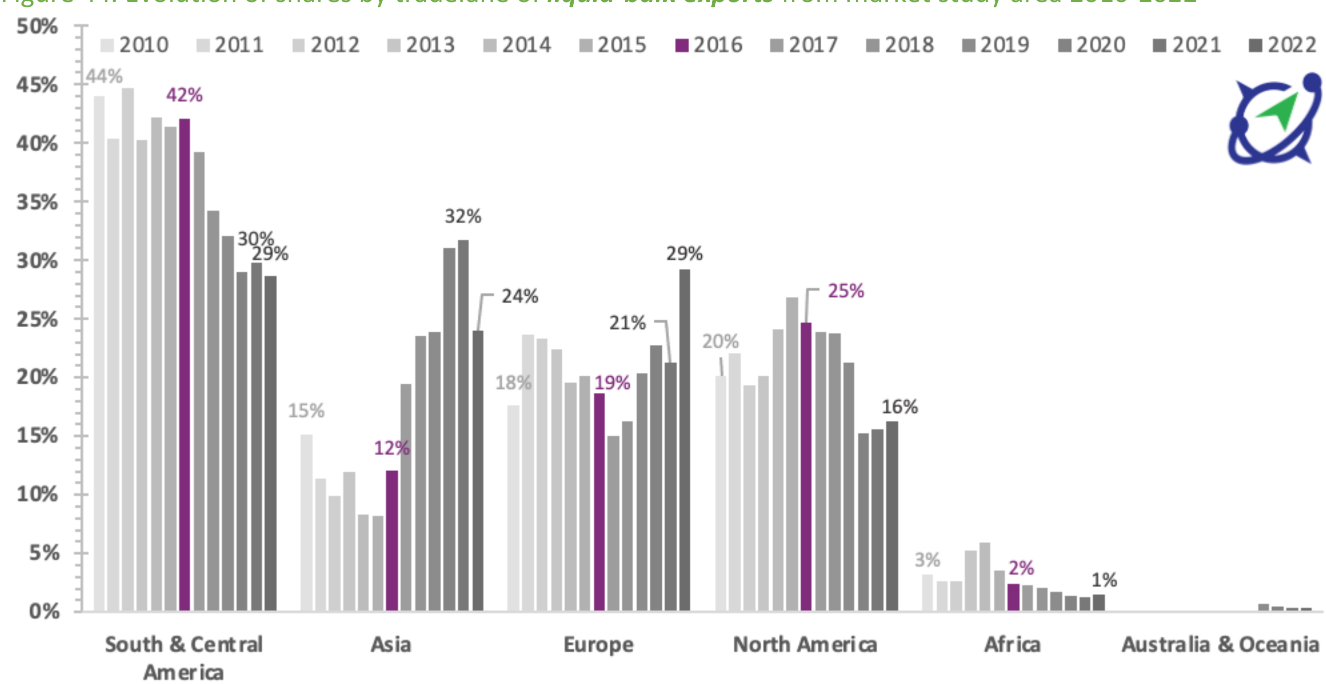
Table 7. ***Liquid-bulk headhaul exports*** by tradelane to all countries from the market study area (**million tons**)

Tradelanes	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2010-22 CAGR
South & Central America	37.8	44.7	64.9	72.2	84.4	88.6	102.1	115.6	118.3	137.1	142.7	149.6	133.5	143.7	157.8	**10.8%**
Asia	10.7	17.4	22.4	20.3	18.7	26.3	20.0	23.0	33.9	68.0	98.3	111.6	143.0	153.0	132.3	**19.7%**
Europe	25.7	33.1	26.0	42.3	43.9	49.4	47.2	56.2	52.5	52.3	68.0	94.8	104.8	102.5	161.1	**14.0%**
North America	18.1	20.1	29.7	39.4	36.4	44.4	58.2	74.9	69.5	83.5	99.2	99.2	70.3	75.2	89.4	**12.1%**
Africa	2.7	4.7	4.7	4.7	5.0	11.6	14.3	10.0	6.7	8.1	8.6	8.2	6.3	5.9	8.0	**8.0%**
Australia & Oceania	0.09	0.16	0.03	0.05	0.29	0.10	0.18	0.01	0.28	0.54	0.69	3.14	2.16	1.66	2.16	**25.8%**
Total (world)	**46.7**	**58.0**	**60.4**	**86.4**	**85.6**	**105.5**	**119.9**	**141.1**	**129.1**	**144.4**	**176.5**	**205.3**	**183.5**	**185.2**	**260.7**	**13.1%**

Source: Bujanda & Allen, 2023. CAGR 2008-2021.

The U.S. significantly expanded its natural gas and crude oil export capacity in recent years, particularly after lifting long-standing restrictions on crude oil and natural gas exports in 2016. A major development in U.S. exports came with the opening of the Asian and European markets, which gained more prominence after 2016 over markets in South & Central America. In 2020, the tradelane of Asia surpassed that of South & Central America peaking in 2021 with a 32% market share, versus 29% of South & Central America in the same year. A similar trend is observed for the European trade which peaked in 2022 with a 29% share as shown in Figure 44.

Figure 44. Evolution of shares by tradelane of ***liquid-bulk exports*** from market study area 2010-2022

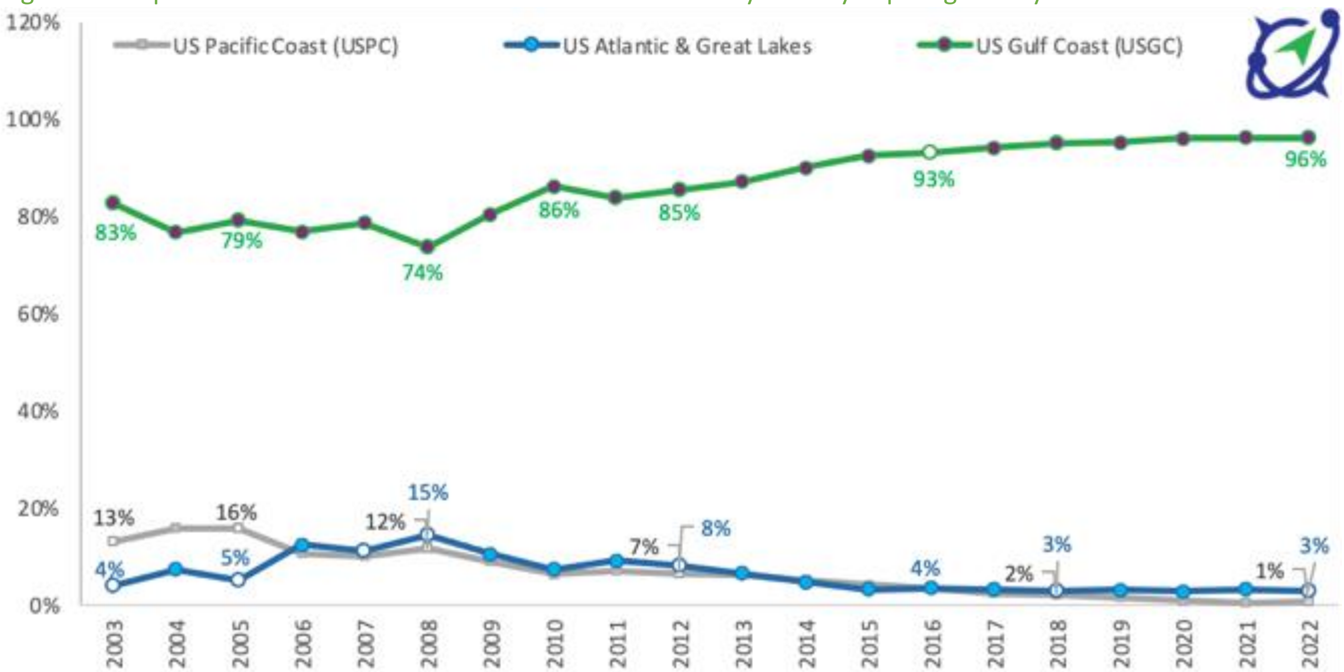


Source: Bujanda & Allen, 2023.

The development of hydraulic fracturing (fracking) and horizontal drilling technologies has enabled the rapid and cost-effective extraction of oil and gas from shale rock formations. This turned the U.S. from a net importer into a net exporter of oil and gas products, while helping to increase stability against geopolitical supply disruptions. Main Latin American liquid-bulk destinations include, by relevant order: Brazil, Chile, Peru, Colombia, Ecuador, Argentina, Uruguay, and Venezuela. Main Asian destinations include, by relevant order: China, South Korea, Japan, India, Singapore, Taiwan, and Thailand.

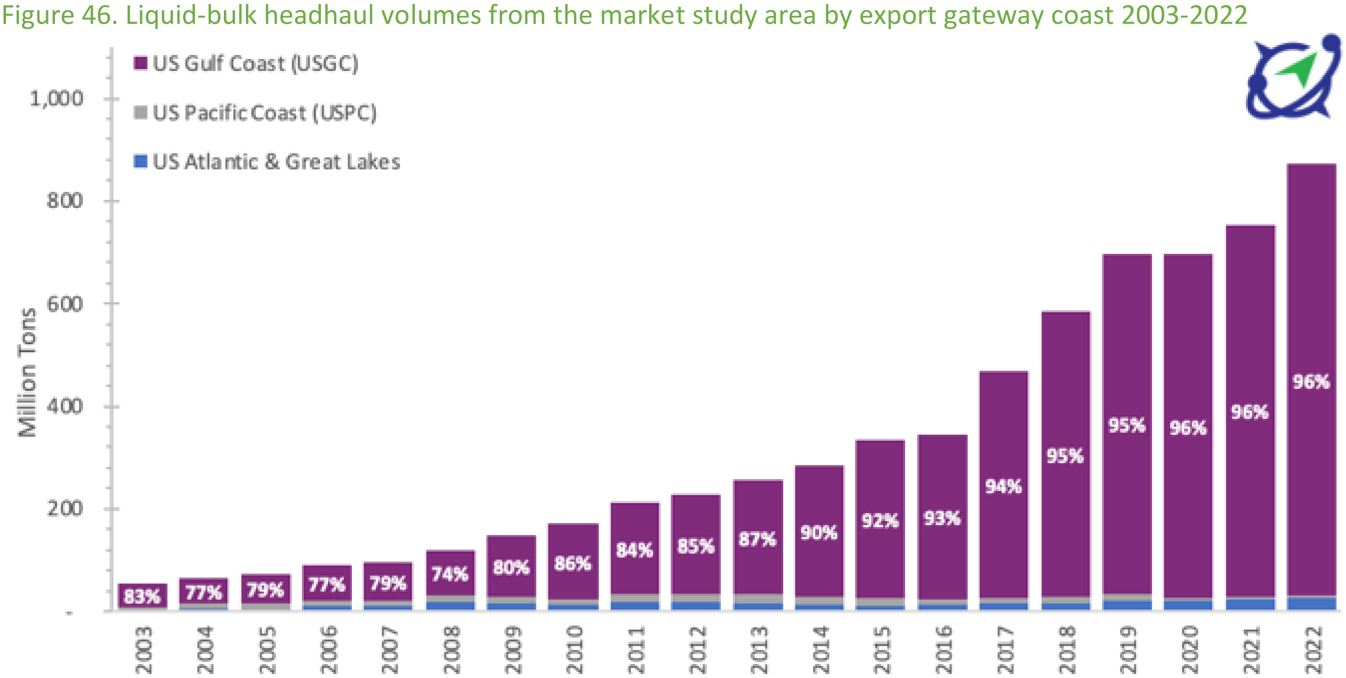
In terms of coastal shares for liquid-bulk exports, the USGC has average market share of 87% between 2003-2022, surpassing by far exports via ports in the USPC and in the U.S. Atlantic Coast and the Great Lakes. The U.S. Atlantic Coast & the Great Lakes handled an average of 6% of liquid-bulk exports. Competition for liquid- exports flows is largely influenced by the location of oil and gas extraction sites and of the refineries that process their products and the availability of pipeline connectivity among the extraction sites, the refineries, and the export gateway ports, which is highly concentrated near the USGC. These competitive dynamics are illustrated by market share in Figure 45 and by volume in Figure 46.

Figure 45. Liquid-bulk headhaul volumes from the market study area by export gateway coast



Source: Bujanda & Allen, 2023.

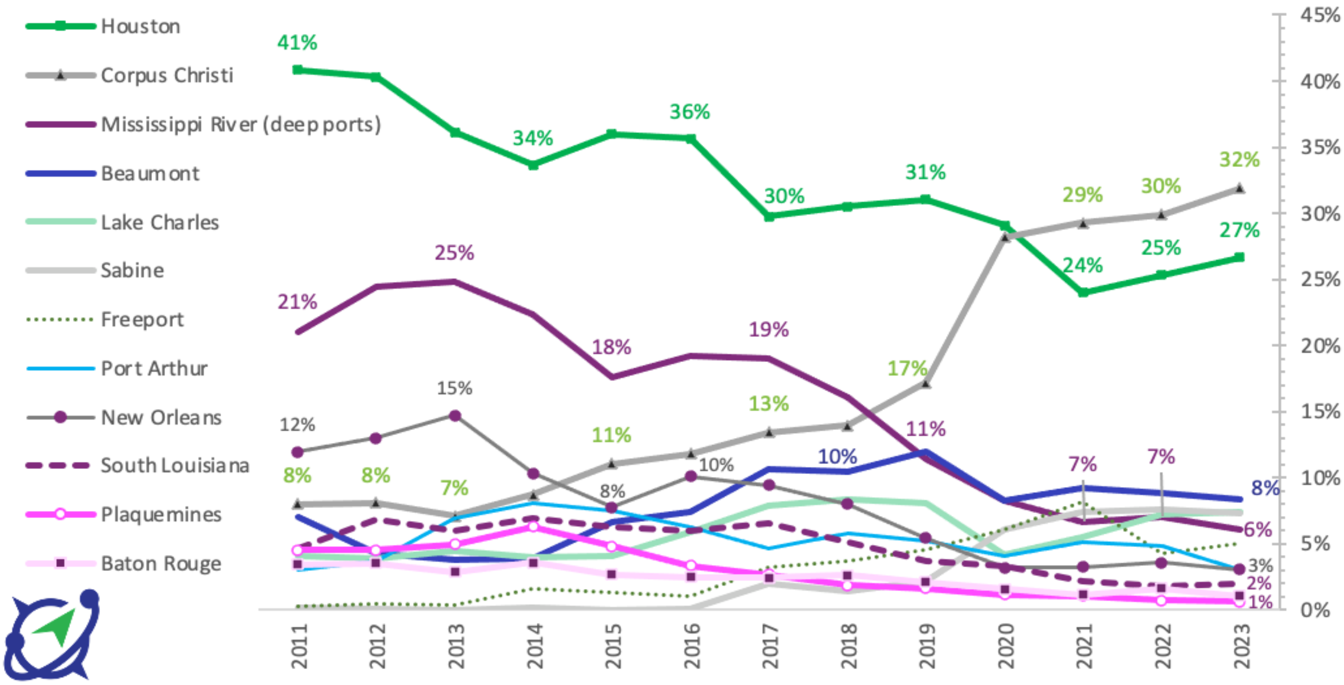
Figure 46. Liquid-bulk headhaul volumes from the market study area by export gateway coast 2003-2022



Source: Bujanda & Allen, 2023.

Starting in 2015, Corpus Christi surpassed all the deep ports in the Mississippi River and in the USGC after 2020 when it surpassed Houston. This is due to the proximity to the Eagle Ford, Permian Basin, and the Barnett shale oil & gas plays. Deep ports in the Mississippi had historically ranked second. This does not mean that the volumes of the other USGC ports have decreased; it only means that the volumes thru Corpus Christi have grown way faster. Increased volumes from the Texas shale plays have also impacted the ports of Beaumont, Sabine, Freeport, and Port Arthur, as shown in Figure 47 and by volume in Figure 48.

Figure 47. Market share by U.S. Gulf port for ***Liquid-bulk headhaul exports*** from the market study area



Source: Bujanda & Allen, 2023.

Figure 48. ***Liquid-bulk headhaul export volumes*** from the market study area by U.S. Gulf port 2003-2022

Source: Bujanda & Allen, 2023. Data constraints prevent us from analyzing Plaquemines separate from New Orleans Customs District, as reported by the U.S. Census, prior to 2011. Hence, Bujanda & Allen assumed the U.S. Census reports Plaquemines and New Orleans combined under the "New Orleans Port Customs District" label. After 2011, Bujanda & Allen estimated the breakdown between the New Orleans Customs District and Plaquemines by subtracting the volumes reported by PPHTD from the total volumes by the U.S. Census.

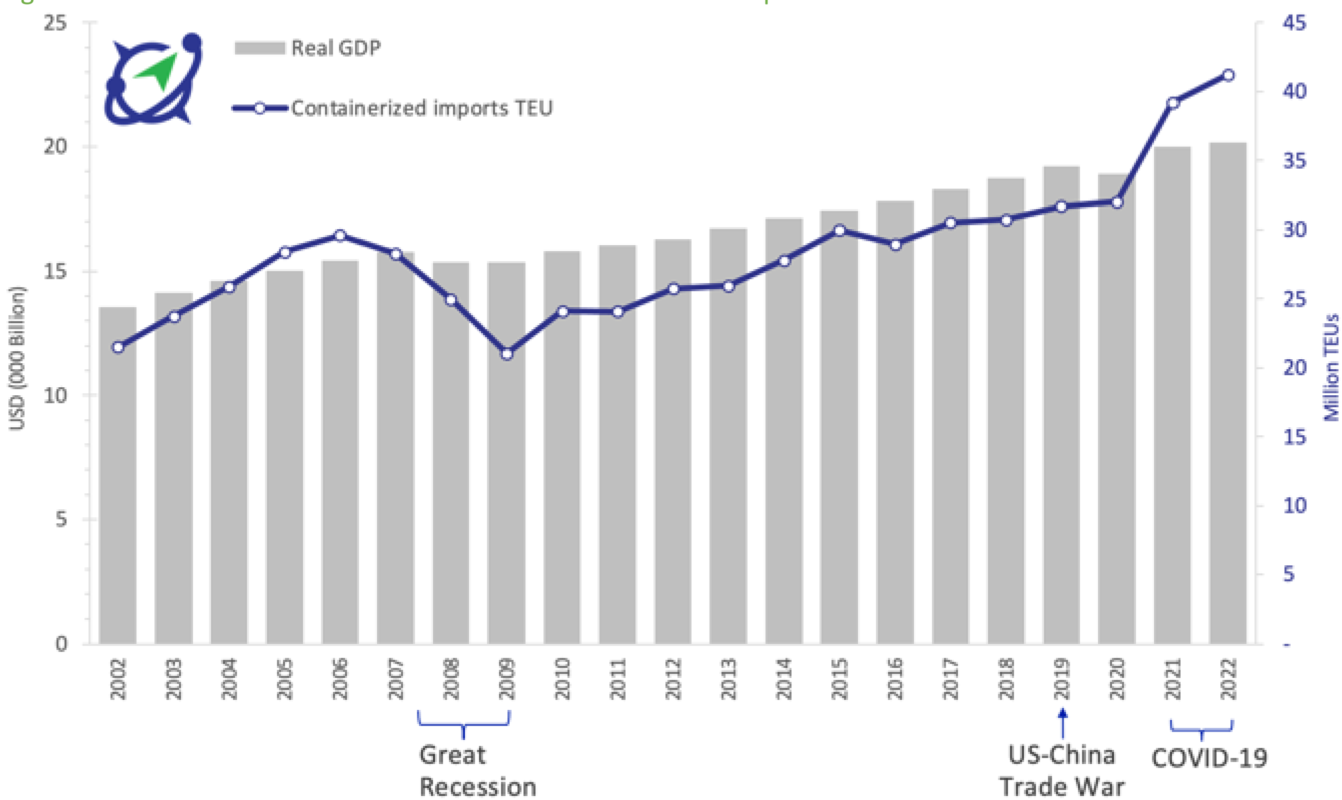
3.4 Market demand for containerized cargo

This section analyzes North American market demand for containerized cargo, considering inbound and outbound, loaded, and empty containers. Bujanda & Allen quantified and assessed total N. America port throughput shares for each of the Pacific, Atlantic, and Gulf coasts and international laden volumes breaking them down by imports and exports, headhaul and backhaul. We analyzed headhaul volumes for imports and exports and identify the tradelane composition for each (i.e. Asia, Europe, South & Central America, Africa, and Oceania). We also analyzed total headhaul volume and market share by tradelane (i.e. Asia, Europe, South & Central America, Africa, and Oceania) for each of the U.S. Pacific, Atlantic, and Gulf coasts.

3.4.1 Containerized cargo and economic activity 2002-2022

When analyzing the statistical behavior of headhaul volumes for containerized imports against Real GDP growth, containerized imports soared during periods of strong economic boom to meet global demand, which were fueled by increasing consumer spending. On the other hand, economic downturns produced declines in headhaul volumes for shipments because of weaker U.S. demand. Containerized headhaul imports by vessel and their relationship to Real GDP are shown in Figure 49.

Figure 49. Containerized headhaul volumes and their relationship to Real GDP



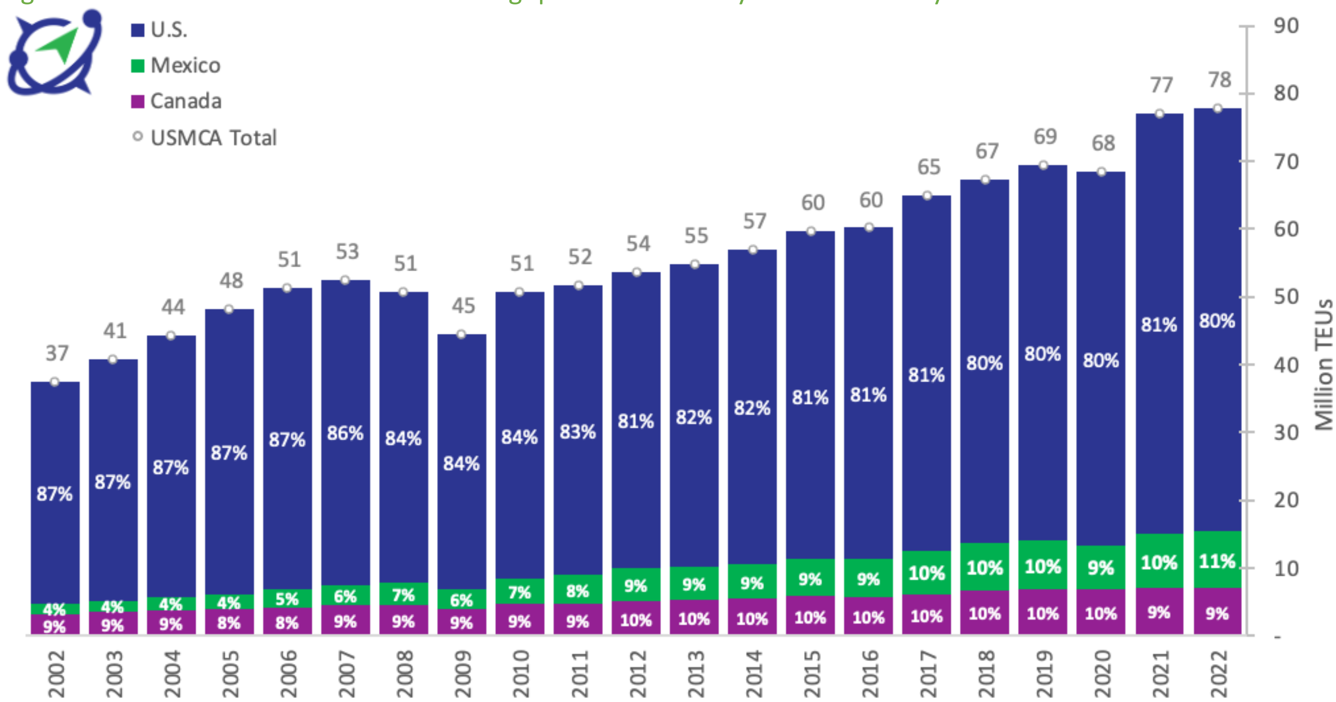
Metric	CAGR 2002-08	2010-18	2002-18
Real GDP growth	2.1%	2.1%	2.0%
Containerized imports growth	2.5%	3.1%	2.3%
Containerized imports multiplier	**2.2x**	**2.0x**	**1.1x**

Source: Bujanda & Allen, 2023.

3.4.2 North America market for containerized cargo

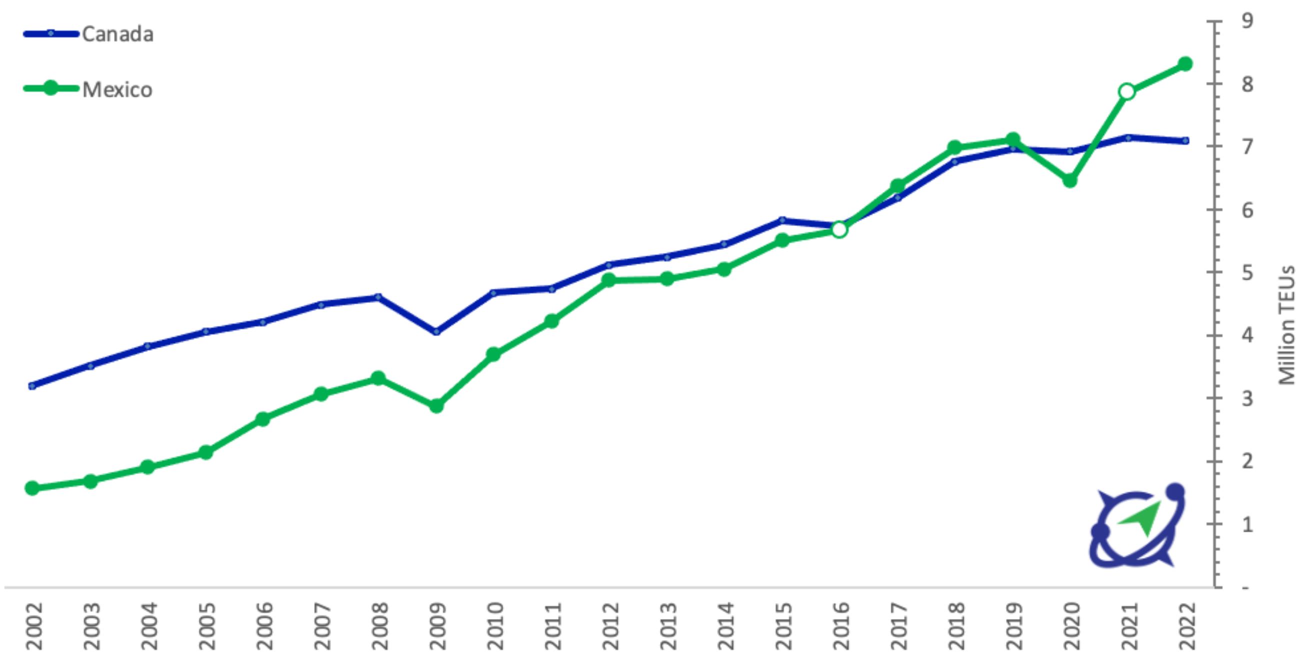
The North American market for containerized cargo is defined as the USMCA free trade region. The U.S. is the destination of a significant number of containers arriving via Canadian and Mexican ports. Similarly, some containers imported via the U.S., mainly via the U.S. West Coast (USWC), carry raw materials and inventories-in-process that travel to manufacturing plants in Mexico, where products are finished, and then travel back into the U.S., which is the main destination for final consumption. The U.S. has consistently comprised more than 80% of the North American since 2002, as shown in Figure 50. Mexico container throughput started accelerating after 2010, surpassing Canadian volumes after 2016, interrupted only in 2020 due to COVID-19, and growing more prominently after 2021, as shown in Figure 51.

Figure 50. North American container throughput and shares by USMCA country



Source: Bujanda & Allen, 2023. *% shares rounded up to the nearest integer.

Figure 51. Container throughput via Mexico versus Canada



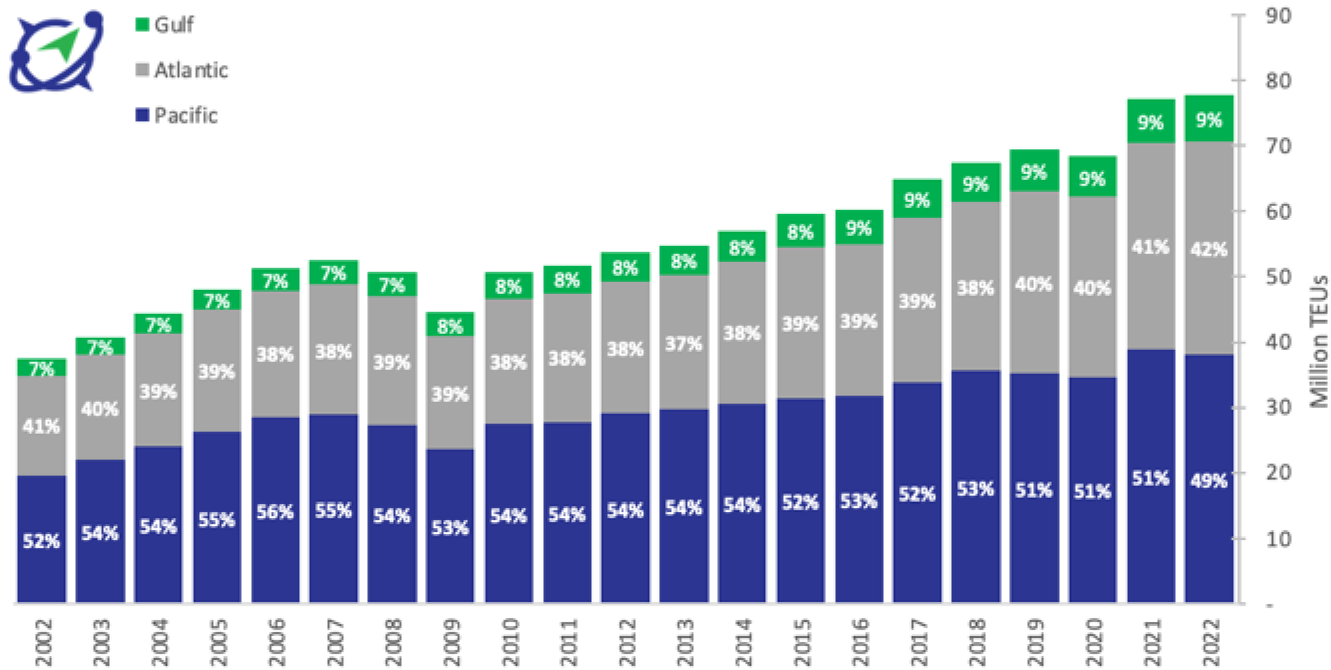
Source: Bujanda & Allen, 2023.

This trend is expected to continue, as more Chinese FDI continues spurring reshoring of production plants from Asia to Mexico.

Coastal shares

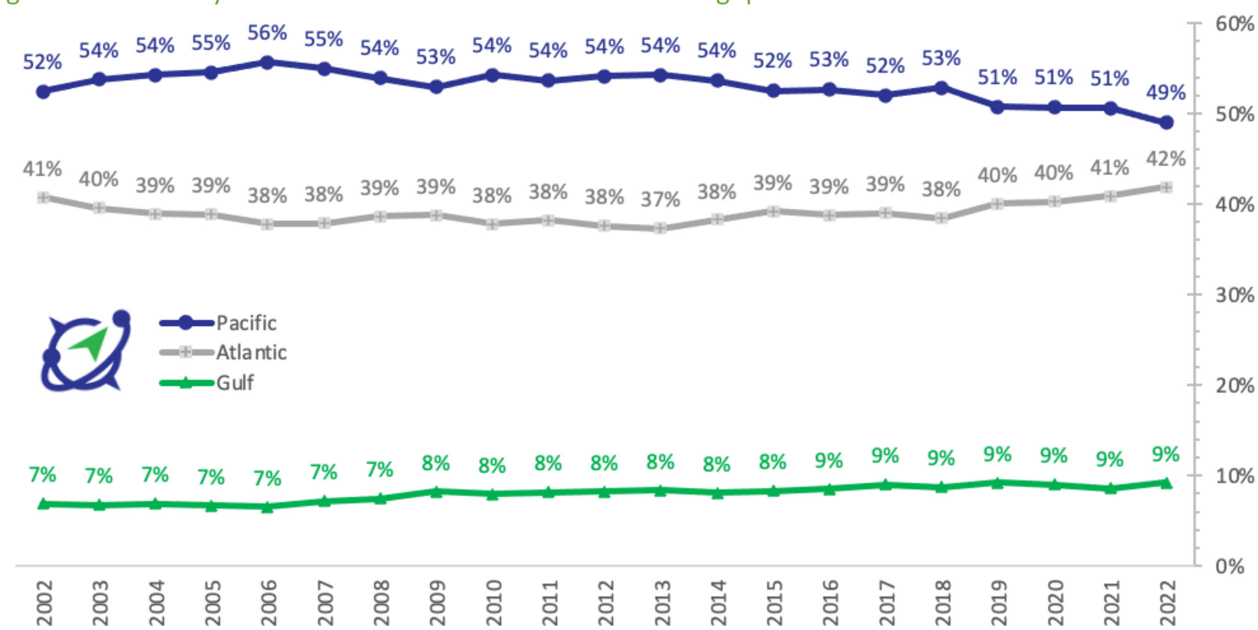
In terms of coastal shares, North American container throughput has historically been dominated by ports in the Pacific Coast, which market share peaked in 2006 and has continued to decrease until 2022 with 49%. Ports in the Atlantic and Gulf coasts have captured some of the market from ports if the Pacific. These trends accelerated after 2019, when the COVID-19 restrictions caused supply chain disruptions at most ports and were particularly notorious at the ports of Los Angeles and Long Beach. Supply chain disruptions including congestion, labor issues, increased consumer demand and shortages of empty containers. The North American container throughput broken down by coastal shares is shown in Figure 52. The Atlantic Coast had a 2022 market share of 42% and the Gulf of 9%, as shown Figure 53.

Figure 52. North American container throughput and shares by coast



Source: Bujanda & Allen, 2023. *% shares rounded up to the nearest integer.

Figure 53. Shares by coast of North American container throughput

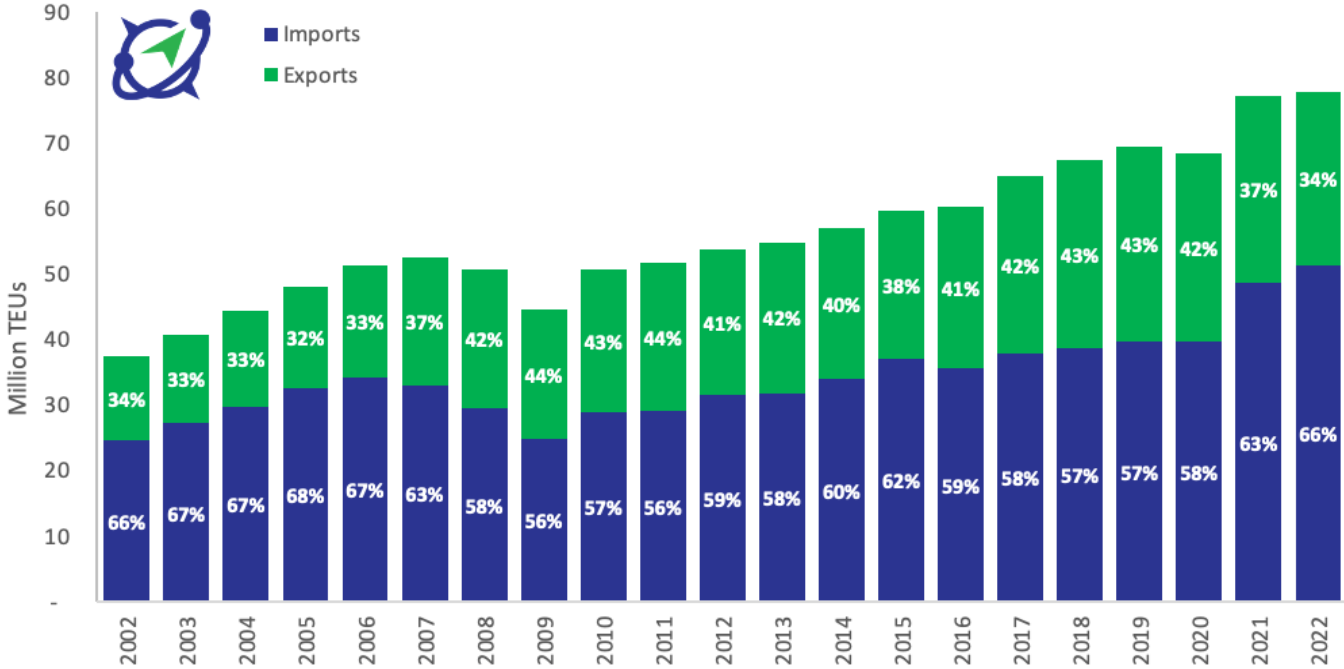


Source: Bujanda & Allen, 2023. *% shares rounded up to the nearest integer.

North America containerized cargo trade balance

In terms of headhaul versus backhaul trade flow, North American international imports have historically represented about 61% of the total trade balance compared to 39% corresponding to exports. The trade balance has changed over the years. Between 2002-2008, the share for imports was about 65% compared to 35% for exports, which decreased to 59% for imports and 41% export between 2010-2018, prior to the beginning of the U.S.-China Trade Wars and COVID-19 disruptions. During 2020-2022, these trends have reverted more aligned with long-term trends, having imports at an average of 62% and exports at 38%, even reaching 66% for imports and 34% for exports in 2022, as shown in Figure 54.

Figure 54. North American international laden volumes by trade flow (imports & exports)

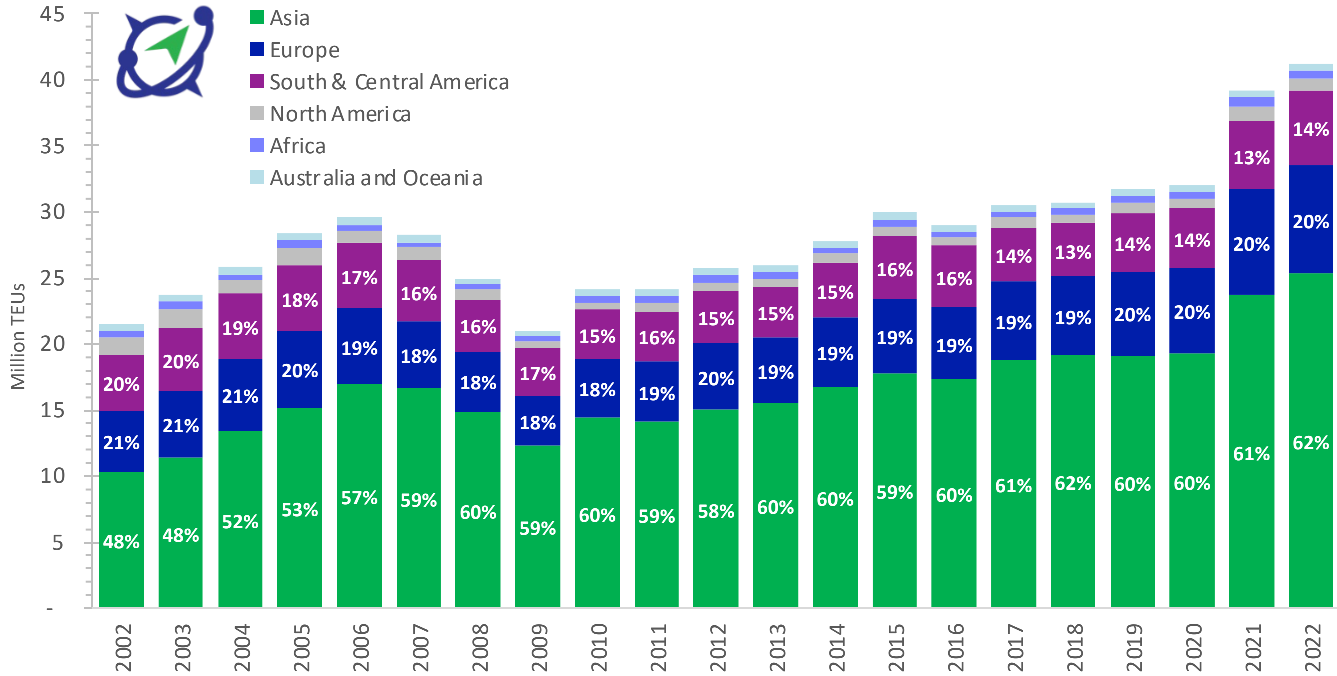


Source: Bujanda & Allen, 2023. *% shares rounded up to the nearest integer.

North American headhaul volumes by tradelane

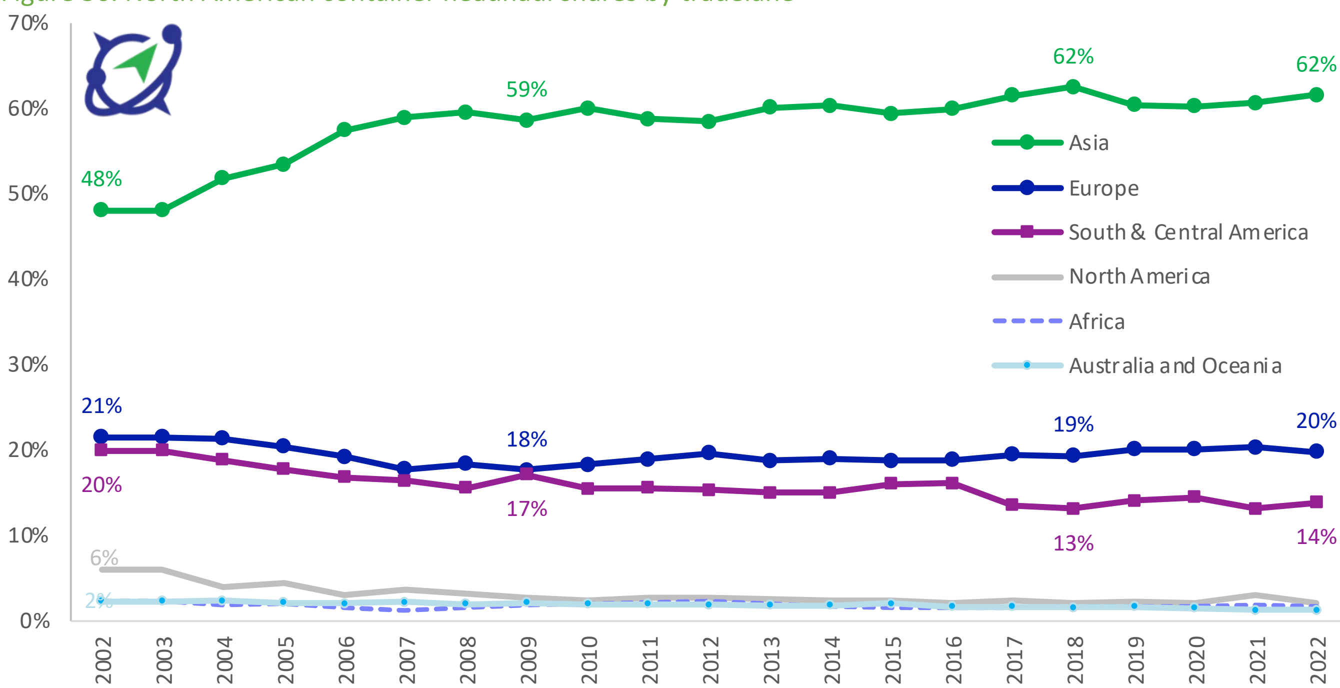
The Asia-to-North America tradelane is one of the busiest and most significant in terms of container imports into North America, handling about 60% on average between 2002-2022. Major ports on the U.S. West Coast, such as Los Angeles and Long Beach, handle a substantial portion of container imports from Asian countries like China, Japan, South Korea, and Taiwan. The Trans-Atlantic tradelane that connects Europe, particularly Northern Europe, with North America ranks next handling about 20% on average of containerized headhaul volumes. Ports on the U.S. East Coast, such as New York–New Jersey and Savannah, play a vital role in handling container imports from European countries like Germany, United Kingdom, and the Netherlands. South & Central America is the tradelane in third place with a 16% market share. The North American container headhaul volumes by tradelane are shown in Figure 55 and their share trends in Figure 56.

Figure 55. North American container headhaul volumes and shares by tradelane



Source: Bujanda & Allen, 2023. *% shares rounded up to the nearest integer.

Figure 56. North American container headhaul shares by tradelane

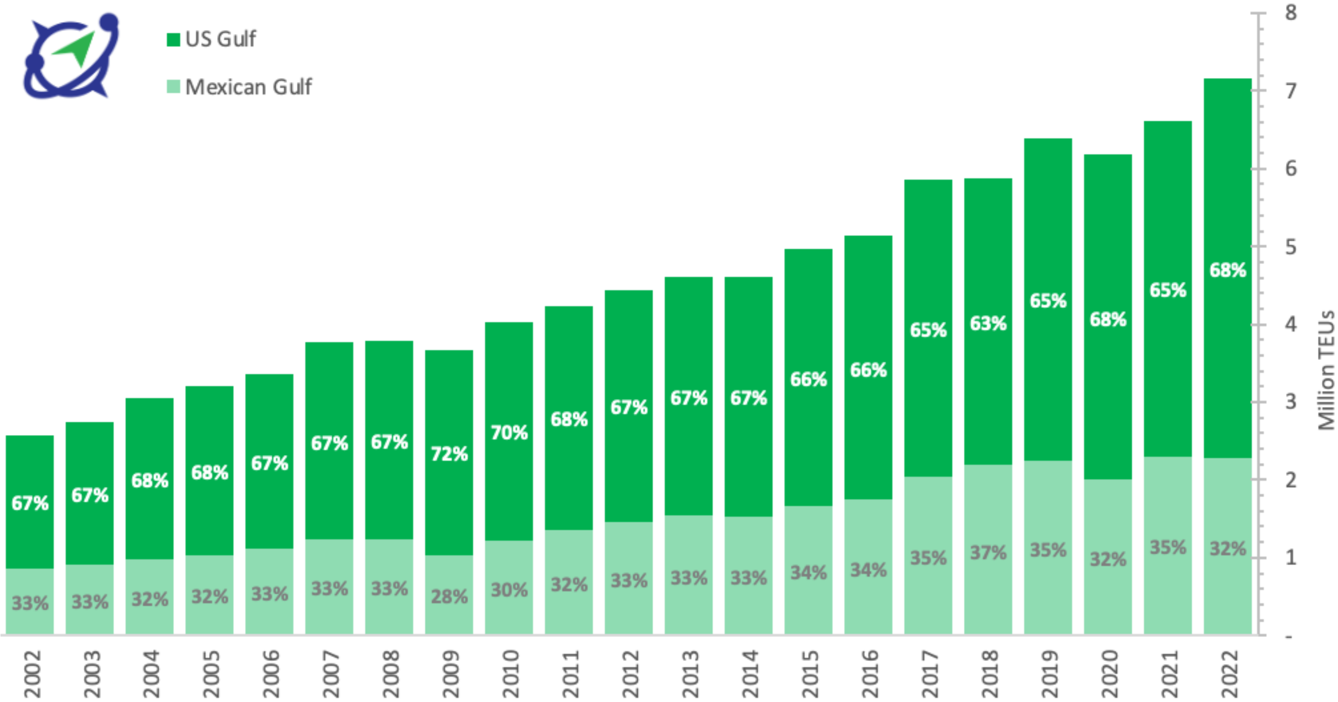


Source: Bujanda & Allen, 2023. *% shares rounded up to the nearest integer.

Gulf Coast throughput volumes

Throughput volume of containerized cargo via the Gulf Coast totaled 7.1 million TEUs in 2022, from which 68% moved through ports in the USGC and 32% through the Mexican Gulf Coast. Based on the 2002-2022 average, U.S. ports have handled 67% of the total Gulf market, while Mexican Gulf ports have handled an average of 33%. While these shares have remained consistently close to the average over the years, U.S. Gulf ports had larger shares during recession years (e.g. 2009, 2010, and 2020), as shown in Figure 57.

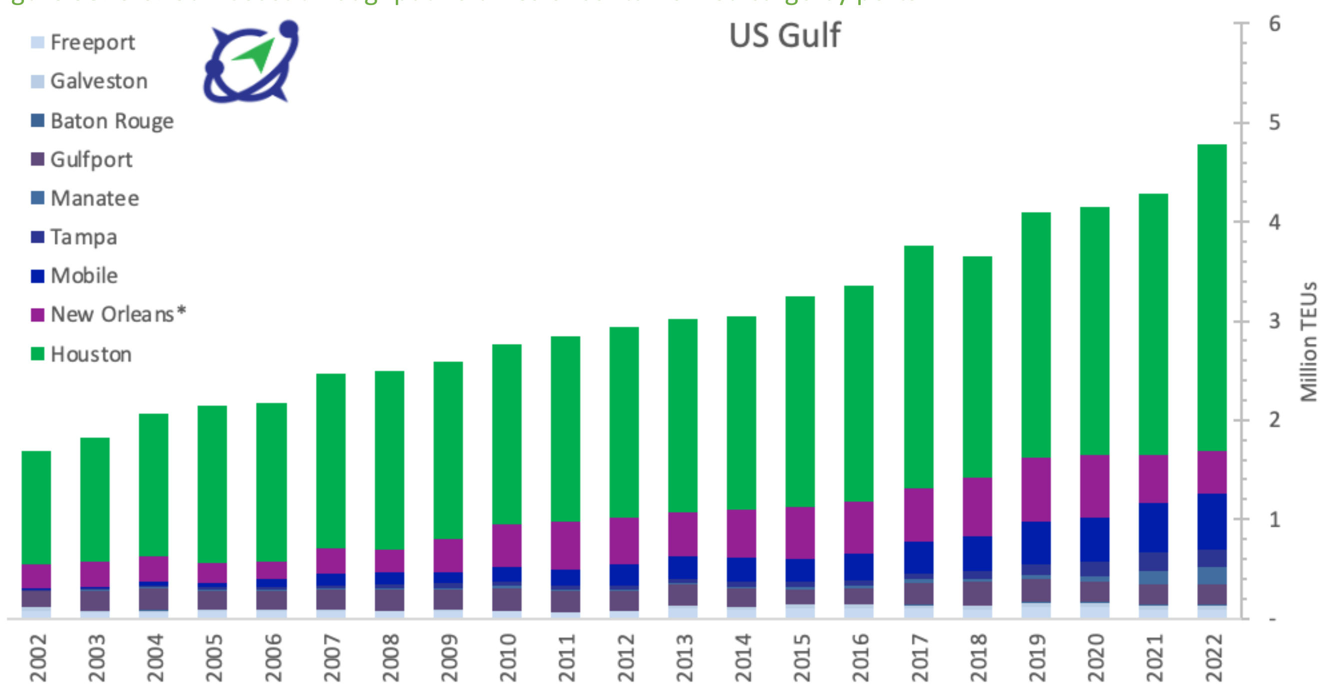
Figure 57. Gulf Coast throughput volumes of containerized cargo (U.S. and Mexico)



Source: Bujanda & Allen, 2023. *% shares rounded up to the nearest integer.

Regarding ports in the USGC, Houston is by far the number one container port, with an average market share of 63% from 2002-2022. Ports handling containers in the New Orleans region had an average market share of 15% from 2002-2022 and have gained share particularly from 2010-2018. With an average market share of 9%, Mobile is also gaining market accelerating after 2015 at par with New Orleans since 2021. Other ports in the U.S. Gulf with significant container headhaul volumes include Tampa, Manatee, Gulfport, Baton Rouge, Galveston, and Freeport, as shown in Figure 58.

Figure 58. U.S. Gulf Coast throughput volumes of containerized cargo by ports

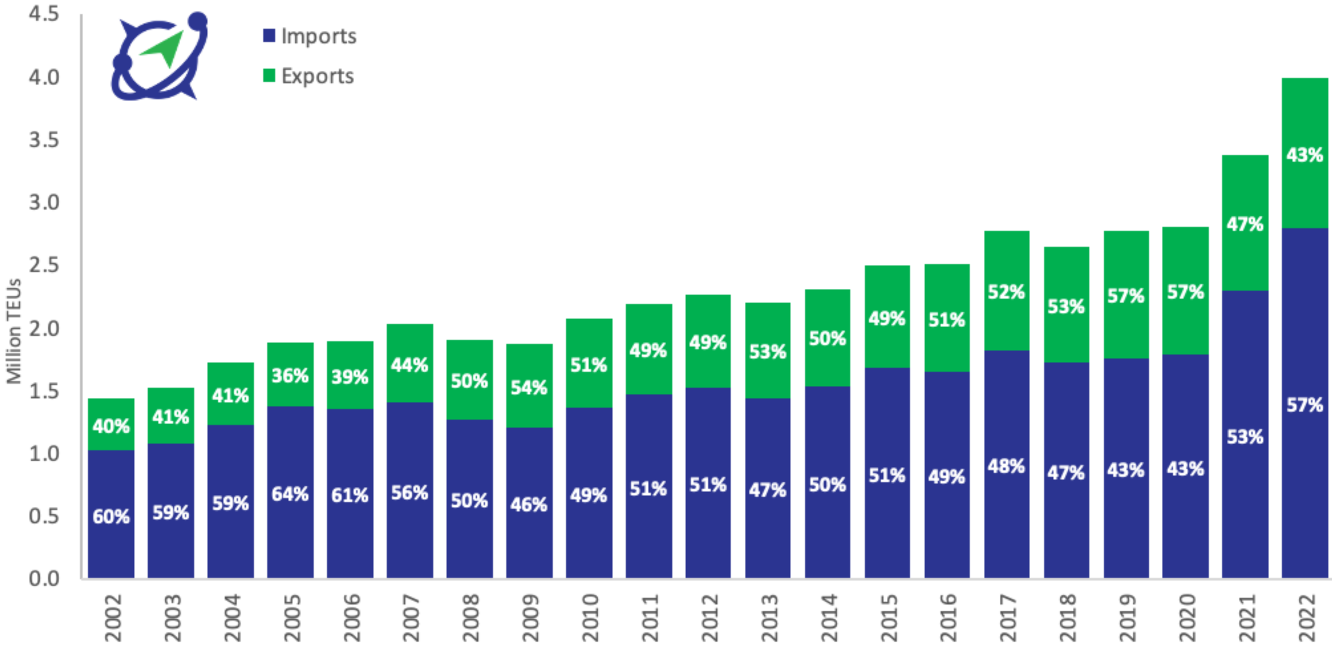


Source: Bujanda & Allen, 2023. Tampa report volumes only based on their fiscal year (FY), as opposed to calendar year like the rest of the ports. *2022 Volumes obtained from a 3rd party data provider (not confirmed by the port).

U.S. Gulf Coast containerized cargo trade balance

In terms of the trade balance (i.e. imports vs. exports) for containerized cargo, the USGC follows a similar pattern to the U.S. and the entire North America region, where international laden imports comprise the headhaul flow, although at smaller proportions than at the national scale. On average, imports represented 52% of the trade balance from 2002-22 via the U.S. Gulf with exports representing the remaining 48%. However, the import shares climbed to 53% in 2021 and 57% in 2022, as shown in Figure 59.

Figure 59. U.S. Gulf Coast international laden volumes by trade flow (imports & exports)

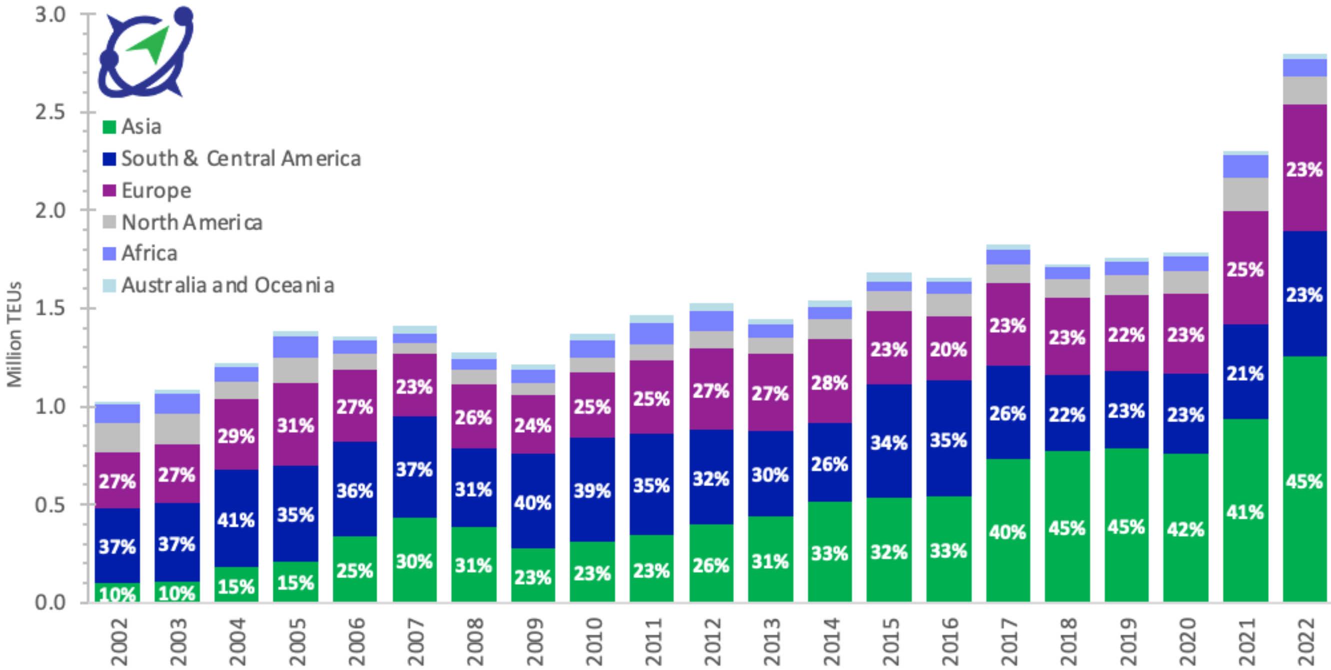


Source: Bujanda & Allen, 2023.

U.S. Gulf Coast headhaul volumes by tradelane

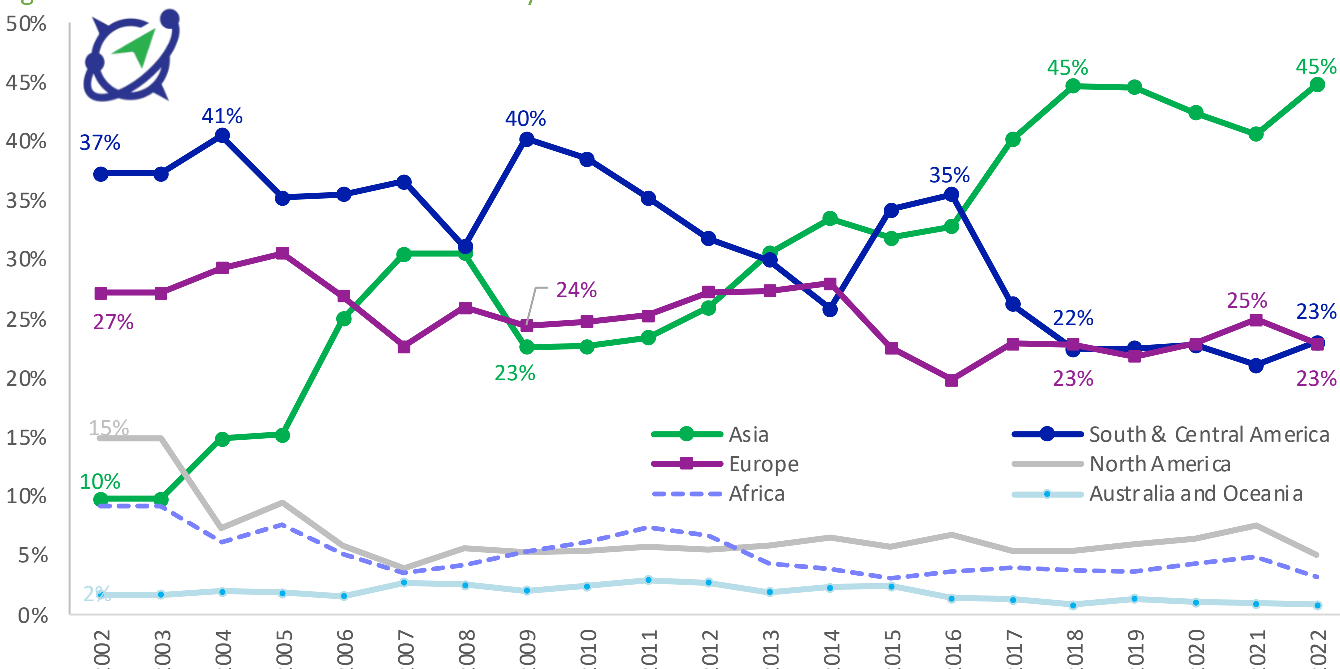
Regarding USGC headhaul volumes by tradelane, containerized imports from Asia have boomed since 2002, increasing from 10% of the total USGC headhaul volumes to 45% in 2022 (i.e. more than 400% in terms of volume). During the same time, the market share of imports from South & Central America decreased from 37% in 2002 to 23% in 2022; although in terms of absolute volume, the number of TEUs almost doubled. Europe also had a market share of 23% in 2022, which is more than double the TEUs handled in 2002, as shown in Figure 60. The evolution of the trends for the volume share by tradelane are shown in Figure 61.

Figure 60. U.S. Gulf Coast headhaul volumes and shares by tradelane



Source: Bujanda & Allen, 2023.

Figure 61. U.S. Gulf Coast headhaul shares by tradelane

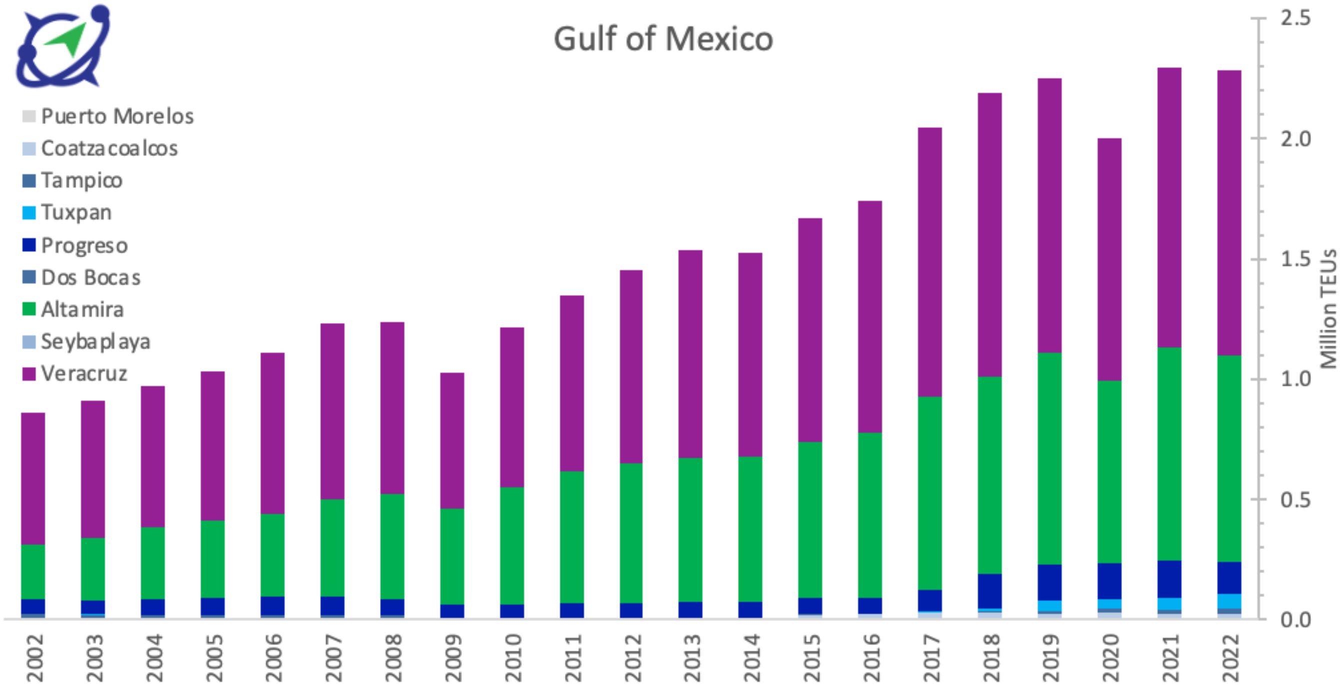


Source: Bujanda & Allen, 2023.

Mexican Gulf Coast headhaul volumes by port

Regarding ports in the Mexican Gulf Coast, Veracruz has historically been the dominant port with a 52% share of container headhaul volumes imported via the Mexican Gulf Coast. Nonetheless, Altamira has been increasing its market share from 31% prior to 2009 to more than 39% after 2018. Other ports in the Mexican Gulf include Tuxpan, Tampico, Coatzacoalcos, and Puerto Morelos, as shown in Figure 62.

Figure 62. Mexican Gulf Coast throughput volumes of containerized cargo by ports



Source: Bujanda & Allen, 2023.

4. Competitive analysis

In assessing the competitiveness of PPHTD infrastructure our team evaluated the existing facilities, the expansion potential in the current footprint, connectivity to road, rail, air, and water resources to determine how Plaquemines stacks up against other regional ports and harbor systems. This section provides an overview of the port and its competitive position. We describe the status of PPHTD infrastructure and competing ports and their most relevant terminals.

4.1 Port infrastructure and competitive position

From its beginnings in the 19th century, Plaquemines Port has grown to become one of the 12 busiest ports in the U.S. in terms of tonnage – having moved more than 47 million tons of cargo to destinations worldwide in 2022. As a landlord port, the terminal facilities maintenance, upgrades, and expansion, rest primarily with tenants versus PPHTD. Nonetheless, PPHTD is responsible for ensuring maintenance of waterside access to docks and wharves, managing highway and roads development, planning, and connections to maximize efficient and safe movement of cargo to and from tenant facilities. Consequently, PPHTD must work closely with NOGC and UP to optimize future cargo growth opportunities while minimizing local traffic impact and community disruption.

4.2 Current status of PPHTD infrastructure

The current infrastructure of the Plaquemines Port and harbor is well positioned and situated to meet or exceed the organic growth of the existing cargo mix moving through the port. There is capacity to handle the anticipated growth in the various bulk commodities, both liquid and dry, as well as breakbulk volumes.

From 2011 through 2022, PPHTD volumes have averaged 47.6 million tons throughput per year. The highest volume year during the period was 2014 with total throughput of 59 million tons. Over the last five years the average throughput volume was 41.6 million tons with 2022 being the apex at 47.6 million tons. Under the current operating conditions, it is concluded that throughput volume of the top ten commodities in the port could more than double with minimum or no additional infrastructure investment required.

4.3 PPHTD infrastructure profile

Stretching from the Gulf of Mexico to mile 81.7 on the Mississippi river, the main channel for the Plaquemines Parish Port approximately 50 miles from the Gulf, offers a 55+ feet draft. The Port is served primarily by the UP Class I Railroad, and it can connect with BNSF as well. PPHTD's location provides unparalleled access for barges to the entire Mississippi waterway system to the upper Midwest regions of the U.S. There is a robust and extensive pipeline system currently in place with excess capacity that can address the anticipated growth in liquid bulk, petroleum, and gas commodities.

PPHTD's infrastructure also includes the Belle Chasse-Scarsdale ferry landing and the Pointe a la Hache landing that provides transportation across the Mississippi River from Plaquemine to access the east bank connecting highways 15 and 35. The Pointe a la Hache Landing is currently closed and scheduled to reopen in 2024. It is widely used by both workers getting to their jobs and visitors who want to experience the Mississippi River.

4.4 Tenant terminal profiles

PPHTD is a vital hub for maritime commerce and trade, comprising 15 terminals that serve various industries and cargo types. Here is a summary of the key terminals in the port:

1. **Amax Metal Recovery Inc**—Handling nickel and breakbulk cargoes, maintains two berths at Plaquemines Parish Port with a length of 700 ft and alongside depth of 35 ft. The facility can accommodate one ship and one barge at the same time and offers rail service.

2. **Bass Enterprises Production Company**—Handles crude oil in the Port and operates two berths: a loading dock is a Pointe a la Hache and a berth at Cox Bay. The loading dock is 200 ft long with alongside depths from 25 to 30 ft, and the Cox Bay berth is 500 ft long with alongside depths from 12 to 15 ft.
3. **Chevron Pipe Line Company (Cal-Ky Division)**—Operates a landing in Plaquemines Parish Port for crew boats and for receiving supplies like water, diesel, and lubricating oil. The berth is 60 ft long alongside depth of 10 ft. Chevron Pipeline Company also operates the 500 ft long, 25 ft deep Empire Barge Wharf handling crude oil.
4. **Chevron Oak Point**—Operates a berth of 250 ft in length and alongside depth of 40 ft that handles crude oil and petroleum products that are used to blend lubricating oils for transportation and industrial equipment. This Plaquemines Parish Port facility has capacity to store from 8 to 10 million gallons, and it handles barges from 180 to 250 ft in length.
5. **Conoco Inc**—Operates a 900 ft berth with alongside depths from 10 to 18 ft that handles oil and gas drilling and production materials and equipment. The facility includes a 800 ft^2 warehouse in PPHTD.
6. **Halliburton Services**—Operates two Plaquemines Parish Port berths of 800 ft that handle drilling mud, chemicals, and potable water.
7. **United Bulk Terminals**—United Bulk Terminals Davant is one of the largest bulk terminals in the U.S. Gulf. It is a 1,200-acre bulk terminal at mile 55 of the Mississippi River with extensive loading, discharging and storage capabilities along 3.5 miles of riverfront. The site specializes in Coal and Pet Coke, with capacity for other bulk commodities.
8. **HSPV LLC**—Operates berths from 540 to 982 ft with an alongside depth of 53 ft and handles grains. With rail service, the International Marine Terminal has capacity to store over 346.1 million ft^3 (9.8 million m^3) of cargo. It also has 17.2 acres of open storage.
9. **Marathon Oil Company**—Operates a wharf in Plaquemines Parish Port of 500 ft with alongside depths from 17 to 24 ft. The facility coordinates and supplies offshore drilling and production activities.
10. **Marathon Petroleum Company**—Operates the Venice Terminal handling crude oil by tanker. This Plaquemines Parish Port berth is 1,000 ft with alongside depth of 40 ft.
11. **Shell Offshore Inc**—Operates a berth in Plaquemines Parish Port that is 1,000 ft with alongside depths from 8 to 15 ft. The facility handles oilfield supplies and equipment for offshore drilling operations, and it contains a 4-acre heliport area for eight helicopters.
12. **Stolthaven Braithwaite Terminal**—Handles breakbulk cargoes using a 576 ft berth with alongside depth of 40 ft, and it has six truck racks. The terminal can accommodate barges up to 300 ft with draft of 14 ft. The facility includes 80 storage tanks with a total capacity for 9,129 ft^3 (258.5 m^3)
13. **International Marine Terminals Kinder Morgan**—Operates three berths with a total length of 703 ft and alongside depths from 40 to 51 ft. With an annual throughput capacity of over 25 million tons, this terminal handle coal, phosphate, and grains. This full-service terminal operates 24 hours per day 360 days per year and provides for the discharge of ocean-going vessels carrying phosphate or grains to river barges and for the direct transfer of bulk commodities from barge to ship.
14. **Texaco Pipeline Company**—Operates a crew boat dock at Pilottown that is 80 ft with alongside depth of 8 ft. The dock supports crews, supplies, and equipment.
15. **Tosco Refining Company, Alliance Refinery**—Operates two berths of 280 and 1,205 ft with alongside depth of 40 ft. The facility contains 51 storage tanks with total capacity for over 38.8 million ft^3 (1.1 million m^3) of petroleum products or crude. It also has 11 pressure spheres with capacity for 2,246,010 ft^3 (63,600 m^3). The terminal has rail service.

16. **Venture Global Plaquemines LNG LLC—**Is developing a LNG export facility in Plaquemines Parish, Louisiana, approximately 20 miles south of New Orleans. When fully developed, Plaquemines LNG will have an export capacity of up to 20 million metric-tons per year.
17. **NOLA Terminal—**Is under development and will include an area of 158 acres located at Mile Marker 59 on the lower Mississippi River. The project will feature crude oil pipelines, ship, and barge dock system along with land-side storage facilities. Upon completion, the terminal will be capable of accommodating New-Panamax vessels for loading and unloading crude oil and other clean petroleum products.

4.5 Gulf Coast port comparison

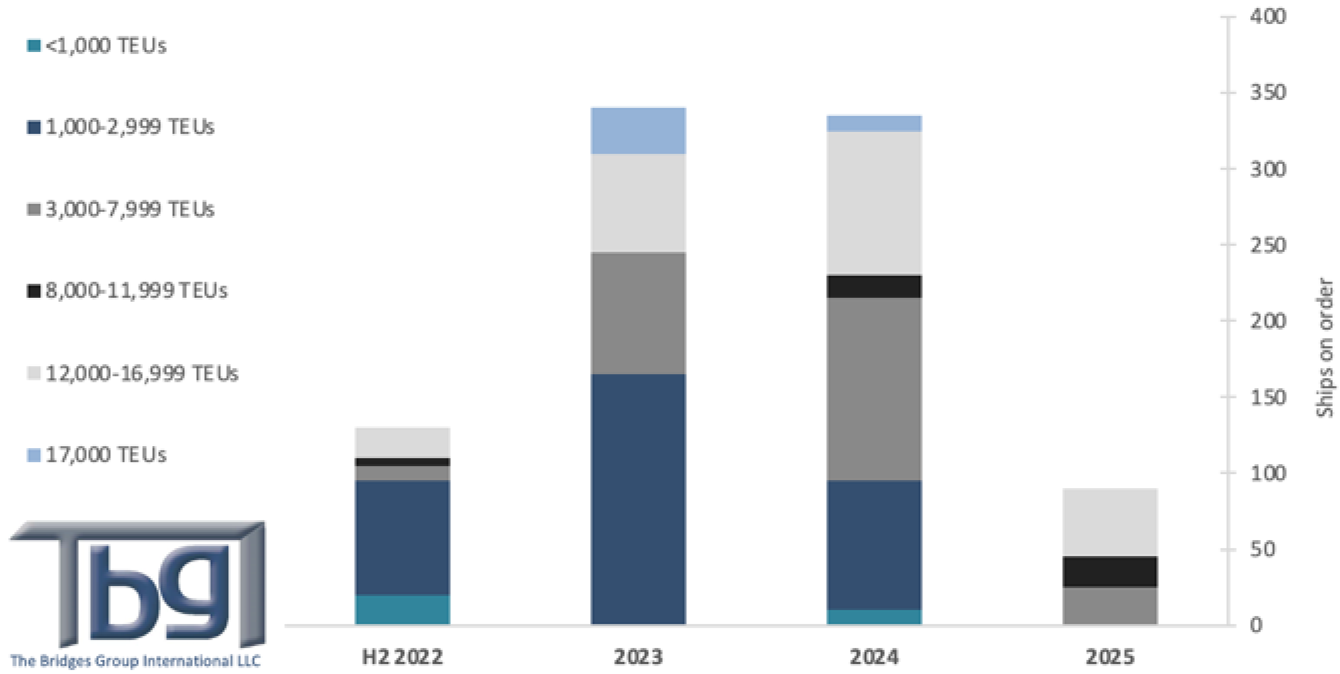
The opportunity and the challenge facing the Plaquemines Port is developing infrastructure to support the diversification of the Port's cargo mix. As traditional drybulk commodities stabilize with modest growth projections, the Plaquemines Port must build for the future and develop infrastructure consistent with supply chain requirements and needs.

The continuing year-over-year growth of intermodal transportation and container cargo worldwide will create additional demand for container vessel and terminal services. This presents an unparalleled opportunity for the port to lead the nation in bringing forward an integrated state of the art multimodal transportation center on the Gulf Coast. PPHTD can optimize and leverage Plaquemines prime location, hundreds of acres of available real estate, just 50 miles from the Gulf of Mexico, the first deep water port on the Mississippi river at 50 ft depth and no air draft limitation.

Very Large Containers Ships (VLCS) container vessels are currently being delivered to the industry in response to the increased capacity demand. 13,000+ TEU capacity that can move through the Panama Canal will become commonplace in the Gulf of Mexico at ports that can accommodate their size. The Ultra Large Container Ships (ULCS) 15,000 to 21,000+ TEU vessels cannot transit the Panama Canal and will have limited if any visibility in the Gulf.

The order book for additional newbuilds exceeding +13,000 TEU capacity vessels over the next five years, represents a significant percentage of the total, as indicated in Figure 63.

Figure 63. Container ships orderbook by year of delivery



Source: The Bridges Group International with data from Alphaliner, 2023.

Most, if not all, the ports on the Gulf coast do not have the necessary water depth needed to accommodate the current fleet of the largest neo-post panamax class of container vessels and certainly not the new builds coming online in the next five years. Presently, Houston, Mobile, and New Orleans, where PPHTD is located, have the deepest draft depths at 45 ft; although, only Houston and Mobile have cranes with capabilities (high & length) to handle Super PPX vessels, as illustrated previously in Table 8.

Table 8. Infrastructure characteristics of ports in the U.S. Gulf Coast

Port	Draft depth	Air draft	Linear berth	STS Cranes	Rail facility
Houston	45 ft (14 m)	Unlimited	▪ 10,000 ft container ▪ 15,830 ft non-container	▪ 2 Panamax ▪ 11 PPX ▪ 13 Super PPX	▪ On-dock ▪ Near dock
New Orleans	45 ft (14 m)	170 ft (52 m)	▪ 3,500 ft container ▪ 74,000 ft+ non-container	▪ 9 PPX	▪ On-dock
Gulfport	39 ft (12 m)	Unlimited	▪ 4,000 ft container ▪ 7,800 ft non-container	▪ 3 Panamax	▪ On-dock
Mobile	45 ft (14 m)	Unlimited	▪ 2,000 ft container ▪ 22,000 ft+ non-container	▪ 2 PPX ▪ 2 Super PPX	▪ On-dock
Tampa	43 ft (13 m)	Unlimited	▪ 2,900 ft container ▪ 18,000 ft+ non-container	▪ 3 Panamax ▪ 2 PPX	▪ On-dock

Source: The Bridges Group International, 2023.

4.5.1 Port of Houston

Houston is one of the largest ports in the U.S. measured by overall tonnage. It is ranked the 5th largest in the U.S. for containers volume. The port owns and operates 8 terminals along the 52 miles of the Houston Channel. This port has diverse service offerings in dry and liquid-bulk, petroleum, grain, chemicals, the largest breakbulk facility in the Gulf region and it operates two container terminals, Bayport and Barbours Cut, handling more than 3.9 million TEUs in 2022. The port is well positioned for growth. It is authorized to widen the Houston Channel to 700 ft from the current 530 ft. The channel will also be deepened to 46.5 ft. from the current 45 ft.

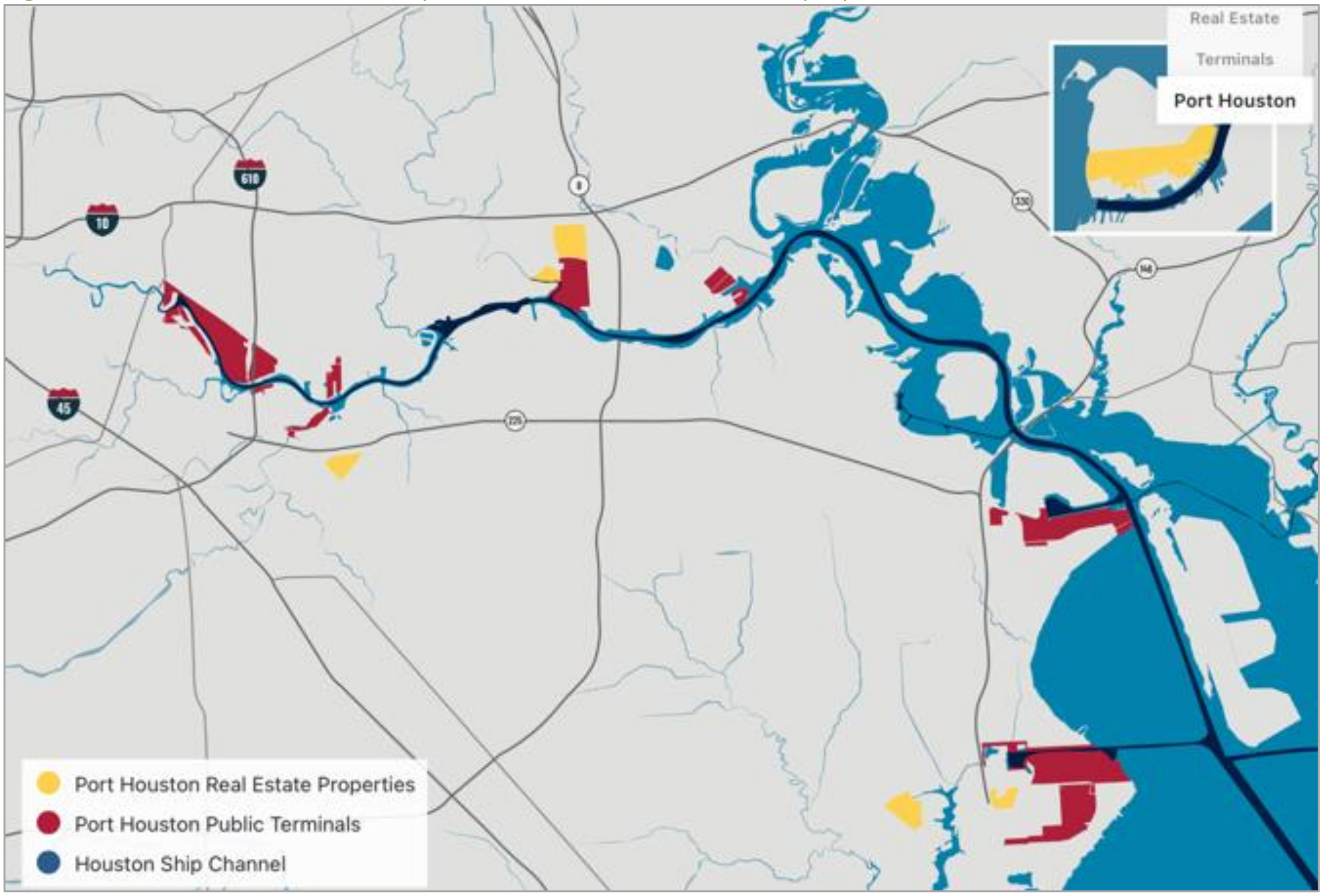
Bayport Terminal is the most modern and environmentally sensitive container terminal on the USGC. When fully developed, it will have a total of seven container berths with the capacity to handle 2.3 million TEUs on a complex which includes 376 acres of container yard and a 123-acre intermodal facility.

The Barbours Cut Container Terminal features 300 acres of container yard space, six berths, 29 entry truck gates, and more than 8,000 ft of working track connecting to off-site warehouses. Port Houston is investing $520 million in capital improvements at Barbours Cut Terminal over the next 10 years (2022–2032).

Port Houston is continuing to modernize the facility to help increase cargo handling efficiency and capacity including developing a container port at Baytown. Current channel, public terminals, and real estate properties for the port of Houston are shown in Figure 64.

An additional container terminal is being developed by a private enterprise at Baytown which will be a separate entity from the Port of Houston.

Figure 64. Port of Houston channel, public terminals, and real estate properties



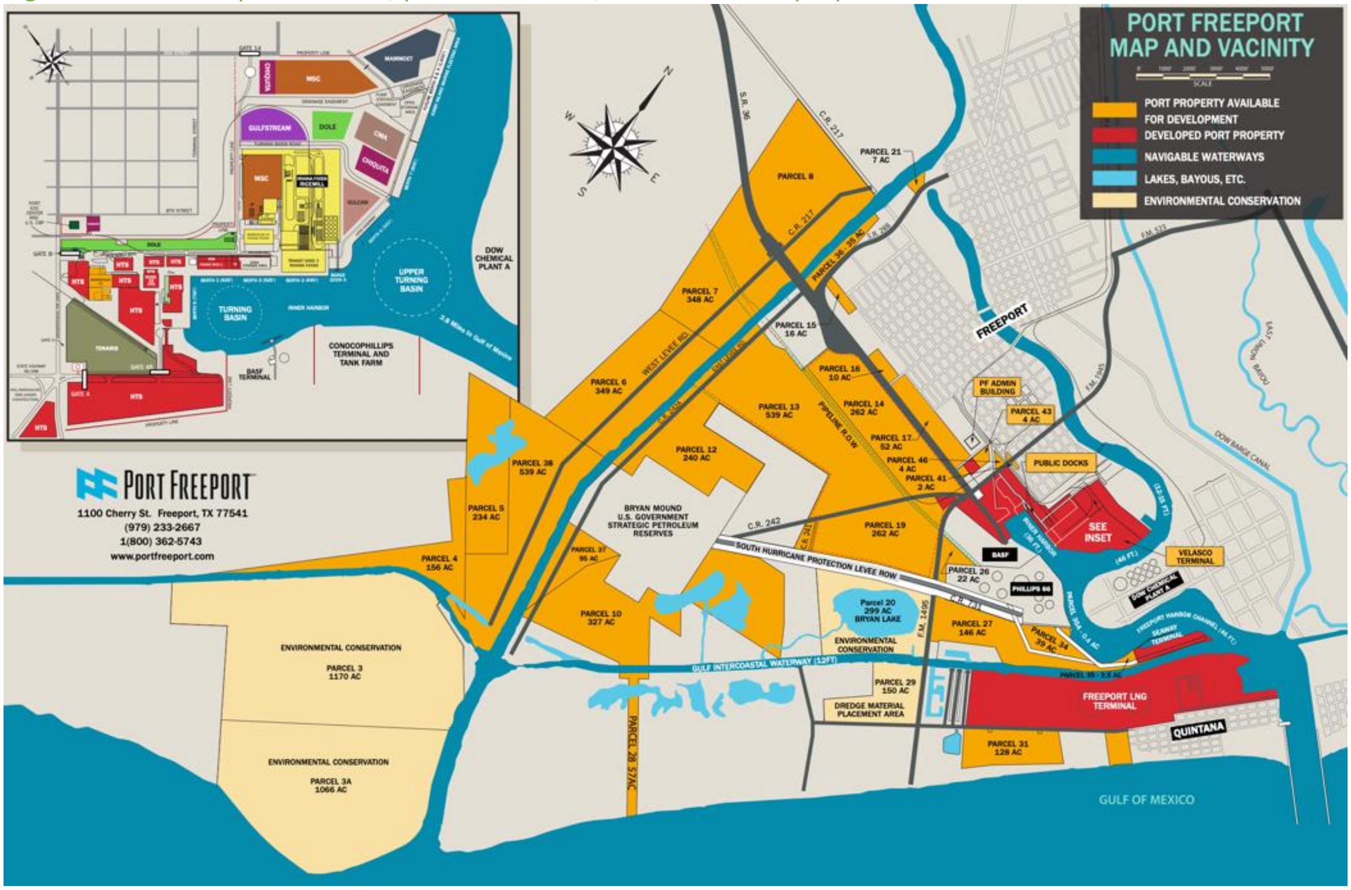
Source: Houston Port Authority, 2023.

4.5.2 Port of Freeport

Port Freeport is a leading port in the export of crude oil and natural gas liquids. Freeport is ranked 6th in chemicals, 17th in foreign waterborne tonnage, and 26th in containers. Leading commodities include crude oil, petroleum products, rice, liquefied natural gas, and roll-on roll-off cargo. The current channel depth is 46 ft below mean lower low water and is 400 ft wide. There are plans to deepen the channel to 56 ft. The terminal has two post panamax cranes and room to grow the terminal footprint.

The port continues to invest in the infrastructure with the completion of improvements for its berth length to 1,727 ft and deepen its berth draft to 51 ft. With planned container yard expansion and additional ship-to-shore cranes, Freeport will have capacity of 800,000 TEUs. Current channel, public terminals, and real estate properties for Port Freeport are shown in Figure 65.

Figure 65. Port Freeport channel, public terminals, and real estate properties



Source: Port Freeport, 2023.

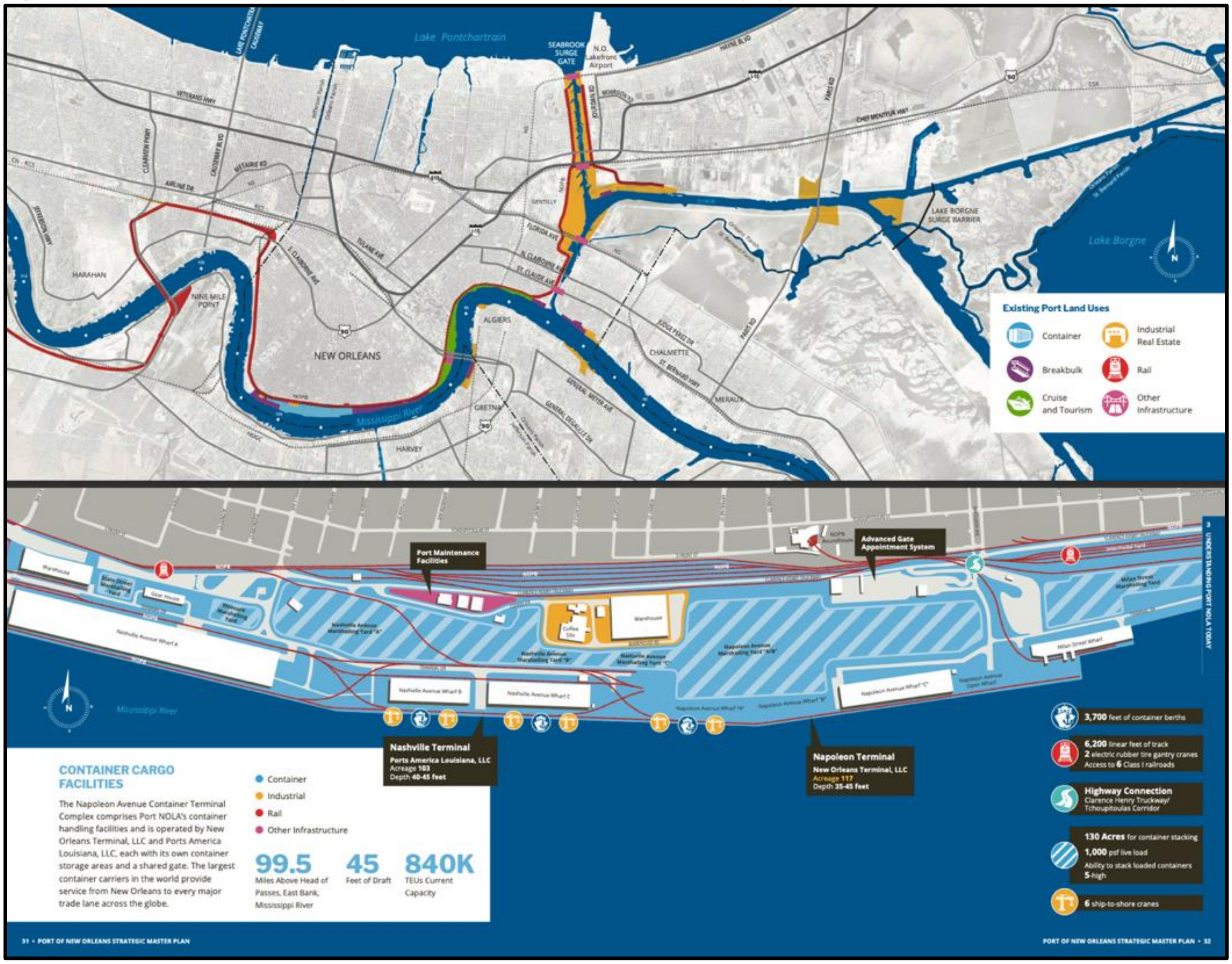
4.5.3 Port of New Orleans

The Port of New Orleans is a multi-purpose full-service world-class port and the only port in Louisiana that handles containers. The port is ranked the 5th largest port in the U.S. by total tonnage, 2nd for drybulk tonnage, and 18th for containers. The port handled 430,000 TEUs in 2022. The port has through-put capacity of 1,000,000 TEUs in the current footprint and can expand to 1.5 million with investment in additional real estate and equipment for operations. There are 9 gantry cranes and 3,500 ft of berth length and 45 ft depth alongside.

The port is served by 6 Class 1 railroads, and it owns and operates the short-line rail company New Orleans Public Belt Railroad. There is near dock connectivity to major interstate and state highway systems for truck traffic.

In addition to a diverse cargo mix including agriculture products, steel, grains, roll-on roll-off, containers on barge, international container services, the port also has a robust cruise ship line of business. Current public terminals, freight rail lines, and real estate properties for Port of New Orleans are shown in Figure 66.

Figure 66. Port of New Orleans public terminals, rail, and real estate properties



Source: Port of New Orleans, 2023.

4.5.4 Alabama Port Authority

The Alabama Port Authority surpassed 500,000 TEUs in 2022. In a recent agreement with a major terminal operator, the port is positioned to double its throughput to 1 million TEUs in 2025. At full build-out, the facility is projected to handle 2.5 million TEUs.

The port infrastructure investments include deepening the Mobile ship channel to 50 ft and widening it to 550 ft by 2025. The Port Authority's container, general cargo, and bulk facilities have immediate access to two interstate systems, five Class I railroads, nearly 15,000 miles of inland waterways and air cargo connections. Current channel, public terminals, and real estate properties for the Port of Mobile are shown in Figure 67.

Figure 67. Port of Mobile public terminals, rail, and real estate properties

Source: Alabama Port Authority, 2023.

4.6 Plaquemines proposition

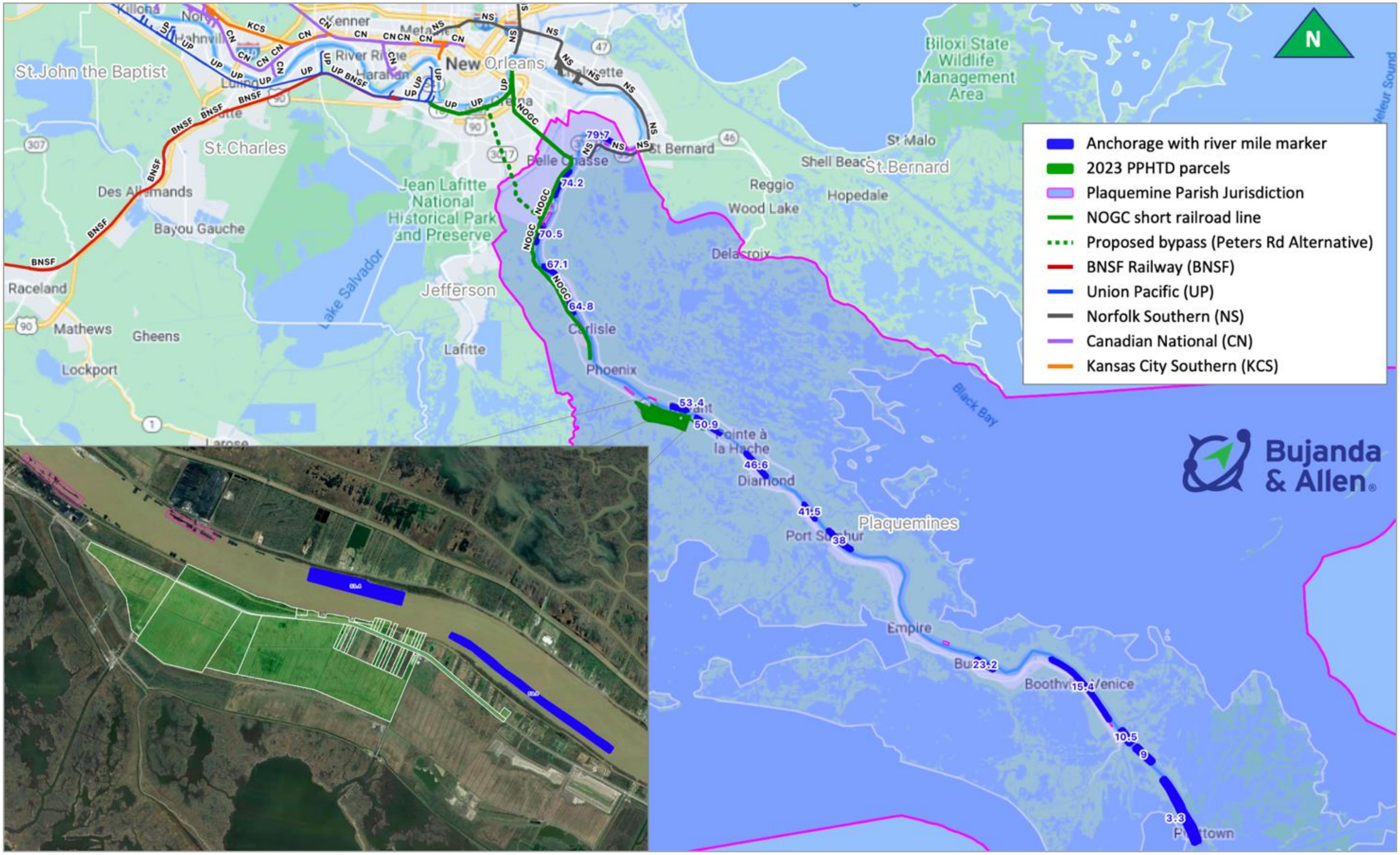
PPHTD is a natural deep-water port that has the best location to capture future growth opportunities by developing the infrastructure to support an innovative mega container terminal with an adjacent Intermodal Container Transfer Facility (ICTF), air cargo logistic facilities, and strategic port operation. PPHTD has hundreds of acres of greenfield land available for immediate development.

The development of the required infrastructure will put Plaquemines at the forefront of attracting a significant share of the anticipated growth of container volume associated with population growth and shifts in consumer trends. More importantly, however, the efficient operations of the terminal and its intermodal rail complex could connect cargos destined to the Midwest markets in four to five days after discharge from ocean going vessel resulting in time and cost savings to the supply chain. The container terminal will enhance the connection of the marine highway system traffic as import and export barge cargo would be serviced on and off ocean-going vessels at a significantly lower cost.

The infrastructure development of the container ICTF facility will support state of the art climate action plans. Alternative fuel powered vessels will be serviced at the port. The recently announced SunGas green methanol production facility in Pineville, LA and the commitment of Maersk to use green methanol to power the new VLCS will support a new line of business for the port, create local jobs and promote net zero greenhouse gas emissions worldwide.

Additionally, an air cargo facility development in conjunction with PPHTD's container terminal and ICTF could support the utilization of both of NAS JB Belle Chasse existing 6,000 ft and 10,000 ft runways capable of handling large air freighters. PPHTD, NAS Joint Base Belle Chase, and its rail partners have identified the property adjacent to the base and UP classification yard as a strategic location for the multimodal air cargo facility. The infrastructure required for the development could support another revenue line of business, support an expanded mission for the base, encourage warehouse and cross-docking opportunities as well as creating a potential strategic military port location that would contribute to and enhance the national security. Current channel, anchorages, terminals, and select real estate properties for PPHTD are shown in Figure 68.

Figure 68. Port of Plaquemines channel, anchorages, terminals, rail, and select real estate properties



Source: Bujanda & Allen, 2023.

4.7 Key takeaways

- The existing port infrastructure at PPHTD is adequate to support the anticipated growth of the port's current customers and cargo mix currently handling.
- Container and intermodal cargo represent significant growth opportunities for the Gulf Coast ports.
- Key drivers of growth for the Gulf Coast ports are water depth in channels, rivers, and waterways, combined with access to railroads, waterways, and highways to efficiently move freight.
- Ocean carriers are deploying more VLCS and ULCS into the transpacific tradelane that will ultimately displace the current post-panamax fleet of vessels calling the Gulf.
- There are five Gulf Coast ports with containers terminals handling international trade: Houston, New Orleans, Freeport, Gulfport, and Mobile.
- Florida Gulf Coast ports were not considered due to market study area limits. Nonetheless, Ports America has significant operations in Tampa; APMT in Miami; Trapac, Ceres, SSA Marine, and Crowley in JaxPort; and King Ocean in Everglades.
- Competing Gulf Ports are moving forward in developing infrastructure to support market growth. Water depth and channel access, air draft limits, terminal throughput capacity, road congestion, and railroad connectivity may limit their ability to handle the VLCS and their volume.
- PPHTD is positioned to develop the infrastructure that will deliver an alternative, competitive, innovative, technologically advanced, and cost-effective solution addressing the industry growth as well as promote supply chain sustainability and resiliency. PPHTD can turn bigger ships faster.

5. Trends in the container shipping industry

This section analyzes specific developments in the container shipping alliances, as well as recent changes and development of vessel sizes for the largest deep-sea trades. This section also evaluates the major implications for PPTHD competitiveness, in terms of vessels presently and potentially calling PPTHD.

5.1 Container shipping alliances

The trend of shipping alliances is an evolving and growing operating feature among the world's largest ocean carriers. An ocean alliance is formed when a group of carriers create a cooperative agreement to work together and rationalize the use of vessels, terminals, and operating equipment. The alliances are global in scale and when effectively managed allow the member carriers to benefit from the economy of scale of their combined capacity and tradelane coverage. The container shipping alliances in 2023 are shown in Table 9.

According to Alphaliner rankings, a maritime shipping data collection and repository tool, the three largest alliances accounted for 80% of the global container market. The three largest alliances include the top ten ocean carriers. MSC, Maersk, CMA-CGM, Cosco Group, OOCL, Evergreen, Hapag-Lloyd, NYK, Yang Ming, MOL, K-Line, and Hyundai Merchant Marine. The remaining 20% of the global container market is handled by and among the 2,114 other vessels operating in worldwide trade.

Table 9. Container shipping alliances in 2023

Alliance	Members	Details
2M	▪ MSC ▪ Maersk	Formed in 2015 with the aim of ensuring competitive and cost-efficient operations. The alliance has come to an end and will discontinue by 2025.
Ocean Alliance	▪ CMA-CGM ▪ Cosco Group ▪ OOCL and ▪ Evergreen	Formed in 2017 and renewed for 10 years ending in 2027. The alliance has 330 ships, out of which 111 ships are operated by CMA CGM. The alliance has a capacity of 3.8 million TEUs.
The Alliance	▪ Hapag Lloyd ▪ NYK ▪ Yang Ming ▪ MOL ▪ K-Line, HMM	Also launched in 2017, THE Alliance has 241 ships calling more than 1150 ports and covering 3.3 million TEUs.

Source: The Bridges Group International, 2023.

5.1.1. 2M Alliance: Maersk and MSC

In January 2023, Maersk and MSC jointly announced that they will discontinue their alliance by 2025.[6] The 2M agreement had a minimum term of 10 years with a 2-year notice period of termination. The 2M alliance members together control about one-third of the world's container capacity and have over 4 million TEUs each independently. The announcement of 2M's termination may signal the beginning of a broad industry-wide restructuring of current operational contracts, particularly on the important east-west trades. This termination will allow both companies to pursue their individual business strategy and may create new opportunities for port and terminal operators as well as positive changes across the supply chain as both companies work to retain and attract more customers.

[6] *Maersk and MSC to discontinue 2M alliance in 2025*. Maersk, 25 January 2023. https://www.maersk.com/news/articles/2023/01/25/maersk-and-msc-to-discontinue-2m-alliance-in-2025

5.1.2 Ocean Alliance: COSCO, OOCL, CMA CGM & Evergreen

Ocean Alliance was launched in 2017 for an initial period of five years between COSCO Shipping, OOCL, CMA CGM, and Evergreen. In 2019, the companies confirmed the extension of the duration to ten years until 2027. The Ocean Alliance includes 330 container ships and an estimated carrying capacity of 3.8 million TEUs. This alliance also has Ever ACE, the largest Ultra Large Container Ship (ULCS) with a capacity of 23,992 TEUs. Ocean Alliance offers a total of 38 different services including 19 transpacific services, 11 services between Asia and Europe (+the Mediterranean), and 4 services between Asia and the Middle East.

5.1.3 THE Alliance: Hapag-Lloyd, ONE, and Yang Ming

Launched in 2017 by Hapag-Lloyd, ONE, and Yang Ming, THE Alliance combines 3.5 million TEUs. That's approximately 25% of the global container capacity. THE Alliance has also deployed a fleet of 249 ships. They connect 76 ports throughout Asia, North Europe, the Mediterranean, North America, Canada, Mexico, Central America, Indian Subcontinent, and the Middle East. In 2019, they optimized port-pair connections to accommodate customers' needs for greater reliability and stability in service quality. In April 2020, HMM from South Korea joined THE Alliance and increased its total capacity by 519,000 TEUs; thereby, increasing THE Alliance's global market share from 25 to 30%. As a part of THE Alliance's ongoing commitment to offer more sustainable services by minimizing the carbon footprint of its service network, a modern series of fuel-efficient 23,500+ TEU vessels will replace smaller vessels.

The creation of these alliances is predominantly positively viewed in the industry because the cooperation among the carriers provides for greater service reliability, service frequency and transit time. Conversely, some believe that the concentration of control and resources led to upward pressure on rates and degradation of shipper choices and customer service.

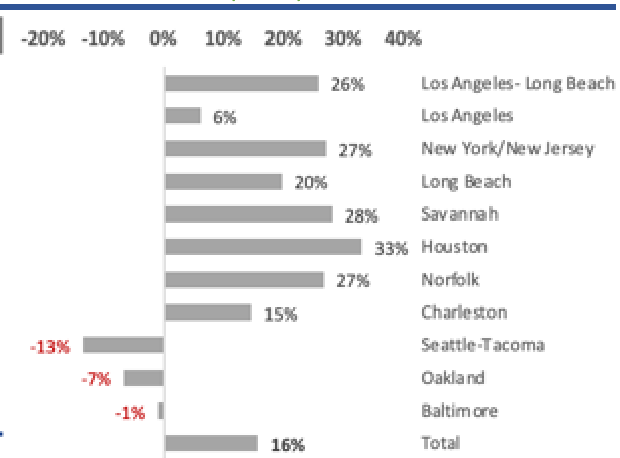
5.2 Container market expansion and throughput growth

Reflecting the growing volume of goods transported by container ships, the global market for shipping containers volume is expected to more than double in the coming years. While the market was sized at about seven billion U.S. dollars in 2021, it should reach almost 16 billion U.S. dollars in 2028.

The growth in U.S. ports between 2019 and 2022 demonstrates the impact of the siege on ports during the COVID-19 pandemic and the associated supply chain challenges at the top ten ports. While global container volumes at US top ten port grew at over a 16% rate over the last three years experts forecast between 0.5% and 1.5% in 2023, and between 5.5% and 6.5% in 2024, as shown in Figure 69.

Figure 69. Container volume growth in major U.S. ports between 2019 and 2022 (TEUs)

Port region	2022	2019	Change	% Change
Los Angeles- Long Beach	19,044,823	16,969,669	2,075,154	26%
Los Angeles	9,911,161	9,337,635	573,526	6%
New York/New Jersey	9,493,664	7,471,059	2,022,605	27%
Long Beach	9,133,662	7,632,034	1,501,628	20%
Savannah	5,892,137	4,599,172	1,292,965	28%
Houston	3,974,900	2,987,291	987,609	33%
Norfolk	3,703,231	2,922,468	780,763	27%
Charleston	2,792,318	2,436,188	356,130	15%
Seattle-Tacoma	2,649,548	3,058,346	-408,798	-13%
Oakland	2,337,129	2,500,461	-163,332	-7%
Baltimore	1,069,288	1,078,257	-8,969	-1%
Total	**50,957,038**	**44,022,911**	**6,934,127**	**16%**



Source: The Bridges Group International, 2023.

As a result of the service disruptions and supply chain backups during the pandemic, U.S. companies are under pressure from boards of directors and Wall Street analysts to make their supply chains more resilient. One way to do that is to use four or five gateways in a "Four-Corner strategy" rather than concentrating imports in one port gateway. This pattern of shifting gateways started to emerge in 2019 as well. While volume grew in all three coastal regions, the Gulf coast experienced a 33.1% increase in volume and 1% increase in overall market share for the U.S., as shown in Table 10.

Table 10. Container volume growth in major U.S. ports by coastal region (TEUs)

Coastal region	2022	2019	Change	% Change	2022 Share	2019 Share
West Coast	24,031,500	22,528,476	1,503,024	6.7%	47%	51%
East Coast	22,950,771	18,507,144	4,443,627	24%	45%	42%
Gulf Coast	3,974,900	2,987,291	987,609	33.1%	8%	7%

Source: The Bridges Group International, 2023.

5.2.1 More container volume requires larger vessels

Maritime shipping is the backbone of world trade; it is estimated that some 80 percent of all goods are carried by sea. With the growth of the world economy over the past decades, the volume of freight transported by ships has increased as well. In 2021, about 1.95 billion metric tons of cargo were shipped globally, up from some 0.1 billion metric tons in 1980. Naturally, the global container fleet has grown as well. Between 1980 and 2022, the deadweight tonnage of container ships grew from about 11 million metric tons to roughly 293 million metric tons.

The size of container vessels will continue to grow as more capacity is delivered to the fleet. The Mediterranean Shipping Company (MSC) took delivery of two mega ships in March 2023—MSC Tessa and MSC Irina—which are among the world's largest container ships to date at more than 24,000 TEU each. It followed the delivery in February of the 24,118 TEU OOCL Spain, the first of six under construction.

The global container fleet is forecast to grow by 6.3% in 2023 and by 8.1% in 2024. Supply is set to rise with the easing of port congestion and deliveries of new vessels ordered during the boom of the past two years. BIMCO predicts that 4.9 million TEU will be delivered in 2023 and 2024, equivalent to an additional 19% of the fleet size at the beginning of 2023.

5.2.2 Larger container vessels requires modern infrastructure

With the introduction of the massive vessels, terminal infrastructure will require newly designed container terminals, equipped with modern state of the art ship-to-shore container cranes to load and unload the boxes. Other changes including rail connections and network integration, terminal operating systems, automated terminal operating equipment, yard management, on-dock rail connectivity and maintenance protocols. Absent these changes, ports will not be able to take advantage of the growth opportunity presented by the anticipated expansion of the container shipping industry.

In addition to the economy of scale that the larger vessels offer, the industry is committed to reducing its carbon footprint and promoting positive climate action and achieving net zero emission goals. The vessels are being designed to be powered by alternative fuels such as liquefied natural gas, methanol, compressed natural gas, and e-methanol. Listed below are three examples of the industry's commitment to carbon reduction and a more sustainable environment.

- **Methanol (Maersk)**—In late 2022, SunGas Renewables announced a strategic green methanol partnership with Denmark-based Maersk, the world's second largest container shipping company, to produce green methanol from multiple facilities around the country. Maersk is a leader in decarbonizing marine shipping by using green methanol to fuel its new and growing fleet of methanol powered container vessels. The BLRE project is SunGas Renewable's first facility to produce green methanol for Maersk.
- **LNG (MSC)**—MSC Washington, built in China and delivered in 2022, is the company's first LNG-fueled containership. MSC has a massive orderbook which Alphaliner calculates at a total of 127 vessels with a carrying capacity of 1.66 million TEU. Included in this are 10 LNG fueled container ships to be operated by MSC.
- **Dual fuel (Evergreen)**—Evergreen Marine has sealed the order for twenty-four methanol dual-fuel containerships in a monumental step toward decarbonizing its fleet. The 24 vessels are reported to be in the 16,000 TEU size range and are expected for delivery between 2026 and 2027. Container vessel size and corresponding port infrastructure are shown in Figure 70.

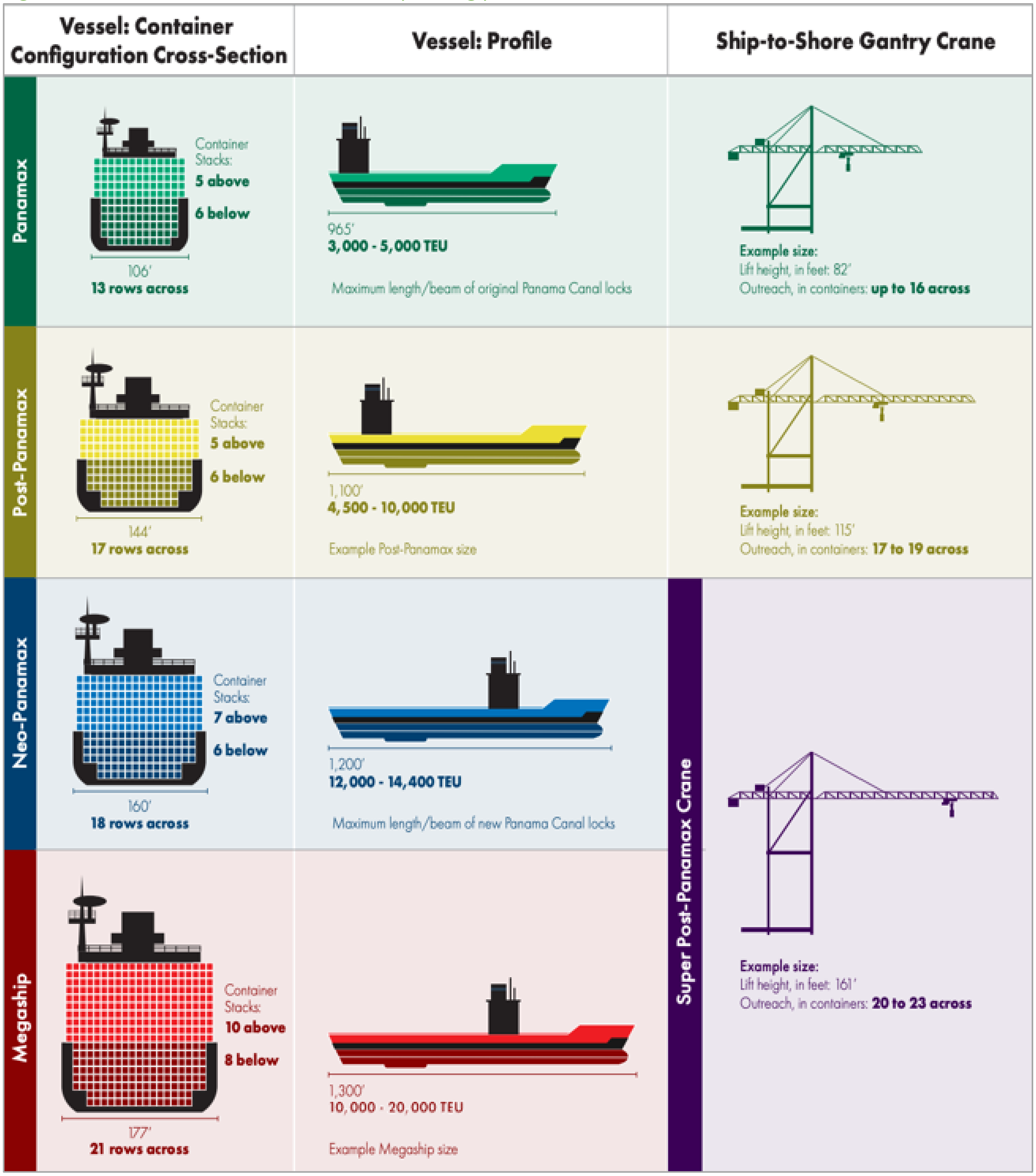
5.3 Major implications for PPHTD

PPHTD is ideally positioned to develop the infrastructure that will deliver an alternative, competitive, innovative, technologically advanced, cost effective and timely solution that addresses the industry growth potential as well as promote supply chain sustainability and resiliency.

As a greenfield development opportunity PPHTD has the available real estate assets to immediately attract partners to develop a mega container terminal with 4,000 ft berth, 250- 300 acres yard initial footprint and 75 to 100 acres intermodal container transfer facility.

With the existing pipeline network PPHTD can potentially leverage the current customer base and commodities become a service center for vessels requiring alternative fuels and bunkers such as, LNG, e-methanol, hydrogen, etc.

Figure 70. Container vessel size and corresponding port infrastructure



Source: USDOT BTS, 2023. Vessel size and corresponding crane size. All cranes or vessels in a column are to scale with each other, but scale differs between columns.

6. Route economics & key target markets

This section evaluates route cost competitiveness of freight movement to and from the U.S. Midwest via PPHTD and the Mississippi River System and connecting marine highways. First, this section evaluates route costs for drybulk and agribulk commodities originating in the study area to final customers in Asia, Europe, South/Central America, Africa, and Mexico using the proposed Mississippi River barge route versus incumbent rail routes. Next, this section evaluates the route cost economics of containerized imports from Asia, Europe, South/Central America, Africa, and Mexico to final customers in the market study area using PPHTD versus incumbent routes. This section concludes with a summary of logistical advantages of each route and takeaways.

6.1 Non-containerized cargo routes

6.1.1 General assumptions

Bujanda & Allen calculated the route costs for drybulk cargo by modal component (i.e. truck, rail, and barge). Route costs were calculated first for the primary incumbent routes and then compared to the routes that the cargo would follow using the barge route via PPHTD. Cost, distance, and similar inputs were obtained for each modal segment of the trip for each route analyzed. Then, all costs were converted to dollars per metric-ton ($/MT) to allow consistency across modes based on payload factors and the carrying capacity for each mode and their respective units, as shown in Figure 71.

Figure 71. Unit capacity by mode of transport in metric tons.

a) Truck	b) Jumbo Hopper railcar (5,161 ft^3)	c) River barge
19 metric tons (41,888 lb)	**100 metric tons** (223,400 lb)	**2,000 metric tons** (4,409,245 lb)

Source: Bujanda & Allen LLC, 2023.

As observed, the river barge overshadows the other two transportation modes, handling roughly 20 times as much as a railcar and 100 times as much as a truck.

6.1.2 Drybulk and agribulk routes by rail

Bujanda & Allen identified the main incumbent routes for drybulk and agribulk exports from major draw regions and barge loading terminals within the market study area to each of the following export gateways: PPHTD, Houston, Portland, Norfolk, and Mexico City via Laredo. All routes have rail as the inland transport component and two have barge. An additional route analyzed is the U.S. West Coast (San Pedro Bay + Oakland), as Oakland announced efforts to revamp agribulk exports.[7] Given the high correlation and similarity on values between drybulk and agribulk route costs in all modes, these route costs are analyzed collectively as a single category. Route costs for liquid-bulk can be expected to follow similar patterns for each of the modes analyzed; although, most liquid-bulk freight moves by pipeline given that is the most economical mode of transport for liquids.

The incumbent routes to each export gateway are explained next and displayed in Figure 72:

- **Plaquemines (PPHTD).** This is the main corridor for the Gulf Coast gateway for agribulk, drybulk, and non-containerized exports. There are two alternatives to move cargo from the U.S. Midwest to PPHTD, by rail and barge, each detailed next:

[7] Port of Oakland Launches Program to Expedite Ag Exports. Port of Oakland, Press Release, Jan 3, 2022: https://www.portofoakland.com/press-releases/port-of-oakland-launches-program-to-expedite-ag-exports

- **By rail:** UP provides a direct service to gateway ports in the New Orleans region, via a corridor parallel to the Mississippi River, for a total route length of 890 mi. BNSF provides service to New Orleans, via its Houston corridor, with a total length of 1,210 mi. This corridor connects with CSXT interchange in the east-west direction and with UP, KCS, and CN in the north-south direction. An alternative route (not shown) is operated by Kansas City Southern (KCS) serving both ports, Houston and New Orleans. These gateways also serve an important amount of traffic of drybulk and agribulk exports destined to the Port of Veracruz in the Gulf of Mexico.
- **By barge:** River transportation is available through the Port of St. Louis[8] along the Mississippi River. This route is composed of a truck trip from loading points within a 150 mi radius to St. Louis and a 1,190 mi movement by barge along marine highway M-55 from St. Louis to PPHTD, the export gateway. The Port of St. Louis presently handles all cargo-types.

- **Seattle, Tacoma, and Portland.** This 2,240 mi long route is the primary route for agribulk exports destined to Asia via the Pacific Northwest (PNW), which includes the ports of Portland, Vancouver, WA, Kalama, Longview, Seattle, and Tacoma. This route is served by BNSF and UP. UP connects directly to loading sites near Kansas City, along the Missouri River, and in St. Louis, MO which is assumed as our loading point. Hence, we assume most cargo will follow UP corridors to minimize interchange or trackage-rights usage fees, consistent with industry practices.

- **Norfolk.** This 1,510 mi route is the primary corridor for drybulk and agribulk exports via Norfolk, VA in the East Coast. This route is served by the Norfolk Southern (NS) with interchange with CSXT. Truck loading points are assumed within a 150 mi radius to and from St. Louis.

- **Mexico City via Laredo.** This 2,040 mi corridor is served by BNSF and UP on the U.S. side of the border. UP connects with Kansas City Southern Mexico (KCSM) in Laredo, Texas and this corridor extends all the way to Mexico City (CDMX). This corridor was considered the most representative route choice between the study area and Central Mexico.[9] There is also a water route from the current draw area to Mexico City, which incorporates barge to Galveston and New Orleans, a transgulf vessel to Veracruz, and truck to Mexico City.

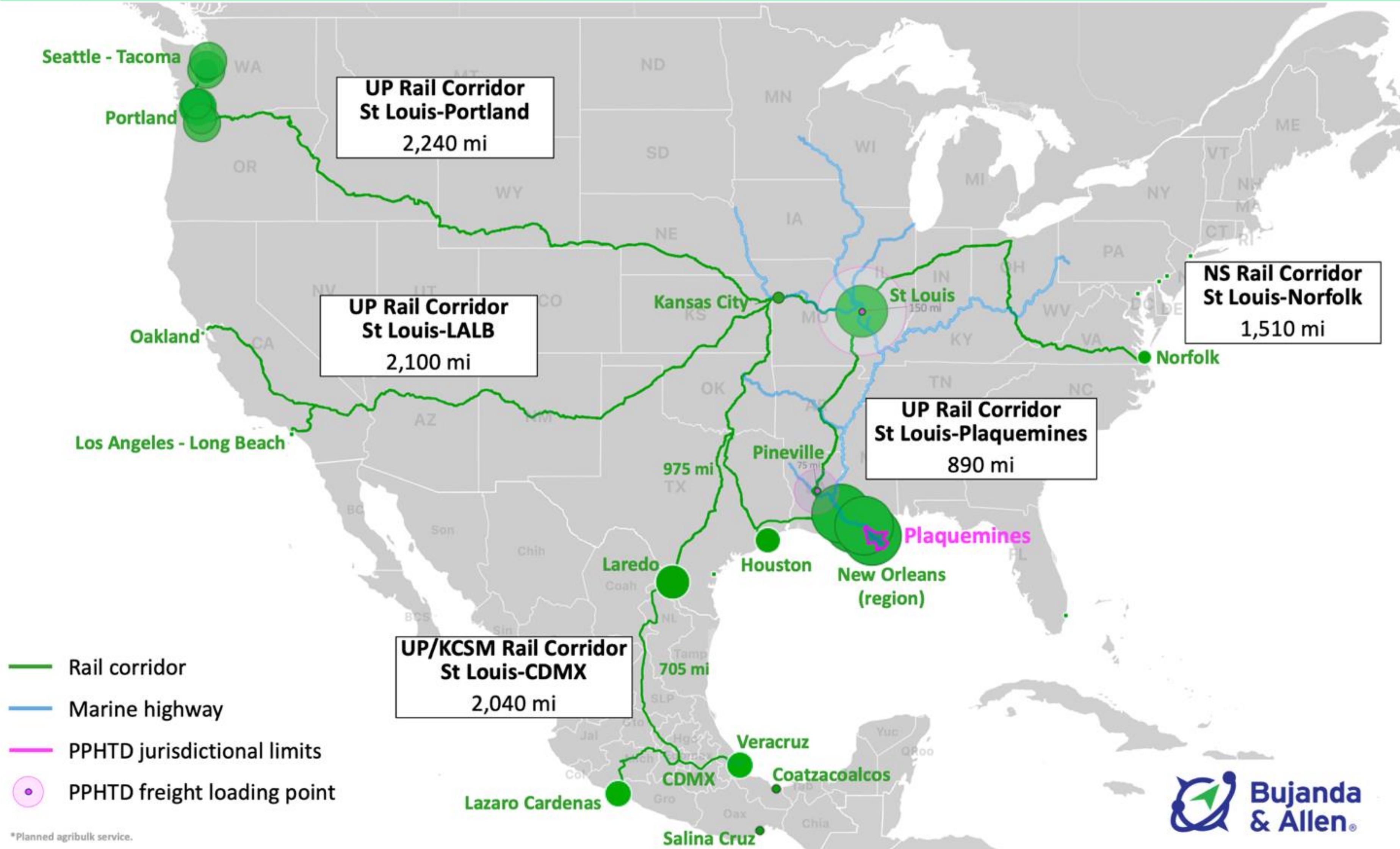
- **San Pedro Bay (+ Oakland).** This is the corridor for non-containerized exports moving via other ports on the West Coast (primarily Los Angeles or Long Beach), since the bulk of this cargo is destined to Asia. It is about 2,100 mi long to the Los Angeles-Long Beach (LALB) area and is served by UP and BNSF. Additional loading points for exports along the Missouri River include Kansas City (360 mi upriver from St. Louis), Brunswick, MO (250 mi upriver from St. Louis), and the planned Heartland Port Project (167 mi upriver from St. Louis).

[8] The Port of Metropolitan St. Louis (PMSL), as defined by the USACE, is 70 miles long and includes both sides of the Mississippi River. It is the third-largest inland water port by tonnage in the U.S. and the northernmost ice- and lock-free port on the Mississippi River. The City of St. Louis Port District, which is within the PMSL, covers 19 miles of riverfront and 6,000 acres of developable land, including the Municipal River Terminal (MRT). The Port is the second-largest inland port by trip-ton miles, and the third-largest by tonnage in the U.S., with more than 100 docks for barges, 16 public terminals on the river inside the port facility, and about 55 docks/terminals considering those outside the port limits in the towns of Madison, St Clair, and St Charles. The Port of St. Louis presently handles all non-containerized cargo-types and container on-barge by SCF.

[9] There are three main rail corridors connecting Central Mexico with the Texas border:

i. The Ferromex corridor that extends from Queretaro, Aguascalientes, Torreon, Chihuahua, and Cd. Juarez connecting with UP and BNSF in El Paso.
ii. The KCSM corridor that extends from Mexico City, San Luis Potosi, Saltillo, and Piedras Negras (interchanging with Ferromex) connecting with UP in Eagle Pass.
iii. The KCSM corridor extends from Mexico City to San Luis Potosi, Saltillo, and Nuevo Laredo connecting in Laredo.

Figure 72. Incumbent routes—main rail corridors for drybulk and agribulk exports from the U.S. Midwest

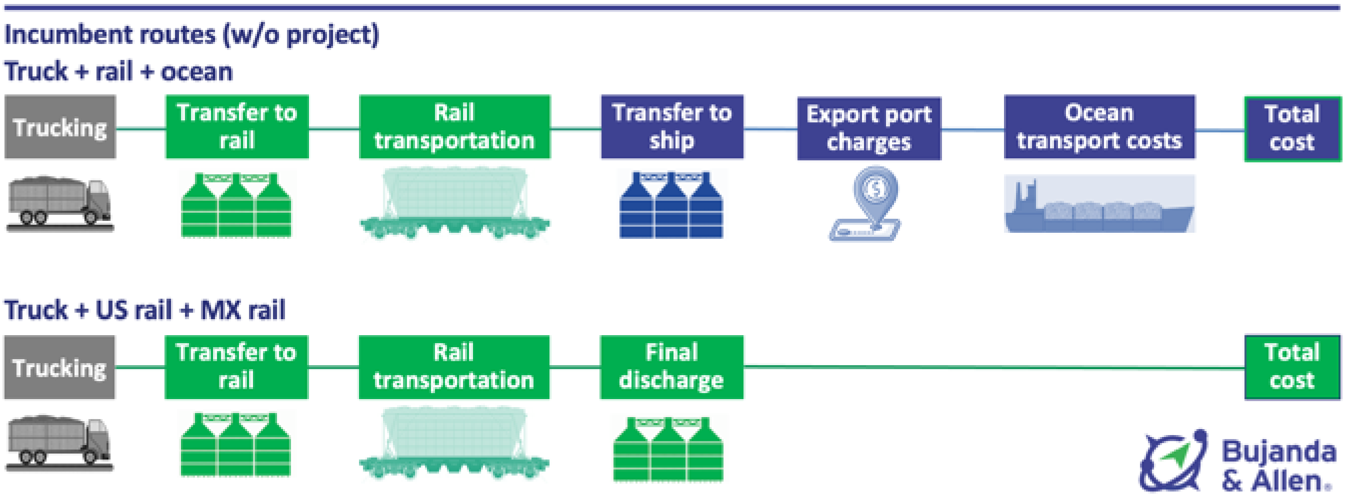


Source: Bujanda & Allen LLC, 2023.

6.1.3 Route costs for drybulk and agribulk cargo via incumbent routes (rail)

Bujanda & Allen estimated route costs via incumbent routes by considering each handling movement and modal segment of the supply chain. Segments analyzed include the trucking trip from the loading point (e.g. a farm, mine, or mill), discharging of trucks, temporary storage, loading to railcar, rail transportation, transfer to ocean vessels, port charges, and ocean transportation via each of the export gateways in the U.S. Additionally, an inland rail route was analyzed via Laredo into Mexico City. The handling movements and modal segments for each route analyzed are illustrated in Figure 73.

Figure 73. Rail, transloading, and ocean transportation costs for drybulk and agribulk cargo by rail ($/MT).



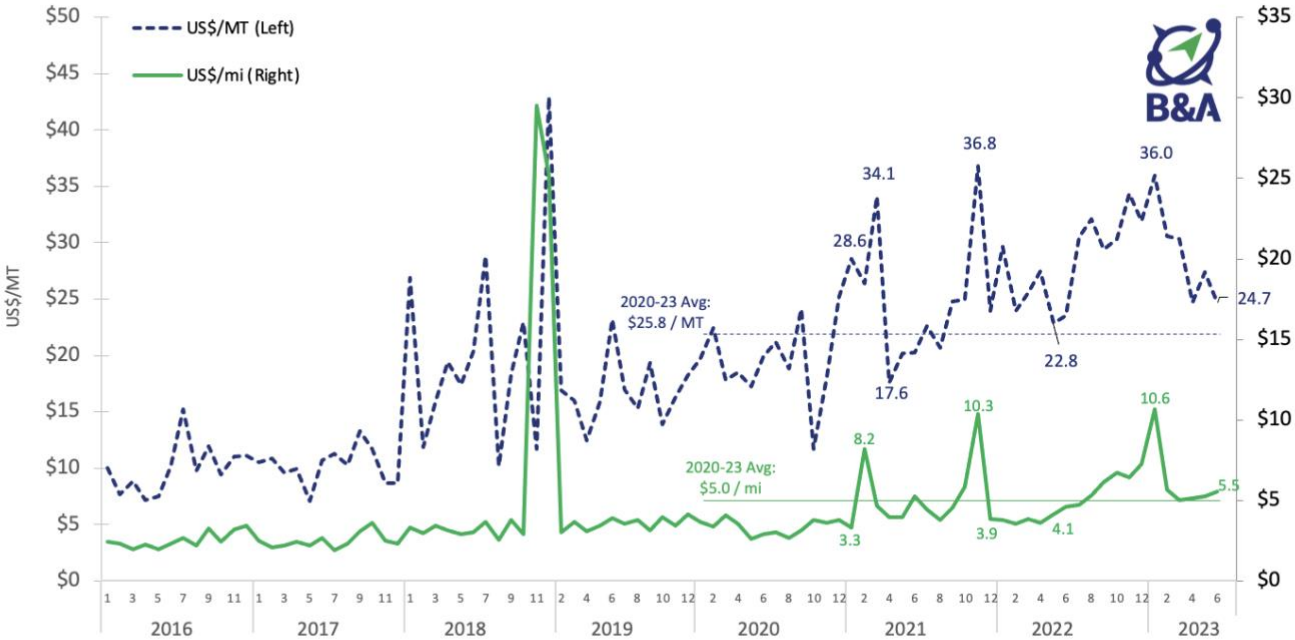
Source: Bujanda & Allen LLC, 2023.

Bujanda & Allen first analyzed the historical trends of freight rates by truck, rail, and ocean vessel, primarily due to increased volatility after the COVID-19 disruptions. For rail and vessel rates, the spread between the two major incumbent drybulk and agribulk gateways, the U.S. Gulf and the PNW was analyzed.

Since the aggravation of the COVID-19 pandemic in early 2020, supply chains severely slowed down due to numerous reasons: port shutdowns (primarily in China), disrupted shipping and railroad lanes, labor and material shortages, unpredictable changes in demand, etc. These shocks had a material impact on the historical freight rate trends, which were further exacerbated by the most recent inflationary trends.

The volatility of truck rates for drybulk and agribulk shipments originating in the U.S. Midwest increased from $11.7/MT in 4Q20 to $36.8 /MT in 4Q21, then decreased to $24.7/MT in 2Q22, as shown in Figure 74.

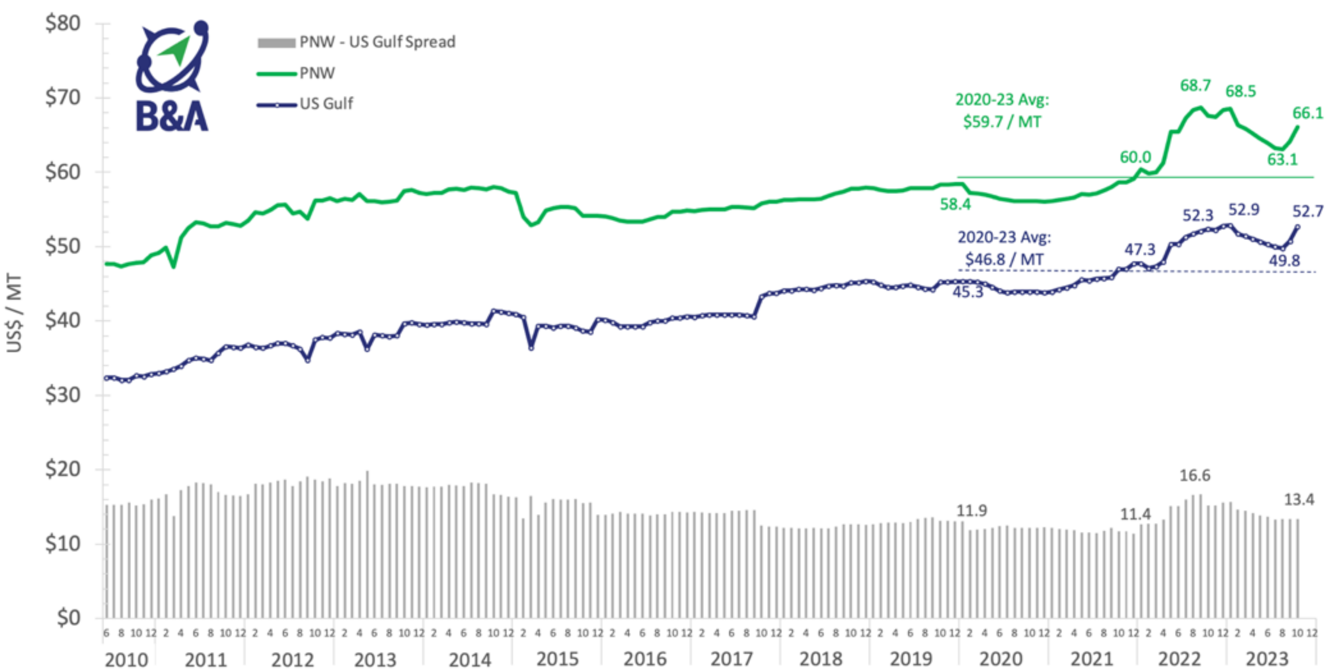
Figure 74. Truck rates for drybulk and agribulk shipments from the U.S. Midwest



Source: Bujanda & Allen, 2023.

The rail rates for drybulk and agribulk shipments from the U.S. to Asia via ports in the two major incumbent gateways, the U.S. Gulf and the PNW, reflected less pronounced volatility in the early stage of the pandemic. However, during the late part of 2022 rail rates for drybulk and agribulk shipments from the US Midwest to the U.S. Gulf and the PNW were more pronounced, subsequently to fall to levels closer to the mean, as it was the spread between the two. The spread is the difference between the more expensive rail rates via the PNW route and the less expensive U.S. Gulf. This spread on rail rates has a direct impact on the basis and pricing of grain future contacts. The rail rates for drybulk and agribulk shipments via the U.S. Gulf and the PNW are shown in Figure 75.

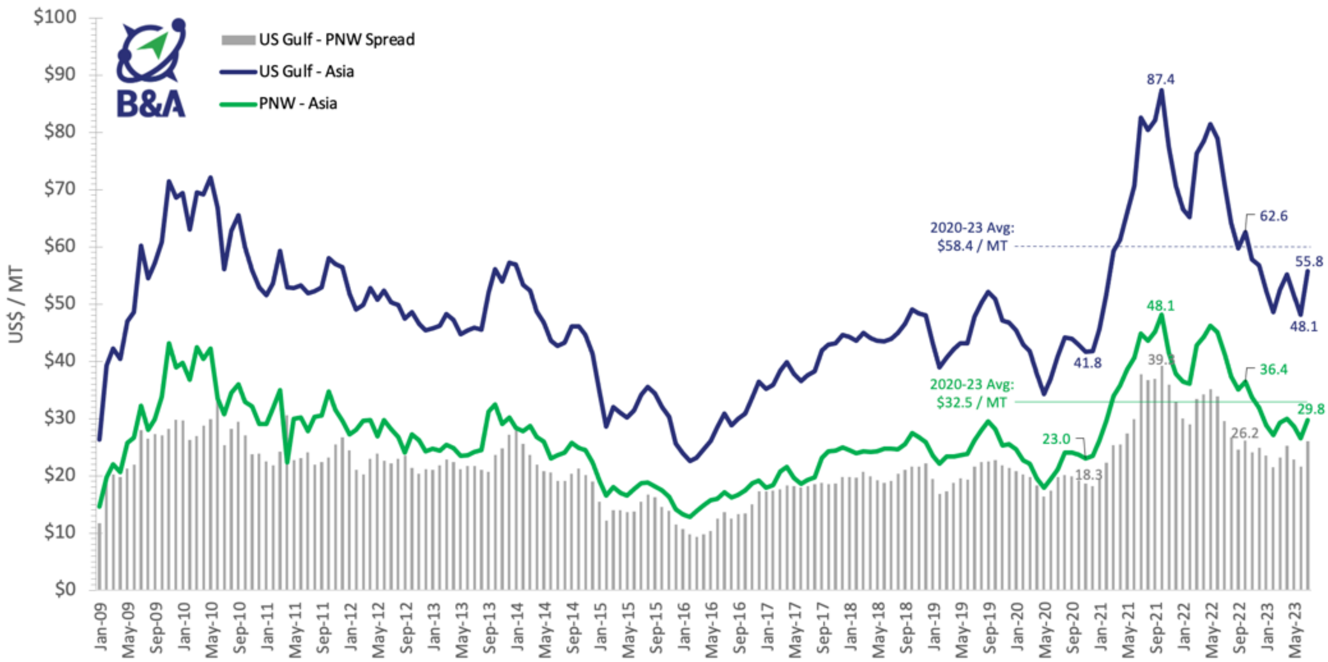
Figure 75. Rail rates for drybulk and agribulk shipments from the US Midwest ($/MT)



Source: Bujanda & Allen, 2023.

The vessel rates for drybulk and agribulk shipments from the U.S. to Asia via ports in the two major incumbent gateways, the U.S. Gulf and the PNW, reflected higher volatility during the pandemic, particularly after 1Q21. Via the U.S. Gulf, rates increased from $41.8/MT to a peak of $87.4/MT (double) in 4Q21, which translated into a spread of $39.3/MT over PNW ports during the same quarter. On the late 2Q23, rates dropped to $48.1/MT creating a spread of $26.2/MT over the PNW, before bouncing back to $55.8/MT and $29.8/MT, as shown in Figure 76.

Figure 76. Vessel rates for drybulk and agribulk shipments to Asia ($/MT)



Source: Bujanda & Allen, 2023.

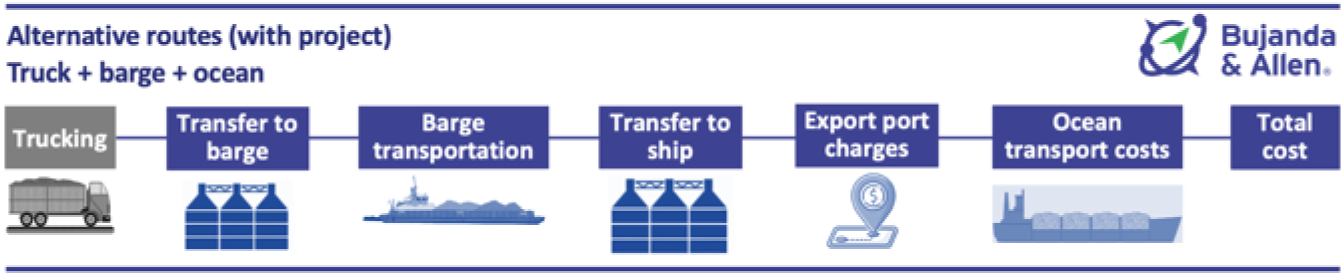
With each transport mode having its own advantages and disadvantages in addition to cost (e.g. reliability, travel time, frequency, parcel size, safety, etc), many of these factors have a strong influence on logistic choices made by BCOs and play an increasingly important role on transportation mode and route selection.

6.1.4 Drybulk and agribulk route costs via PPTHD's marine highway route (barge)

By using the marine highway alternatives, we assume shippers looking to export drybulk and agribulk freight out of the market study area would have to truck their cargo to barge docks, transfer it to loading bins for storage, and reloading into barges, before freight is shipped to PPHTD. To understand a broad spectrum of the different range of outcomes, we analyzed two loading points in separate geographies: (i) St. Louis, MO and (ii) Pineville, LA. Both assume different driving ranges. Shippers looking to export drybulk and agribulk freight near St. Louis would have to truck their cargo 150 mi to loading river terminals or docks in St. Louis and 75 mi for loading near Pineville.

Once in the port, shipments will have to be discharged from the trucks into temporary storage and then loaded into barges for transportation to PPHTD in the Gulf. The construction of the barge rate includes truck discharge, storage, barge loading, barge transportation from either loading points to PPHTD, and a transfer cost from the barge to the ocean liner vessel. The cost elements for exporting drybulk and agribulk cargo to these same foreign destination regions but using routes that would rely on the barge route are shown in Figure 77.

Figure 77. Route costs via the barge route for drybulk and agribulk cargo to Asia ($/MT)

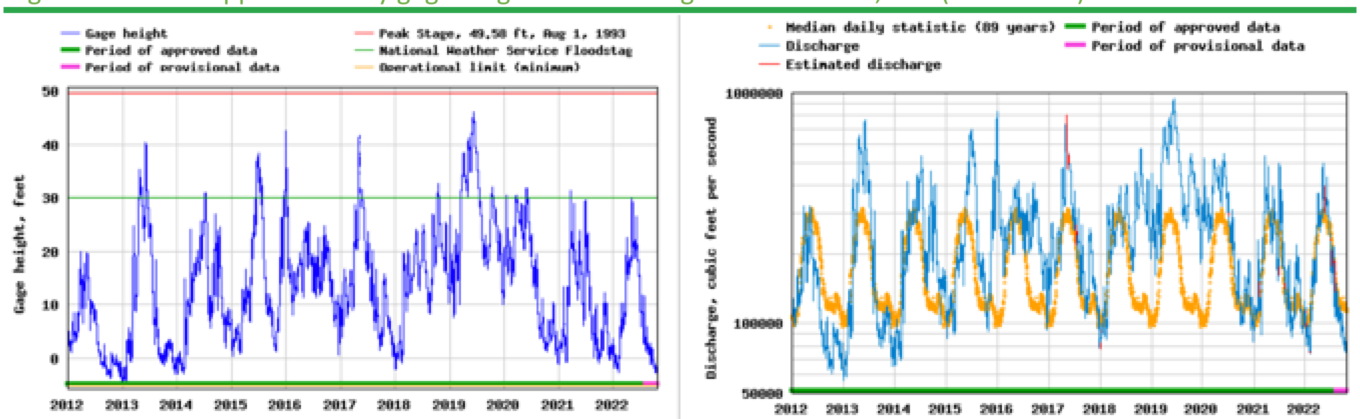


Source: Bujanda & Allen LLC, 2023.

Bujanda & Allen analyzed the historical trends of freight rates by barge for different marine highway segments. Periods of abnormal low water levels disrupt marine barge traffic, as low water levels force barge and towboat operators to limit the payloads they can take to prevent barges from running aground. Because a portion of the operating expenditures are fixed, lower barge payloads result in higher unitary costs. Higher barge rates are very apparent in the late part of 2013 and 2014, which precisely coincide with the last time the Mississippi River was below its 89-year median daily gage readings.

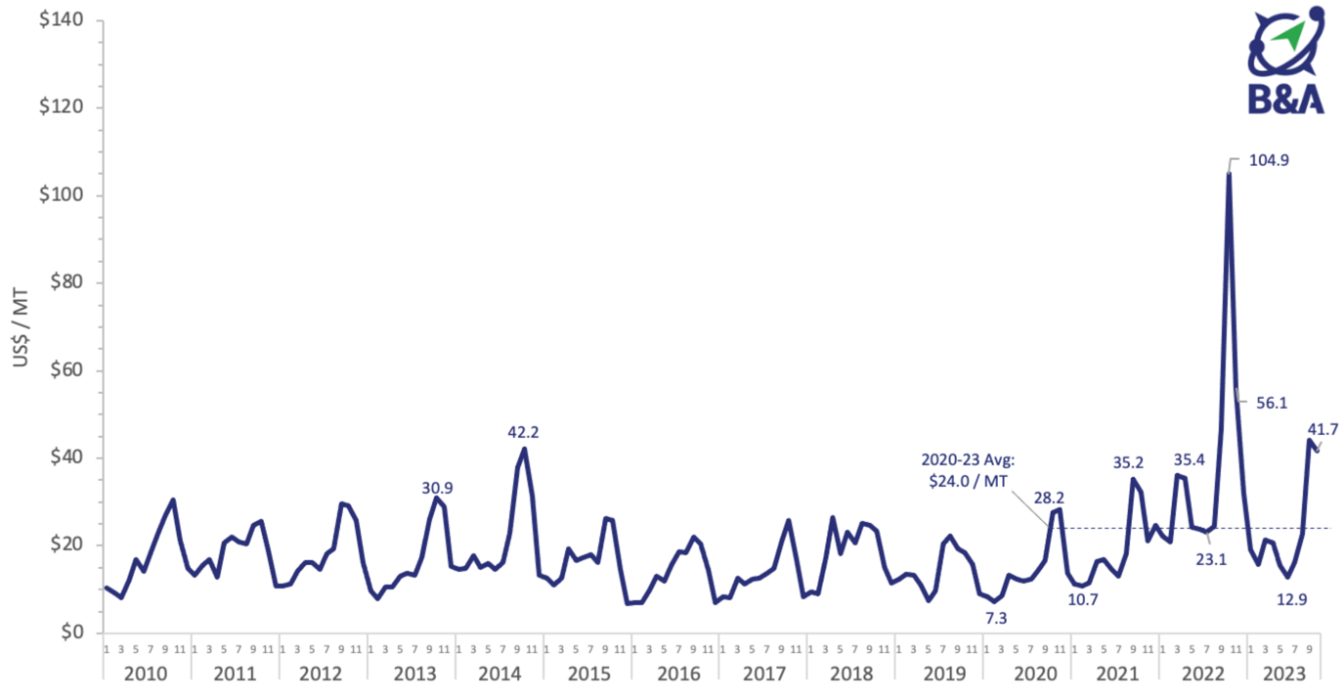
In the winter of 2022, the Mississippi River reported abnormally low water levels, which is bringing rates to historically high levels combined with other macroeconomic events such as high inflation and the invasion of Ukraine. Water levels for the river are illustrated in Figure 78. Average barge rates for downbound drybulk and agribulk shipments from the U.S. Midwest are shown in Figure 79. Detailed time-series for rates from major loading points indicate that barges loading in the Lower Illinois river are about 11% higher than the Mid-Mississippi; moreover, the highest, abnormal peak observed in the winter of 2022 has reverted to the mean although it bounced back to traditional historical maxima observed in 2013 and 2014, as shown in Figure 80.

Figure 78. Mississippi River daily gage height and discharge near St. Louis, MO (2012-2022)



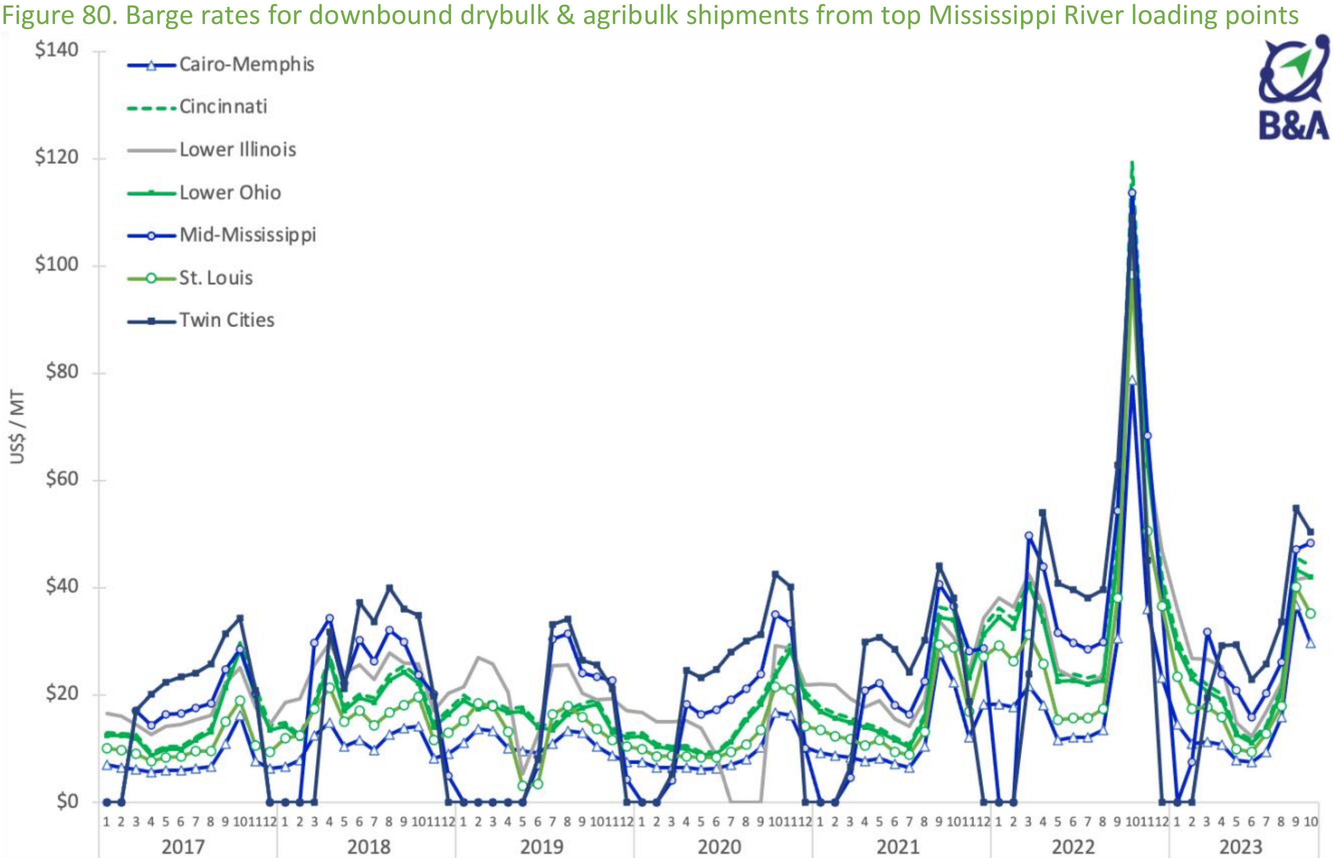
Source: Bujanda & Allen LLC, 2022 with data from NOAA.

Figure 79. Average barge rates for drybulk and agribulk shipments from the U.S. Midwest (2010-23)



Source: Bujanda & Allen LLC, 2023.

Figure 80. Barge rates for downbound drybulk & agribulk shipments from top Mississippi River loading points



Source: Bujanda & Allen LLC, 2023.

The cost chains for drybulk and agribulk exports were divided into the following categories:

- **Trucking (drayage)**. The first leg of an export trip begins with the movement of freight from its origination site (e.g. a farm) to the loading terminal.
- **Barge transport costs**. Long-haul barge movements represent the next leg of the trip to PPHTD. These costs include loading and discharging costs incurred by the barge operator.
  - *Barge loading.* These costs are incurred at the port and paid by the barge operator.
  - *Barge discharging.* These costs are for discharging freight from the barge into storage bins at the export gateway (e.g. New Orleans), and as with the loading operation, paid by barge operators.
- **Transfer costs (ship loading) at the gateway**. These are costs that are incurred at the gateway port for loading grain onto the ocean vessel for transportation to destination ports in Asia and Europe.
- **Ocean transport costs**. The representative destination ports in Asia and Europe (e.g. Shanghai and Rotterdam) for exports and its associated ocean transportation costs remained unchanged.

6.2 Containerized cargo routes

6.2.1 General assumptions

Bujanda & Allen calculated the route costs for containerized cargo by component—truck, rail, and barge—for the primary incumbent routes, and then compared them to the route costs offered by the proposed barge route via St. Louis, MO and Dallas, TX. Once cost inputs were obtained and calculated for each cost component per route, all costs were converted to dollars per 40 ft container ($/FEU). The payload capacities assumed by mode are illustrated in Figure 81.

Figure 81. Unit capacity payloads assumed by transportation mode, in metric tons and 40 ft containers.

a) 40 ft container by truck	b) 40 ft container by rail	c) River barge

15 metric tons (33,070 lb)	**15 metric tons** (33,070 lb)	**236-48 containers** per barge

Source: Bujanda & Allen, 2023.

For container on barge (COB) service, presently, there are barge operators providing service between St. Louis and ports in New Orleans. This weekly service operates 195-200 ft barges capable to accommodate 36 loaded 40 ft-containers (3 high) and 48 if empties (4 high). Typically, 1 tugboat can push up to six container barges.

6.2.2 Containerized route costs via incumbent routes (rail)

Shippers and receivers looking to move freight have two primary gateway alternatives through which containers can be routed: (i) San Pedro Bay (SPB) on the West Coast and (ii) New York-New Jersey (NYNJ) on the East Coast. These two incumbent routes are the primary corridors for containerized imports, with Savannah quickly gaining prominence. Secondary corridors go through the Northwest Seaport Alliance (NWSA), ports in Seattle and Tacoma, for the Asia trade and through Norfolk and Baltimore for the European trade. Laredo serves as a top gateway for land traffic with Mexico. Ports in New Orleans serve as a gateway for some traffic to and from Asia, Europe, and South America, and is the only alternative providing connection to M-55. Containerized route costs via incumbent routes involve ocean, rail, transloading, and drayage cost components, as shown in Figure 82.

Figure 82. Ocean, rail, transloading, and drayage transportation costs for containerized cargo by rail ($/FEU).

Source: Bujanda & Allen, 2023.

The incumbent routes for containers are detailed next and displayed in Figure 83.

- **Plaquemines Port (PPHTD)**—This is a rail route for containerized cargo handled via the U.S. Gulf also competing with a COB service via the Mississippi River (M-55 and M-35). This corridor is suitable for double-stack trains. For our route cost analysis, this corridor begins at St. Louis, MO and continues 890 mi southbound via the UP railroad to PPHTD, passing through Little Rock, AR and Pineville, LA en-route to Batton Rouge and ports in New Orleans, where it connects with the NOGC. Formerly a UP branch line, the NOGC is a 32-mile short-line that interchanges with the UP in Westwego, LA. The railroad serves over 20 switching and industrial customers and is the only railroad operating east of Avondale, LA on the Westbank of the Mississippi River all the way to PPHTD.[10]

- **San Pedro Bay (SPB)**—This is the main route for containerized imports from Asia via the Pacific Coast. This rail corridor is 2,110 mi to St. Louis and is served by UP with a competitive alternative offered by BNSF. Marine containers on double-stack trains dominate this route. This corridor extends all the way to St. Louis traversing Missouri via the junction in Kansas City. Most import containers are railed from the ports of Los Angeles and Long Beach to Kansas City and St. Louis, where we assume the majority are emptied before being trucked (an average of 150 miles) to destinations in the market study area.

- **NYNJ**—This is the primary corridor for containerized imports and exports via the Atlantic Coast. This 1,010 mi long corridor is served from St. Louis to ports in NYNJ via NS. The estimated average trucking distance between loading/discharging regions within the study area and the project site is 150 mi from intermodal ramps in St. Louis. Additionally, this corridor has the alternative of unloading containers at Fort Wayne, Cleveland, Pittsburgh, and other important intermodal points. This corridor is suitable for double-stack trains.

- **Savannah**—This gateway, located 935 mi from St. Louis, has recently gained prominence as a viable alternative for Asian imports, particularly after ports in the West Coast faced congestion issues related to the disruptions caused by the COVID-19 pandemic. This corridor shares some similarities in terms of route length and cost with NYNJ and Norfolk, being among the most competitive ports in the U.S. East Coast.

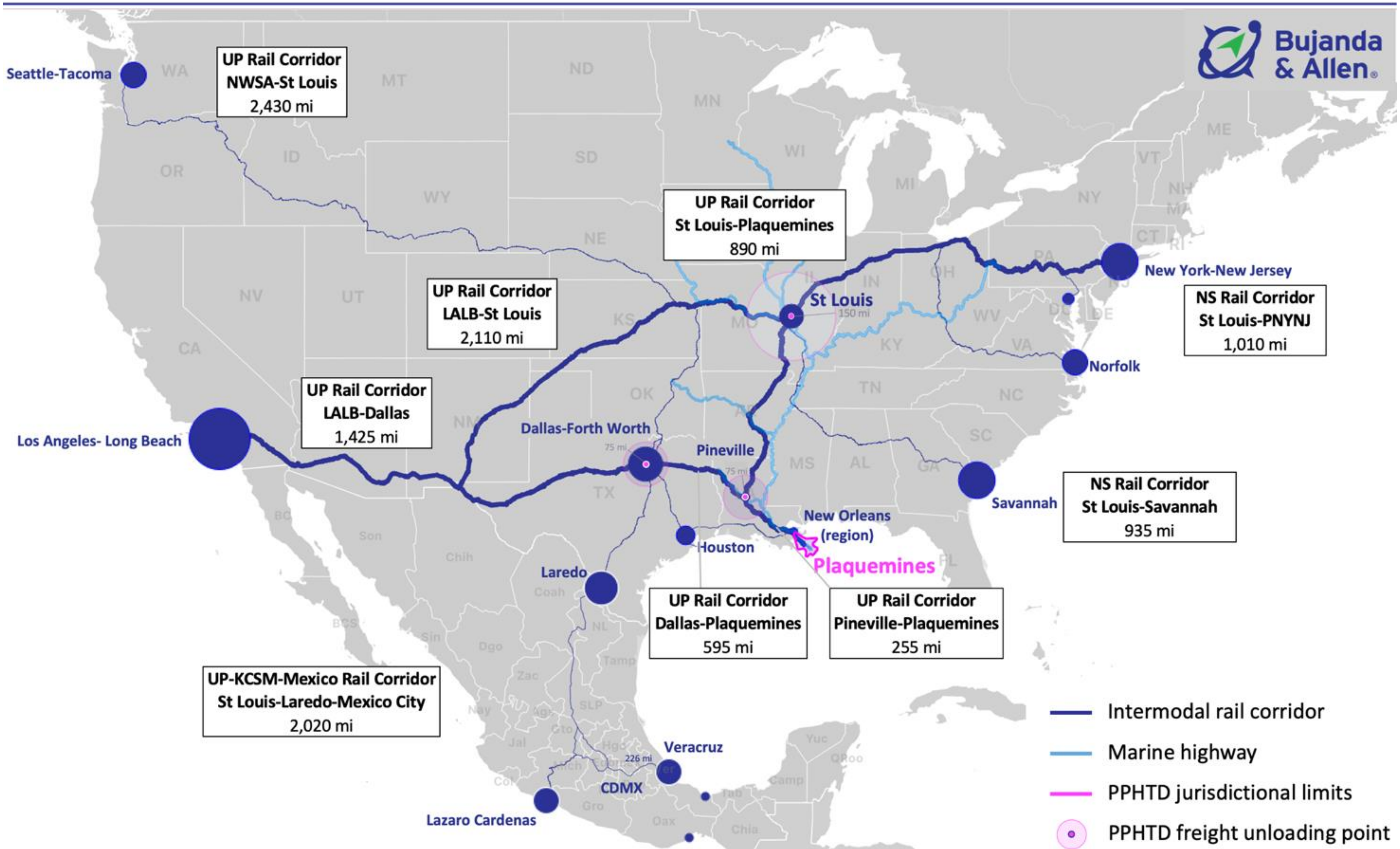
- **Norfolk—**This is a third alternative gateway for containerized imports via the Atlantic Coast. The route is 1,120 mi, served by NS via Fort Wayne to Bellevue near Cleveland, OH, where it diverts southbound towards Columbus, Roanoke, and onwards to the Norfolk port. This corridor is also suitable for double-stack trains and offers numerous interchanges with CSXT.

- **Northwest Seaport Alliance NWSA (Seattle and Tacoma)—**This is a second alternative for containerized imports via the Pacific Coast. It is 2,430 mi to St. Louis, and it is served by UP and BNSF from container terminals in the NWSA. This corridor is also suitable for double-stack trains. This corridor extends from Kansas City to St. Louis, MO mostly parallel to the Missouri River. Although no intermediate intermodal ramps are reported, there are some port projects that have plans to serve COB on the Missouri River.

- **Laredo-Mexico-City—**This 2,020 mi corridor is served primarily by BNSF, but between Temple, TX and Laredo, TX, it must use UP tracks to access the port of entry at Laredo. UP connects with Kansas City Southern Mexico (KCSM) in Laredo, Texas and this corridor extends all the way to Mexico City (Cd. de Mexico or CDMX). This corridor was considered the most representative route choice between the study area and Central Mexico. There is also a water route from the current draw area to Mexico City, which incorporates truck and barge to New Orleans, a transgulf vessel to the Port of Veracruz, and truck 226 mi to Mexico City.

[1010] A map of NOGC was introduced in Figure 15 on Section 2.5, pg.17, earlier in the report.

Figure 83. Intermodal rail routes for container movements to and from Northeastern Missouri.



Source: Bujanda & Allen, 2023. In December 2022, A.P. Moller - Maersk announced a green* methanol Letter of Intent with U.S. based SunGas Renewables Inc, a spin-out of GTI Energy, and a leader in providing technology and equipment systems for large-scale production of renewable fuels. Currently planned to be constructed in Pineville, LA, 255 miles from PPHTD, the first facility is expected to begin operations in 2027 and have an annual production capacity of approximately 400,000 metric tons. E-methanol can move by container tanks, barge, or by pipeline. The UP corridor connects directly to PPHTD. BNSF runs a competing corridor on their west bank and can connect to UP at Avondale.

6.2.3 Containerized route costs via PPTHD's marine highway route (barge)

Ocean transport costs, either from Asia to San Pedro Bay or from Europe to NYNJ, represent the first leg of an import trip. Ocean transport rates for each tradelane were obtained by Bujanda & Allen and validated with third-party data. Long-haul rail movements represent the next leg of the trip from San Pedro Bay to Kansas City or from NYNJ to St. Louis. There are costs at the import gateway port related to ship-to-shore transfer (ship unloading) and loading into a railcar. The rail rate includes loading and discharging between railcar and yard and between yard and truck, as typically quoted by the industry. Trucking represents the last mode of transportation to get cargoes from the nearest long-haul intermodal platform (i.e. St. Louis MO, Dallas-Forth Worth TX, and Pineville, LA) to destinations in the study area. The structure of the 2023 route costs assumed for containerized cargo imports using incumbent routes is illustrated in Figure 84.

Figure 84. Route costs via alternative routes by barge for containerized cargo imports ($/FEU)

Source: Bujanda & Allen, 2023.

After the second half of 2020, the COVID-19 pandemic disrupted global supply chains, leading to shipment delays and soaring shipping costs. Prior to the pandemic, ocean freight rates from Shanghai to New York faced maximum resistance levels around $4,890 per FEU in 1Q15 and remained significantly below those levels until the second half of 2020. During this period, the average rate from Shanghai to New York was $2,760 per FEU.

Rates from Shanghai to Los Angeles had a very similar behavior finding resistance around $2,720 per FEU in 4Q18. The average 2016-2020 ocean spot rate was $1,780 per FEU.

By October 2021, shipping costs soared, increasing over 500 percent from pre-pandemic levels to more than $16,100 per FEU Shanghai - New York and $12,400 per FEU for the Shanghai – Los Angeles tradelane.

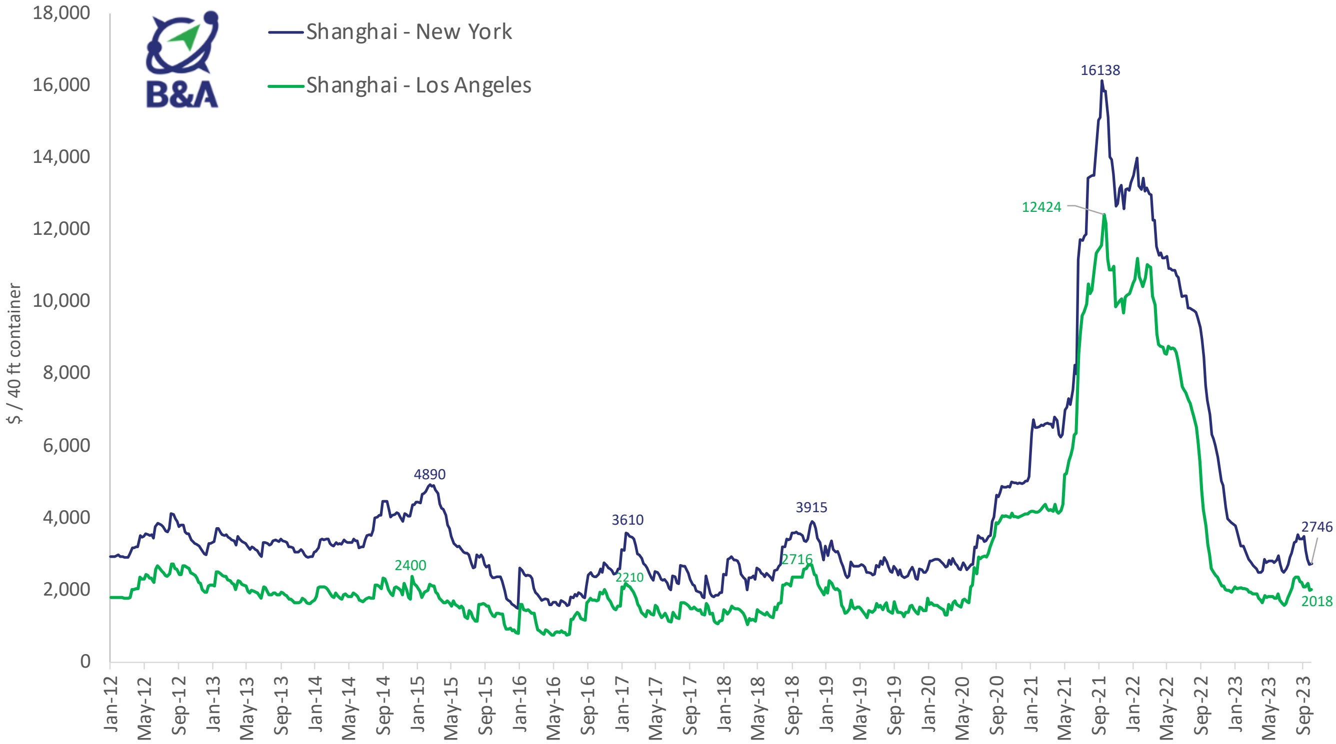
Bujanda & Allen attributes these increases to two main factors:

i) A rapid increase in the money supply triggered by the U.S. COVID-19 stimulus and relief, which was followed by strong consumer demand and a strong rise in demand for intermediate inputs and manufacturing activities, all of which have direct implications for cargo markets.

ii) Strong constraints on shipping capacity driven by logistical hurdles and bottlenecks primarily driven by pandemic disruptions and shortages in containers (e.g. mandated lockdowns in Chinese ports).

Unreliable schedules and port congestion led to a surge in surcharges and fees, including demurrage and detention fees. After 2Q22, ocean freight rates start reverting to historical long-term trends, reaching a bottom floor around the 1Q23. By that time most restrictions and disruptions from the COVID-19, as well as leading indicators of container demand, such as the money supply, disposable income, and consumption expenditures, started to show signs of deceleration and mean reversion, consistent with the timing of decelerating trends of ocean rates. Spot ocean freight rates per FEU from Shanghai to Los Angeles and to New York are shown in Figure 85.

Figure 85. Spot ocean freight rate per 40 ft container from Shanghai to Los Angeles and New York ($/FEU).



Source: Bujanda & Allen, 2023.

6.3 Key takeaways

Our route cost analysis shows the potential savings that can be generated by replacing the inland rail transportation with transportation via the rivers, and how such savings vary for each of the target markets. For containers from Asia, inland cost savings from using a barge or ship from PPHTD are significant compared to shipping a box by rail more than 2,110 mi from San Pedro Bay to St. Louis and then trucking it about 150 mi, on average, to its final destination. Similarly, using a barge or ship from PPHTD is more economical than shipping a box by rail from San Pedro Bay to Dallas or Pineville. The savings from the barge route outweigh the increases in ocean shipping costs. As this route cost analysis demonstrates, Marine Highways could provide a competitive alternative in terms of cost for containers on barge to/from PPHTD, particularly for those destined to or originating closer to the river ports.[11] However, not all BCOs will be incentivized by cost alone. For some, transit times might be more critical, in which case, rail will remain the mode of choice. By comparing rail via PPHTD vs incumbent rail routes via existing gateways, PPHTD offers cheaper routes to/from St Louis, Dallas, and Pineville than alternative ports in the USWC, USEC, and PNW regions.

[11] SCF, a container on barge operator in St. Louis, is currently operating a service on a weekly basis between St. Louis and Baton Rouge for Hapag-Lloyd. SCF estimated it would require at least about 210 boxes/week (11,200 boxes/year) to establish a dedicated service between St Louis and any port in the New Orleans region.

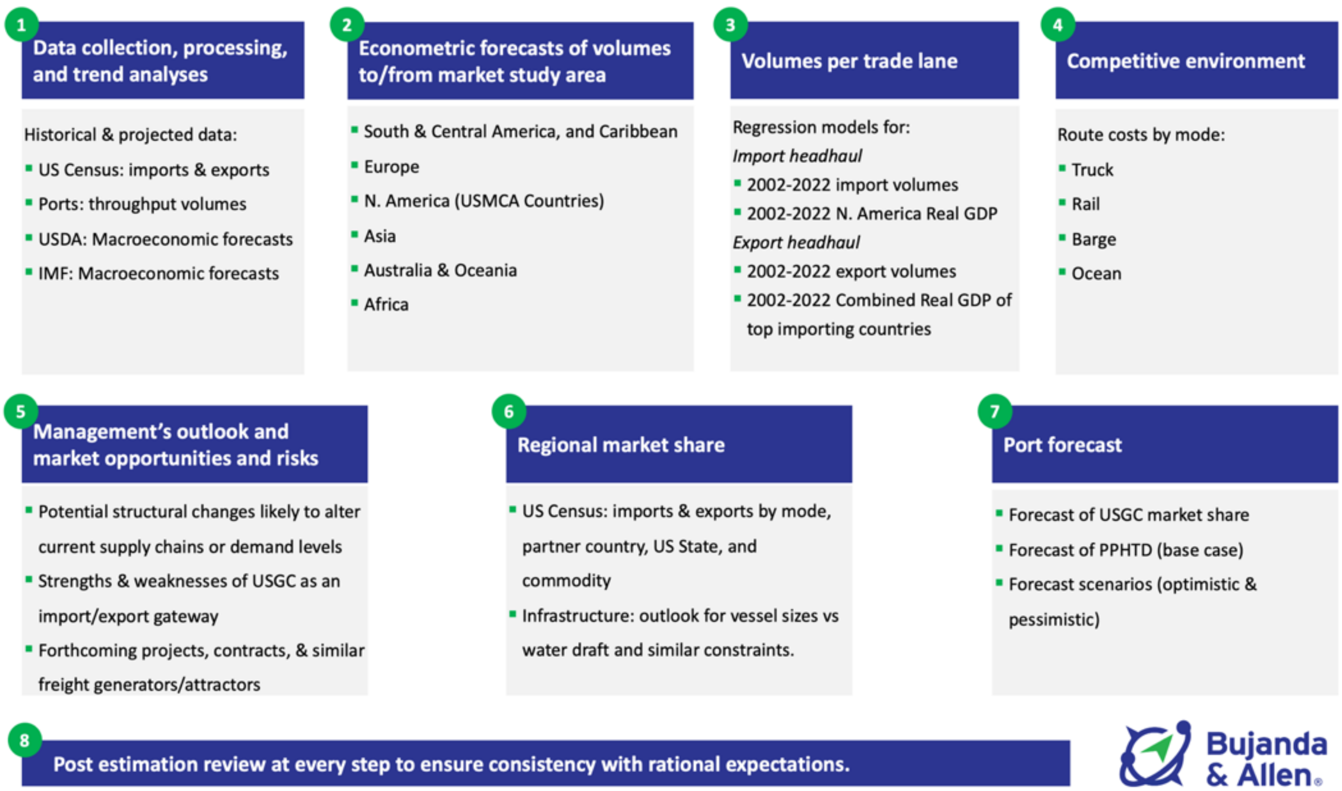
7. Long-term cargo forecast

This section presents Bujanda & Allen's long-term cargo forecast for PPHTD. We begin with an overview of our top-down methodology. Next, this section presents our long-term cargo forecast for non-containerized cargo (i.e. drybulk, agribulk, liquid-bulk, and breakbulk), followed by the forecast for containerized cargo. This section concludes with a summary of the forecasts, including optimistic and pessimistic scenarios.

7.1 Methodology overview

Bujanda & Allen's methodology to develop the long-term cargo forecasts follows a top-down approach composed of eight general steps as described in Figure 86.

Figure 86. Methodology to develop long-term cargo forecasts



Source: Bujanda & Allen, 2023.

7.2 Non-containerized cargo forecast

7.2.1 Drybulk

Drybulk freight moving out of PPHTD and the overall market study area involved **27.5 million tons** of headhaul exports in 2022 with the following breakdown:

- **Metallurgic coal** for steel and **thermal coal** for power generation (**50%**) to Asia, Europe, and S. America.
- **Pet Coke** (**44%**) with similar market dynamics and destinations as the coal markets.
- **Pig Iron** (**4%**) to India, China, Brazil, and various European countries.
- **Limestone** (**1%**) for construction, agriculture, and industrial applications.
- **Fertilizer** (**1%**) to Latin America and Africa.

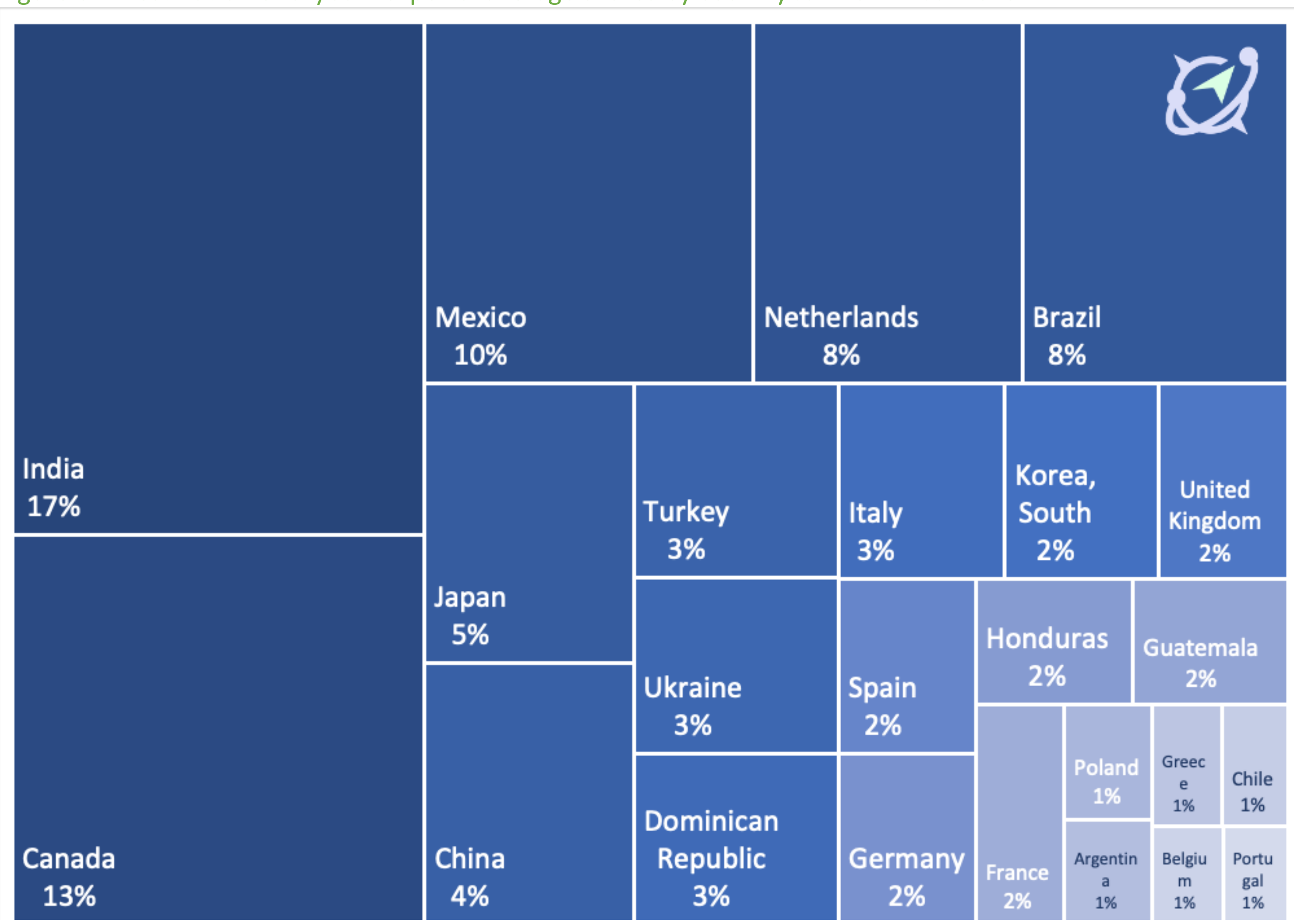
Destination of drybulk exports: demand drivers

Overall, drybulk exports from the market study area grew at a **CAGR of 11%** in the **2002-2008** expansion cycle, interrupted by the Global Recession, and at **4.7%** in the **2010-2018** cycle, interrupted in 2019 by the tariff wars and COVID-19 with the following breakdown by tradelane:

- **Europe** had a **39%** share of the drybulk exports growing at **2.4% CAGR** in the **2010-2018** cycle.
- **Asia** ranks next with **28%** of the drybulk exports growing at **11.1%** in the **same period.**
- **North America** ranks next with **14%** slightly declining.
- **South & Central America** ranks next with a **13%** share growing at **3.7%** annually**.**
- **Africa** ranks next with a **6%** share, growing at **13.2%** annually.

Although Europe has accounted for **39%** of the total drybulk exports from the market study area between 2010-2018, this was not always the case. In 2010, Europe had a **45%** market share, which peaked at **50%** in 2012 before start declining almost every year until 2020 when they bottomed at **22%**. During a similar period, exports to Asia increased from **18%** in 2010 to a peak of **38%** in 2020 becoming the most prominent market for U.S drybulk exports. The average shares by country, based on volumes between Jan 2017 – July 2023 for each of the top destinations of drybulk exports (i.e. the top demand-drivers), are shown in Figure 87.

Figure 87. Destination of drybulk exports: average shares by country Jan 2017 – Jul 2023



Source: Bujanda & Allen with data from the U.S. Census, 2023.

In terms of export shares by coast:

- **U.S. Gulf Coast** had an average market share of **47%** between **2003-2022**.
- **U.S. Atlantic Coast & the Great Lakes** had **43%** market share.
- **U.S. Pacific Coast** had **10%** of the exports during the same period.

7.2.2 Agribulk

Agribulk freight moving out of PPHTD and the overall market study area involve headhaul exports of:

- **Corn** ranking first with **24%** of the agribulk market
- **Soybeans** with **19%**
- **Wheat** with **14%**
- **DDGs** with **7%**
- **Rice** with **3%**
- **Soybean Meal & Pellets** with **2%**.

Destination of agribulk exports: demand drivers

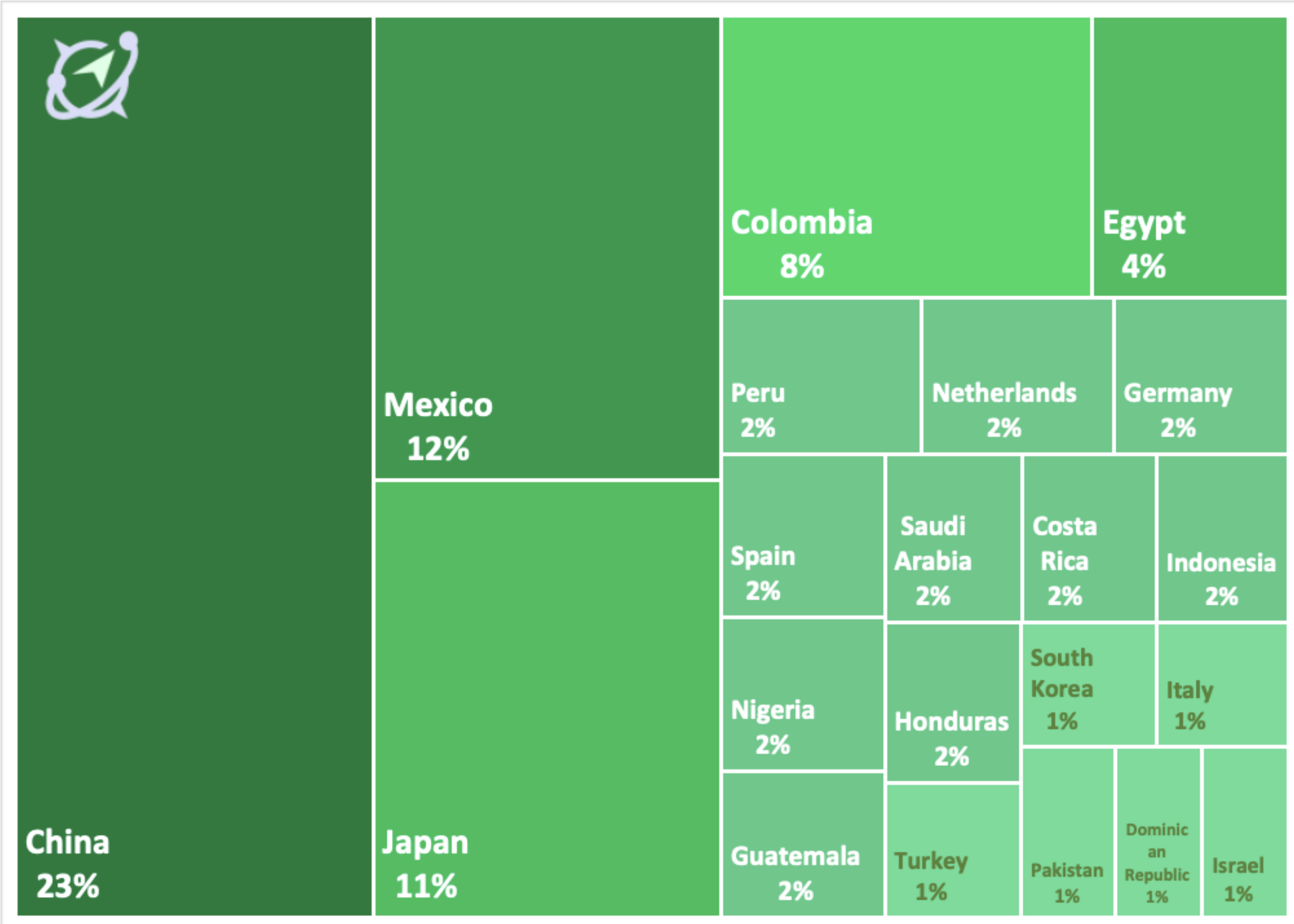
Combined, agribulk exports from the market study area grew at a **CAGR of 1.3%** in the **2003-2008** expansion cycle, interrupted by the Global Recession, and at **3.7%** in the **2013-2020** cycle, until it was interrupted by COVID-19. Nonetheless, the 2011-2020 CAGR of **corn** was **13.3%** and of **soybeans** was **7.4%**, which combined are about 80% of the total agribulk exports.

Shares by tradelane include:

- **Asia** ranking first with a **49%** share of the agribulk exports growing at **2.8% CAGR** from **2010-2021**; however, with a bottom-to-peak CAGR of **4.2%**.
- **South & Central America** ranks next with a **22%** share growing at **2.7%** in the same period, but with a bottom-to-peak CAGR of **14.8%**
- **North America** ranks next with **11%** share, growing at a **4.9%**, but with a bottom-to-peak CAGR of **8.7%.**
- **Europe** ranks next with a **10%** share, growing at a **1.5%**, but with a bottom-to-peak CAGR of **13.3%**.
- **Africa** ranks next with a **9%** share, growing at a -**3.5%**, but with a bottom-to-peak CAGR of **13.3%**.

Historically, Asia has been by far the largest market for U.S. agribulk exports. In 2010, Asia had a **45%** market share, which peaked at **54%** in 2012 before start declining almost every year until 2018 when they bottomed at **29%**. During a similar period, exports to South & Central America increased from **24%** in 2008 to a peak of **29%** in 2018 becoming the most prominent market for U.S exports. The average shares by country based on volumes between Jan 2017 – July 2023 for each of the top destinations of agribulk exports (i.e. the top demand-drivers) are shown in Figure 88.

Figure 88. Destination of agribulk exports: average shares by country Jan 2017 – Jul 2023



Source: Bujanda & Allen with data from the U.S. Census, 2023.

In terms of coastal export outlets by coast:

- **U.S. Gulf Coast** had an average market share of **70%** between **2003-2022**.
- **U.S. Pacific Coast** had**26%** of the exports during the same period.
- **U.S. Atlantic Coast & the Great Lakes** had **4%** market share.

7.2.3 Liquid-bulk and gases

Liquid-bulk freight, including gases, moving out of PPHTD and the overall market study area involve headhaul exports of:

- **Fuel oils (not crude)** grew at a **CAGR of 10%** 2002-2022.
- **Jet Fuel** ranks next also with a **CAGR of 10%** in the same period.
- **Crude Oil** grew at an impressive **CAGR of 56%,** accelerating after the U.S. lifted restrictions on Dec 2015.
- **Natural Gas** grew at an impressive **CAGR of 27%,** accelerating after a regulatory shift in early 2016.
- **Gasoline** had a 2002-2022 **CAGR of 8%.**
- **Other** (benzene, neodene, isobutylene) category also represents a prominent volume growth.

Destination of liquid-bulk exports: demand drivers

Combined, liquid-bulk exports from the market study area grew at a **CAGR of 13.1%** in the **2002-2022** expansion cycle, which was not interrupted by the Global Recession, and just slowed down slightly in 2019 by the tariff wars and COVID-19, with the following breakdown by tradelane:

- **South & Central America** has historically accounted for **38%** of the total liquid-bulk exports from the market study area, on average; growing at a **CAGR of 10.8%** during 2008-2021.
- **Asia** ranks next with a market share of **18%** of the total liquid-bulk exports, which in recent years climbed above **30%**, growing at a **CAGR of 19.7%** during 2008-2021.
- **Europe** ranks next with **21%** of the export market, growing at **14%.**
- **North America** ranks next also with **21%** of the export market, growing at **12.1%**, respectively.
- **Africa** has about **3%** market share, growing at **8%**.
- **Australia & Oceania** has the smallest market share with less than **1%**.

Although **South & Central America** has accounted for **38%** of the total liquid-bulk exports from the market study area, this was not always the case. In 2016, **South & Central America** had a **42%** market share, which started declining until reaching **29% in 2022**. During a similar period, exports to **Asia** increased from **12%** in 2016 to a peak of **32%** in 2021 becoming the most prominent market for U.S liquid-bulk exports. The average shares by country based on volumes between Jan 2017 – July 2023 for each of the top destinations of liquid-bulk exports (i.e. the top demand-drivers) are shown in Figure 89.

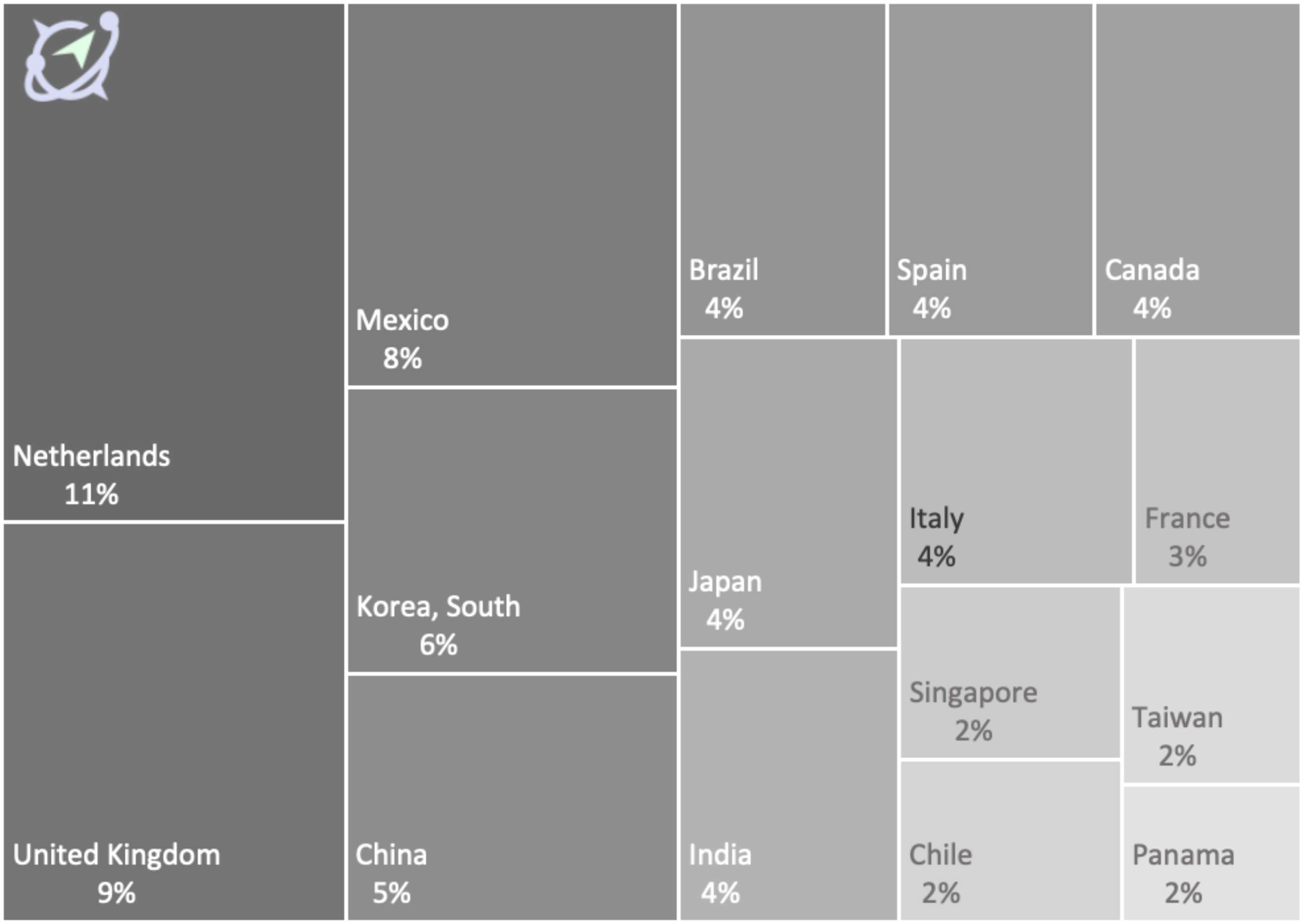
Box 1. Top liquid-bulk importing countries

The Netherlands plays an important role as a European liquid fuels transportation and processing hub. The Netherlands is also the second-largest producer and exporter of natural gas in Europe, following Norway, and is home to Europe's largest natural gas trading hub in terms of spot volumes. The Netherlands is also a major petroleum liquids refining and storage center.

The United Kingdom imports a substantial portion of its oil to meet its energy needs. These imports mainly consist of crude oil and petroleum products from various sources, including countries in the North Sea, the Middle East, the U.S., Africa, and Russia. The UK's oil imports are essential to ensure a consistent supply of energy and feedstock for its refineries, which produce gasoline, diesel, and other petroleum products to meet domestic demand.

Mexico has historically been a significant importer of crude oil and petroleum products from the United States. This trade relationship is driven by geographical proximity and the availability of various crude oil grades that align with Mexico's refining capabilities. These imports are vital for meeting Mexico's energy needs and supporting its limited refining industry.

Figure 89. Destination of liquid-bulk exports: average shares by country Jan 2017 – Jul 2023



Source: Bujanda & Allen with data from the U.S. Census, 2023.

In terms of coastal export outlets by coast:

- **USGC** has average market share of **87%** between 2003-2022, surpassing by far exports via ports in the U.S. Pacific Coast and in the U.S. Atlantic Coast and the Great Lakes.
- **The U.S. Atlantic Coast & the Great Lakes** handled an average of **6%** of liquid-bulk exports.

7.2.4 Breakbulk

The breakbulk econometric model is developed for the total headhaul exports from the market study area. The total headhaul exports is treated as the dependent variable, while the combined Real GDP of the top destination countries for such exports is the independent variable. Given the high volatility of the historical breakbulk cargo volumes, the breakbulk econometric model was estimated using a semi-log model form, where the dependent variable (i.e. total headhaul exports in tons) is in the log form and the explanatory variable (i.e. Total Real GDP of the top destination countries for such exports) is in the linear form.

7.3 Containerized cargo forecast

This section presents the containerized cargo forecast. This section begins with an assessment of PPHTD's position in the North American market and PPHTD's position in the USGC market. This section explores the relationship between North American real GDP and container throughput for imports, exports, and total volumes as the basis of our econometric model. This section presents our forecast of headhaul container volume by tradelane and by coast. This section concludes with the USGC volume forecast by tradelane and the development of three scenarios for PPHTD's market capture rates.

7.3.1 PPHTD's position in the North American market

As of 2022, the container terminals in the New Orleans region collectively ranked as the 24th largest in North America (i.e. U.S., Mexico, and Canada) by total TEU throughput volume, as shown in Figure 90. When only U.S. ports are considered, the New Orleans region market ranks as the 15th largest container port.

Figure 90. North American container ports: location and ranking (2022, TEUs)

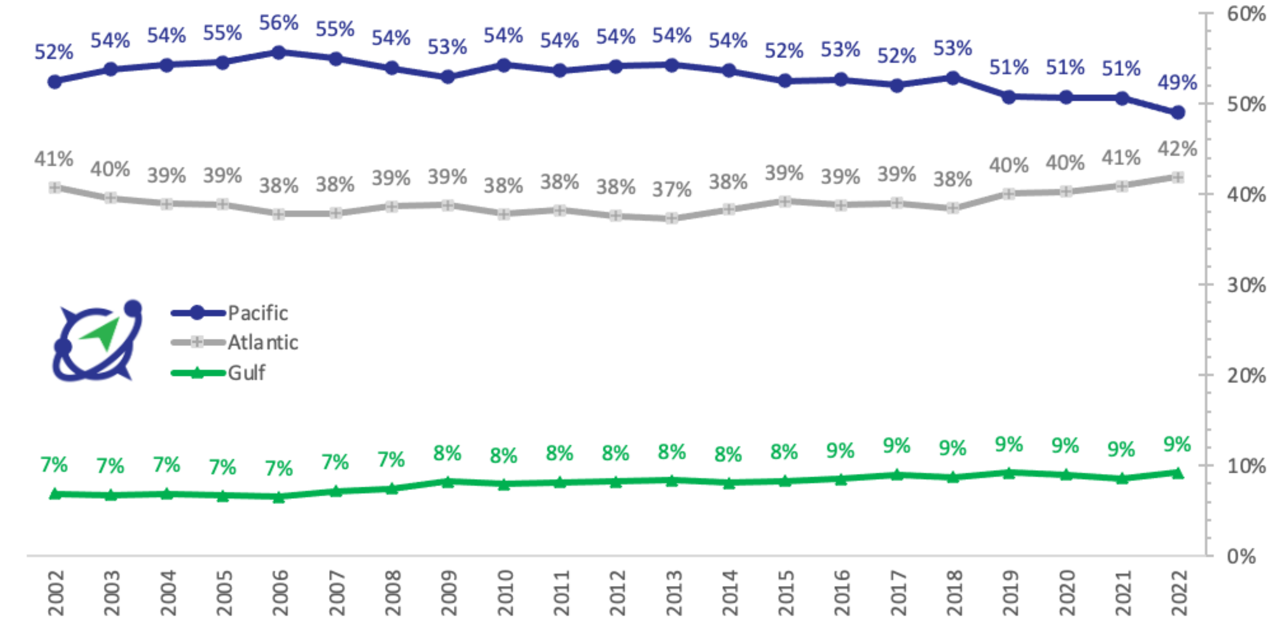
Source: Bujanda & Allen, 2023.

7.3.2 PPHTD's position in the U.S. Gulf Coast market

Coastal shares

Ports in the Atlantic and Gulf coasts have captured some of the market from ports if the Pacific. These trends accelerated after 2019, when the COVID-19 restrictions caused supply chain disruptions at most ports and were particularly notorious at the ports of Los Angeles and Long Beach. The Atlantic Coast had a 2022 market share of 42% and the Gulf of 9%, as shown Figure 91.

Figure 91. Shares by coast of North American container throughput

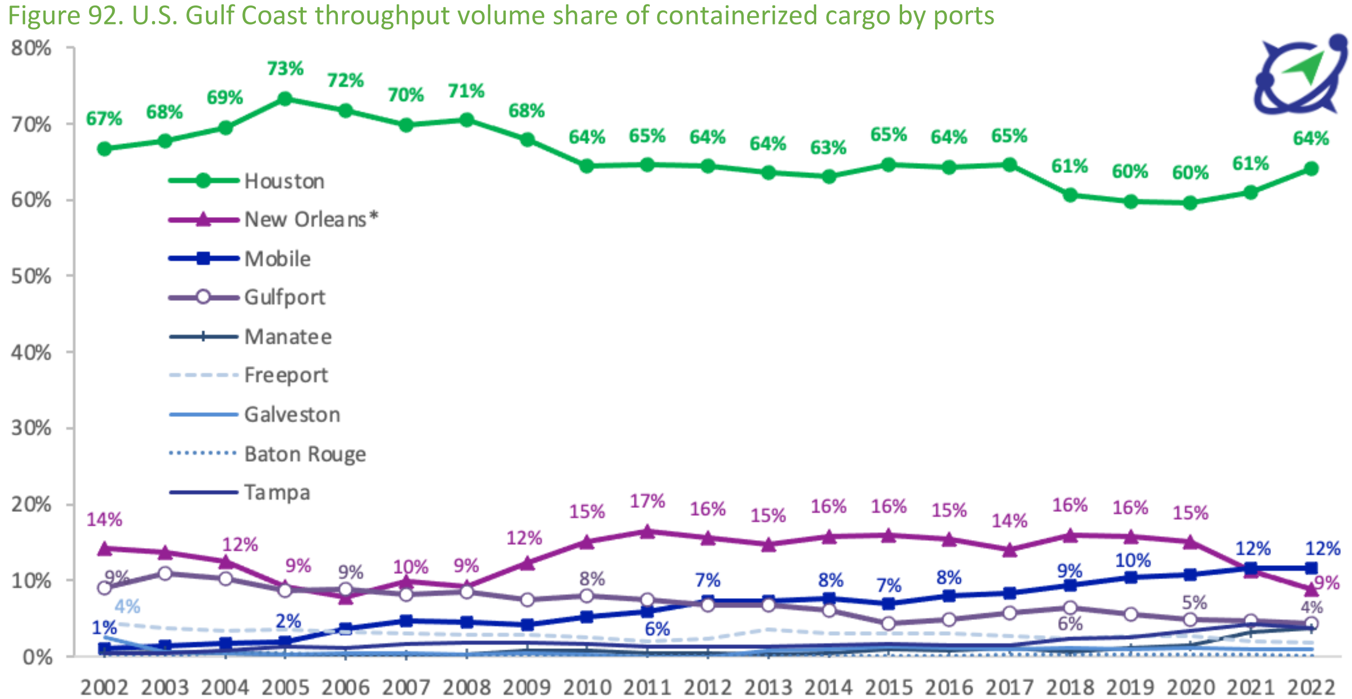


Source: Bujanda & Allen, 2023. *% shares rounded up to the nearest integer.

U.S. Gulf Coast port shares

Regarding ports in the USGC, Houston is by far the number one container port, with an average market share of 63% from 2002-2022. Container ports in the New Orleans Customs District (as defined by the U.S. Census) had an average market share of 15% from 2002-2022 and have gained share particularly from 2010-2018. With an average market share of 9%, Mobile is also gaining market accelerating after 2015 at par with New Orleans since 2021. Other ports in the U.S. Gulf with significant container headhaul volumes include Tampa, Manatee, Gulfport, Baton Rouge, Galveston, and Freeport, as shown in Figure 92.

Figure 92. U.S. Gulf Coast throughput volume share of containerized cargo by ports



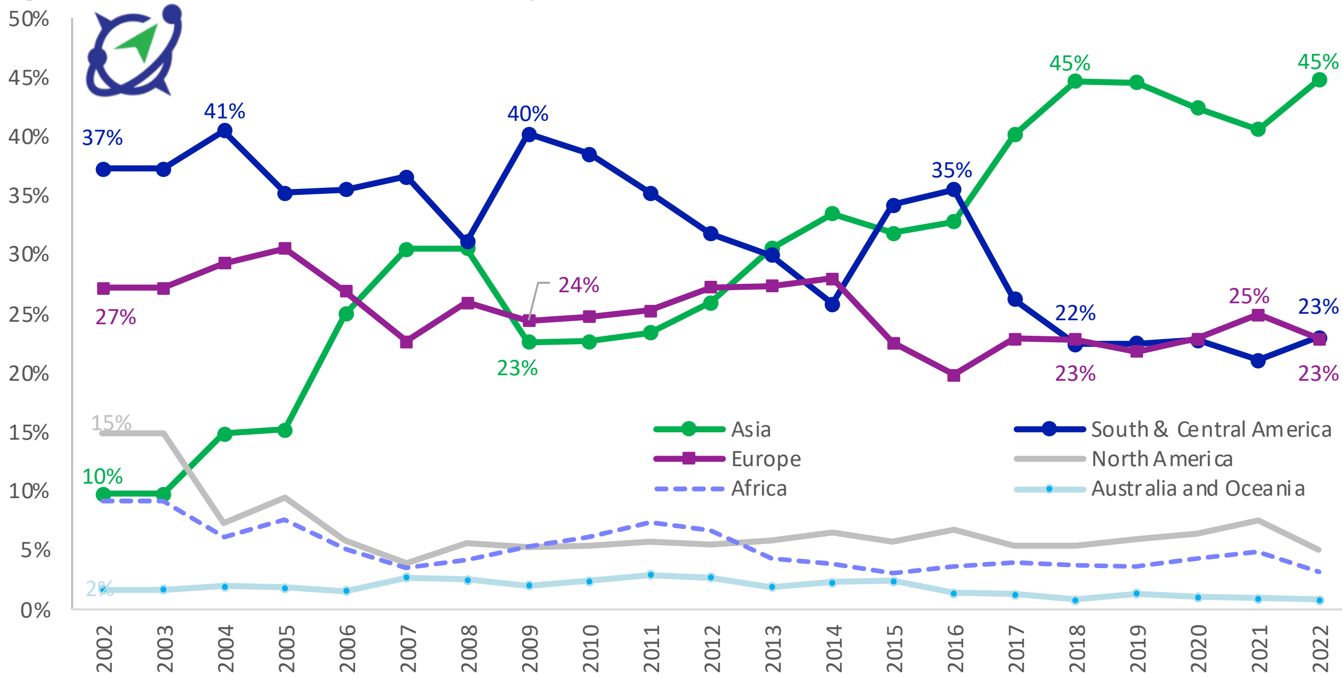
Source: Bujanda & Allen, 2023. *2022 Volumes obtained from a 3rd party data provider not the port.

The throughput volume share of containerized cargo by ports for each tradelane by coast are adjusted each year for the first years of the forecast period until they revert to the long-term mean. Then, the shares are held constant and applied to the total for North America to generate the volume forecast by coast and port region.

U.S. Gulf Coast headhaul volumes by tradelane

Regarding USGC headhaul volumes by tradelane, containerized imports from Asia have boomed since 2002, increasing from 10% of the total USGC headhaul volumes to 45% in 2022 (i.e. more than 400% in terms of volume). During the same time, the market share of imports from South & Central America decreased from 37% in 2002 to 23% in 2022; although in terms of absolute volume, the number of TEUs almost doubled. Europe also had a market share of 23% in 2022, which is more than double the TEUs handled in 2002 (see Figure 60). The evolution of the trends for the volume share by tradelane are shown in Figure 93.

Figure 93. U.S. Gulf Coast headhaul shares by tradelane



Source: Bujanda & Allen, 2023.

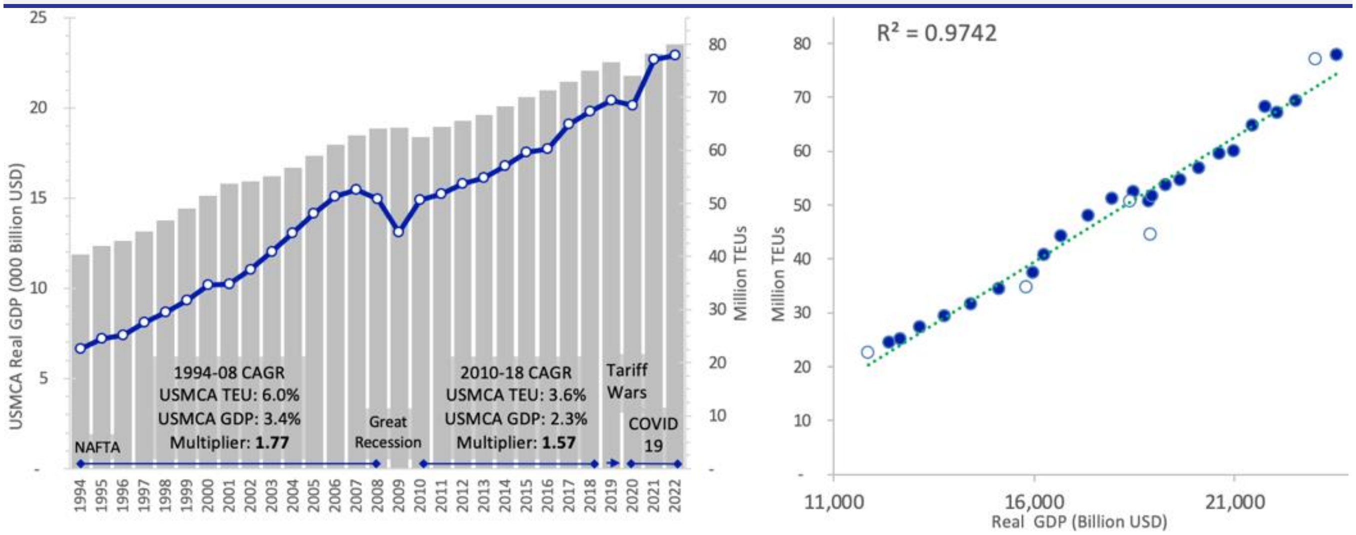
7.3.3 North American real GDP and container throughput

The North America Free Trade Agreement (NAFTA) came into effect in 1994. NAFTA had a profound impact on container trade in North America by fostering increased trade volumes, altering trade routes, prompting infrastructure investments, and promoting greater integration of manufacturing processes. NAFTA led to a substantial increase in containerized trade within North America. The elimination of most tariffs and trade barriers between the U.S., Canada, and Mexico encouraged businesses to expand their cross-border trade activities. As a result, container traffic between these countries grew significantly.

Total port throughput became highly correlated with the combined real GDP of the U.S., Mexico, and Canada until it was interrupted by the Great Recession in 2008. From 1994 to 2008, the combined real GDP of the U.S., Mexico, and Canada had a CAGR of 3.4%, while container throughput grew at a CAGR of 6.0% resulting in a container volume growth rate multiplier of 1.77. From 2010 to 2018, the combined real GDP of the U.S., Mexico, and Canada had a CAGR of 2.3%, while container throughput grew at a CAGR of 3.6% resulting in a multiplier of 1.57. The evolution of this relationship is shown in Figure 94(a) and a linear model highlighting structural deviations are shown in the scatterplot in Figure 94(b).

Figure 94. North America container throughput and USMCA Real GDP: historical relationship

a) USMCA Real GDP and container throughput | **b) Scatterplot of USMCA real GDP vs. container TEUs**



Source: Bujanda & Allen, 2023.

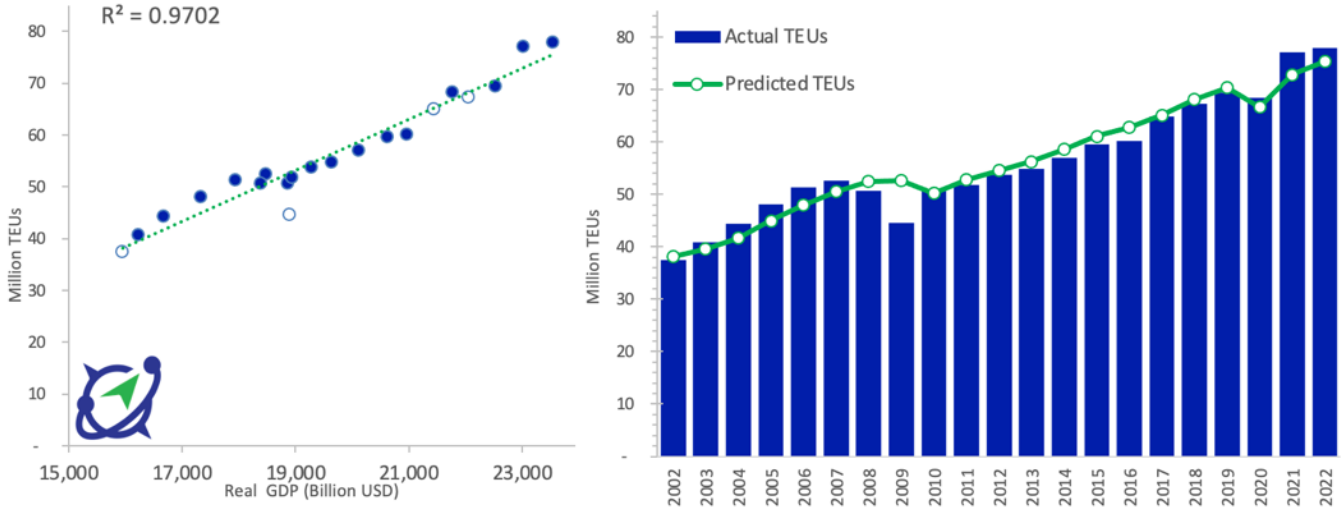
- From 1994 to 2008, NAFTA caused the balance of international trade to shift to Mexico. Ports on the U.S. West Coast, such as Los Angeles and Long Beach, experienced a surge in container traffic due to their proximity to Asian markets. These ports became major gateways for goods destined for the U.S. and Canada. Meanwhile, Mexican ports on the Pacific and Gulf coasts, such as Manzanillo and Veracruz, also saw increased container trade as manufacturing and assembly operations expanded in Mexico. Therefore, container volumes grew marginally slower than predicted by the model during this period.
- From 2001 to 2008, China's accession to the WTO resulted in a shift in the composition of international trade away from Canada and Mexico. China's rise as the "world's factory" prompted a significant shift in global manufacturing. Many companies relocated their production facilities to China to take advantage of its cost-efficiency and export capabilities. This led to a substantial reconfiguration of supply chains and increased reliance on container shipping for transporting finished products and components.
- From 2010 to 2018, volumes returned to the long-term trendline until they were interrupted first by the tit-for-that U.S.-China trade wars in 2019, and subsequently by the COVID-19 pandemic and derived supply chain issues which impacted most supply chains in the USMCA region and the overall western hemisphere.
- In 2020, NAFTA was replaced by the USMCA, which retained many provisions of NAFTA, but includes updates and modifications to address contemporary trade issues. This transition had implications for companies engaged in container trade, as they needed to adapt to the new rules and provisions.

Observed and predicted total TEUs

Based on the period from 2002 to 2022, which accounts for most of the post-NAFTA structural changes, we constructed an econometric model to forecast total container throughput for North America using USMCA real GDP as the leading indicator. Overall, 97.02% of the observed variation in total continental throughput (i.e. imports and exports) is explained by the variation in USMCA real GDP. One of the few deviations of the model is the Great Recession in 2009. The total container throughput model for North America and its backtesting outputs are shown Figure 95.

Figure 95. North America total container throughput

a) Scatterplot of USMCA real GDP vs. container TEUs	b) Actuals and predicted total container throughput

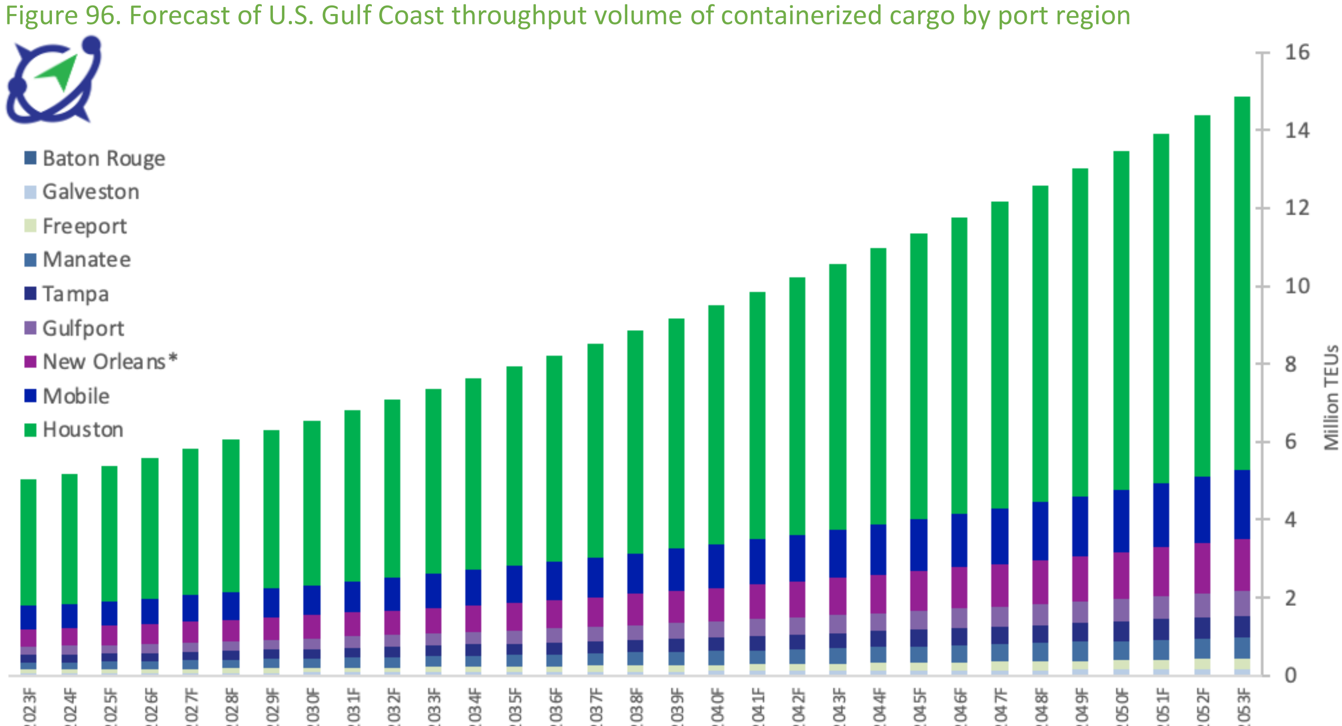


Source: Bujanda & Allen, 2023.

7.3.4 U.S. Gulf Coast volume forecast by port region

The next step was to apply our model to forecast USGC volumes by coast and port region. The throughput volume share of containerized cargo by ports for each tradelane by coast are adjusted each year for the first years of the forecast period until they revert to the long-term mean. Then, the shares are held constant and applied to the total for North America to generate the volume forecast by coast and port region. The USGC throughput volume forecast of containerized cargo by port region are shown in Figure 96.

Figure 96. Forecast of U.S. Gulf Coast throughput volume of containerized cargo by port region



Source: Bujanda & Allen, 2023. *2022 Volumes obtained from a 3rd party data provider.

8. Conclusion

PPHTD serves as a key gateway for America's trade battlefield—the multimodal corridor connecting Canada, the U.S. Midwest, and Mexico. The privileged geographic location and depth of its navigational channel, provide PPHTD with the opportunity to connect the two largest waterways in the U.S. with large linehaul vessels utilizing deep draft ports in existing and future transpacific, transatlantic, intra-Gulf, and Latin America ocean routes. PPHTD has the potential to provide all-water freight connectivity to more than 1,700 river terminals and cargo docks within a 200-mile buffer of the Mississippi River and its tributary marine highways across 20 states. PPHTD enjoys all-water connectivity with more than 1,300 cargo terminals and docks in the GIWW.

PPHTD serves drybulk, liquid-bulk, agribulk, and breakbulk markets for which the projected growth trends in the next 10 years are greater than any other port in the Gulf of Mexico. By 2033, PPHTD's non-containerized freight throughput is expected to reach 100 million tons, with liquid-bulk reaching nearly 30 million tons driven largely by LNG production from the new Venture Global facility. Over the same period, alternative fuels, drybulk, agribulk, offshore wind projects, and container tonnage is expected to surpass 20 million tons. PPHTD aggressive expansion plans consider both vertical and horizontal growth strategies. Horizontal expansion refers to expanding the firm into new areas, whereas vertical growth refers to concentrating on one sector and growing inside the same industry. One example of vertical integration can be the containerization of soybeans and similar grains.

Our non-containerized vertical markets are expected to see a 9.0% CAGR by 2028, driven by the LNG volumes expected from the new *Venture Global Plaquemines LNG LLC* facility. Nonetheless, strong growth is also expected in existing markets: *drybulk* is expected to have a 5.4% CAGR by 2028 driven mainly by growth in pet coke exports to Asia, Canada, and Mexico; *agribulk* with a 2.8% CAGR by 2028 driven by soybean and corn exports to Asia and Mexico; *liquid-bulk* with a 4.8% CAGR by 2028 driven by crude oil exports to Asia, Europe, and Latin America; and *break-bulk* cargo with a 5.3% CAGR with a diverse mix of offshore wind projects and break bulk machinery and parts serving the offshore oil industry. Our forecast for *containerized cargo*, indicates that the overall 6.2% CAGR from 2027 until 2053 is extremely realistic and attainable with two-weekly services. Even the pessimistic scenario indicates that a 3.6% CAGR is attainable and in-line with historical USGC trends.

India, Mexico, China, Japan, and the Netherlands are among the top-5 trading partners for the drybulk, agribulk, and liquid-bulk commodities handled by PPHTD from the market study area. India surpassed China in late 2017 and now has the fastest growing large economy globally. According to the IMF, GDP growth rates in India are expected to remain in the region of 6%-7% over the next five years. We anticipate that strong economic growth in India, Mexico, and China will continue at least for the next fifteen years until they become fully developed economies. This will continue to translate into continued strong levels of demand for raw inputs and similar commodities in the form of drybulk, liquid-bulk, agribulk, and breakbulk, which, in turn, will continue to generate strong demand for PPHTD services.

In the case of Mexico, China is competing strongly to displace the U.S. as Mexico's largest trading partner. Given Mexico's privileged geographic location next to the largest consumer market, the U.S., this trend will only continue to increase as proven by the large amounts of Chinese FDI flowing into Mexico, the relocation of Chinese manufacturing plants into Mexico, and the increased amount of container traffic handled by Mexican ports. Most freight related to manufacturing plants is moved in containers. **Regardless of who is Mexico's largest trading partner, we expect prevailing geopolitical trends will reinforce the growth of USMCA container trade with Asia and among USMCA countries.**

As our route cost analysis demonstrated, Marine Highways provide a competitive alternative in terms of cost for bulk freight and containers on barge via PPHTD, particularly for those closer to the river ports. Inland cost savings from using a barge from PPHTD can be significant compared to shipping a box by rail more than 2,110 mi from San Pedro Bay to St. Louis. Similarly, PPHTD's marine highway cost savings can be expected for inbound containers from Europe instead of using rail from ports in the USEC, from Asia using rail from the PNW, and from Mexican and Latin American traffic. PPHTD also offers significant savings for drybulk and agribulk freight by barge compared to exporting by rail through gateways in the PNW region. Comparing railing freight via PPHTD vs incumbent rail routes via existing gateways, PPHTD offers cheaper routes to St. Louis, Dallas, and Pineville than alternative ports in the USWC. Nonetheless, not all BCOs will be incentivized by cost alone. For some, transit times might be more critical, in which case, barge might not be as competitive as rail.

By 2030, major milestones will have been reached in the global drive to get the shipping sector to decarbonize to zero emissions by 2050. The process of integrating various fuels and technologies into the global fleets of vessels is a work in progress and is proving to be challenging. Coming up with solutions for various engine kinds, fuel types, and storage capacities is a challenge. Compressed natural gas, LNG, LPG, methanol, and biofuels are the primary alternative fuels. PPHTD is positioned strategically across a network of pipelines carrying natural gas. It plans to begin delivering alternative fuels to the international market and building infrastructure for vessel refueling. Vessels traveling the Mississippi River and the Gulf of Mexico will have the opportunity to refuel at PPHTD thanks to this infrastructure.

Through the introduction of a local container terminal, the container market will allow BCOs that specialize in drybulk, agribulk, and liquid-bulk to expand into new markets. With today's technology and know-how, these materials can be blown into containers for intermodal shipment using drybulk and agribulk technology. The economics of this mode transition will be favorable due to the short dray to the container terminal, and it will have little effect on highway traffic. To facilitate intermodal connections, the petroleum tenants of PPHTD additionally truck ISO tanks to Mobile and Houston. By lowering the supplied cost of these ISO tanks and generating vertical volume growth for container carriers, the container terminal will provide additional services. Some of these vertical integration services can generate additional synergies by partnering with and complementing the current offering from deep ports in the mouth of the Mississippi. At some point, these ports might consider exploring the creation of an alliance, such as that of the Seattle-Tacoma Northwest Seaport Alliance in the PNW region.

In closing, by taking advantage of the benefits of marine highways, **PPHTD has the potential to generate economic benefits that translate into cheaper route costs for U.S. importers and exporters, less carbon and non-carbon emissions into the environment, better state for repairs on highways and railways, and decrease crash costs resulting from ton-miles saved due to freight diversion from the incumbent routes (truck + rail) to the marine highway service (truck + barge) alternative.** Moreover, generating direct, indirect, and induced economic impacts to the South Louisiana region and the market study area. The USDOT and MARAD have well-documented parameters and methodologies to estimate such benefits. Further work is required to estimate a potential range of the magnitude of potential benefits that could stem from marine highways moving freight through PPHTD, as well as the economic impacts of related projects.

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