CHANGING TRADE PATTERNS: NAFTA, CUBA & the US GULF COAST

UNIVERSITY OF NEW ORLEANS TRANSPORTATION INSTITUTE (UNOTI)

I-NUF Conference Oct. 17-20, 2017
Overview

• How are trade and transportation related?
• Why are trade patterns changing?
• What are the domestic infrastructure implications?
  – Pipelines
  – Railroads
  – Short Sea Shipping
  – Trucking
• What are the infrastructure implications for the Americas?
Trade and Transportation

“Competitiveness is the set of institutions, policies and factors that determine the level of productivity of a country.”

### Chart

- **Innovation**: 90
- **Business Sophistication**: 80
- **Market Size**: 113
- **Technology Readiness**: 115
- **Financial Market Development**: 100
- **Labor Market Efficiency**: 127
- **Goods Market efficiency**: 93
- **Training and Higher Education**: 80
- **Health and Primary Education**: 88
- **Macroeconomic Environment**: 79
- **Infrastructure**: 83
- **Institutions**: 102
International Trade in Flux
Public Investments Faltering

• Bretton Woods Agreement
• Energy Importer to Energy Exporter
• Infrastructure Investments
• Nationalist Wave
  – TPP
  – Brexit
  – Cuba
  – NAFTA
Bretton Woods Agreement

• The Bretton Woods Conference (1944)
  • 730 delegates from all 44 Allied nations
  • Mount Washington Hotel in Bretton Woods, NH
  • Three main purposes

• Create the International Monetary Fund (IMF)
• Create the International Bank for Reconstruction and Development (now the World Bank)
• Foundation for global trade: international economic cooperation
• US Navy protection if other countries agreed to an “open” global market
The Move From Global Trade

• The American shale revolution severed the largest of the remaining ties that bind America to Bretton Woods.

• United States
  – Geographically wealthy
  – Demographically robust
  – Energy secure

• Shale has the potential to re-industrializes the United States
Geographically Wealthy: National Infrastructure

Energy (on and off shore), highway, rail, maritime, air, infrastructure

Traditional East-West Freight Flows
Geographically Wealthy: The Worlds Largest Navigable Waterway System

- MS River is the world’s longest navigable river, 2,100 miles (3,380 km) long from its mouth at the Gulf of Mexico to its head of navigation at the Twin Cities in MN
- 12 navigable rivers & 3,000 miles (4,828 km) of shielded navigable bays for a total of 14,650 miles (23,577 km)

That is nearly 15,000 miles of navigable waterways. THE REST OF THE WORLD COMBINED ONLY HAS 13,000 miles (20,921 km).
Demographically Robust

### Negative Demographic Trend Counties*

<table>
<thead>
<tr>
<th>Country</th>
<th>Ages 65-69</th>
<th>Ages 0-4</th>
<th>Total Change</th>
<th>% Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Russia</td>
<td>11.3</td>
<td>8.5</td>
<td>2.8</td>
<td>25</td>
</tr>
<tr>
<td>Japan</td>
<td>10.5</td>
<td>5.4</td>
<td>5.1</td>
<td>49</td>
</tr>
<tr>
<td>Germany</td>
<td>4.2</td>
<td>3.5</td>
<td>0.7</td>
<td>17</td>
</tr>
<tr>
<td>Italy</td>
<td>3.4</td>
<td>2.8</td>
<td>0.6</td>
<td>18</td>
</tr>
<tr>
<td>Canada</td>
<td>1.9</td>
<td>1.7</td>
<td>0.2</td>
<td>11</td>
</tr>
</tbody>
</table>

### Positive Demographic Trend Countries

<table>
<thead>
<tr>
<th>Country</th>
<th>Ages 65-69</th>
<th>Ages 0-4</th>
<th>Total Change</th>
<th>% Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>India</td>
<td>39</td>
<td>117</td>
<td>78</td>
<td>200</td>
</tr>
<tr>
<td>China**</td>
<td>55</td>
<td>81</td>
<td>26</td>
<td>47</td>
</tr>
<tr>
<td>Mexico</td>
<td>3.4</td>
<td>10.5</td>
<td>7.1</td>
<td>209</td>
</tr>
<tr>
<td>Turkey</td>
<td>2.7</td>
<td>6.9</td>
<td>4.2</td>
<td>156</td>
</tr>
<tr>
<td>Uzbekistan</td>
<td>1</td>
<td>2.8</td>
<td>1.8</td>
<td>180</td>
</tr>
</tbody>
</table>

### United States

<table>
<thead>
<tr>
<th>Ages 65-69</th>
<th>Ages 0-4</th>
<th>Total Change</th>
<th>% Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>17.1</td>
<td>20.9</td>
<td>3.8</td>
<td>22</td>
</tr>
</tbody>
</table>

* In Millions
** China's 45-59 age group is above 60M.
*** The average life expectancy in Russia is just over 59 years.
Energy Secure: The Shale Revolution

In the US: Natural Gas From Frac’ing Has Surpassed Every Other Form Of Production

Sources: Energy Information Administration, OpenStreetMap, Federal Highway Administration, National Bridge Inventory, American Society of Civil Engineers, U.S. Army Corps of Engineers, MarineCadastre.gov, World Shipping Council, National Energy Education Development Project.
Shale Plays of Lower 48 States

Source: US Energy Information Administration and Duke University study on shale gas and fracing
Sabine Pass LNG – Cheniere Energy

* First Permitted Export Terminal: $6 Billion, 6 Trains, 27 million-tons-per-annum (mtpa)
  * Shipped to 11 Countries in First 6 Months of Operation
  * 20+ LNG Export Shipments Since Operations Began February 2016
## US LNG TERMINALS

### US LNG terminals in operation and under construction

<table>
<thead>
<tr>
<th>Project</th>
<th>Developer</th>
<th>Start Year</th>
<th>Capacity (billion cubic ft/d)</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sabine Pass</td>
<td>Cheniere Energy</td>
<td>2016</td>
<td>3.5</td>
<td>Three trains operation, two under construction, one planned</td>
</tr>
<tr>
<td>Cove Point</td>
<td>Dominion</td>
<td>2017</td>
<td>0.82</td>
<td>One train under construction</td>
</tr>
<tr>
<td>Elba Island</td>
<td>Kinder Morgan Southern LNG</td>
<td>2018</td>
<td>0.35</td>
<td>Ten (small scale) trains under construction</td>
</tr>
<tr>
<td>Cameron</td>
<td>Sempra Energy</td>
<td>2018</td>
<td>2.1</td>
<td>Three trains under construction</td>
</tr>
<tr>
<td>Corpus Christi</td>
<td>Cheniere Energy</td>
<td>2019</td>
<td>2.14</td>
<td>Two trains under construction</td>
</tr>
<tr>
<td>Freeport</td>
<td>Freeport LNG</td>
<td>2019</td>
<td>2.14</td>
<td>Three trains under construction</td>
</tr>
</tbody>
</table>

Source: US energy Information Administration, FERC

Note: Excludes Kenai LNG in Alaska which did not export LNG in 2016
Shale Based Economic Development in the Gulf Coast
LNG Export Competition In a Well-Supplied Global Market
Russia, Qatar, Australia, North Africa, Iran/Central Asia

Competing countries have plans to expand both piped natural gas infrastructure and LNG facility production to markets in Asia, India and Europe within the same timeframe as the US.

LNG as Chemical Feedstock: A Renaissance for the Chemical Industry/US Manufacturing
## LNG as Feedstock In LA

### TABLE 2  
**LOUISIANA VALUE ADDED PETROCHEMICAL FACILITIES**

<table>
<thead>
<tr>
<th>FACILITY NAME / LOCATION</th>
<th>ETHANE CRACKER</th>
<th>ETHYLENE</th>
<th>FERTILIZER</th>
<th>AMMONIA</th>
<th>EPDM, GMA (adhesives)</th>
<th>METHANOL / OTHER</th>
</tr>
</thead>
<tbody>
<tr>
<td>AM Agrigen Industries (St. Charles Parish, LA)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Axiall/Lotte Chemical (Lake Charles, LA)</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>XX</td>
<td></td>
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<tr>
<td>CF Industries (Donaldsonville, LA)</td>
<td></td>
<td>XX</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Dow Chemical (St. Charles, LA; Plaquemine, LA)</td>
<td>XX</td>
<td></td>
<td></td>
<td>X</td>
<td>XX</td>
<td>XX</td>
</tr>
<tr>
<td>Dyno Nobel/Incitec Pivot (Waggaman, LA)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>EuroChem (St. John the Baptist Parish, LA)</td>
<td></td>
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<tr>
<td>Formosa (Point Comfort, LA; James, LA)</td>
<td>XX</td>
<td></td>
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<tr>
<td>Hexion (expansion in LA)</td>
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<tr>
<td>Huntsman Corporation (Geismar, LA)</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
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<tr>
<td>Indorama Ventures (Lake Charles, LA)</td>
<td></td>
<td></td>
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<tr>
<td>Investimus Foris (Grant Parish, LA)</td>
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<tr>
<td>Lion Copolymer (Geismar, LA)</td>
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<tr>
<td>Lotte Chemical (Plant in LA) and Lotte Chemical/Mitsubishi Chemical (at Lake Charles, LA)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>XX</td>
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<tr>
<td>Matheson (Lake Charles, LA)</td>
<td></td>
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<tr>
<td>Methanex (Geismar, LA)</td>
<td></td>
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<tr>
<td>Mosaic Company (Faustina, LA)</td>
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<tr>
<td>Nachurs Alpine Solutions (St. Gabriel, LA)</td>
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<tr>
<td>PotashCorp (Geismar, LA)</td>
<td></td>
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</tr>
<tr>
<td>South Louisiana Methanol (James Parish, LA)</td>
<td></td>
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<tr>
<td>Stepan Co. (Ascension Parish, LA)</td>
<td></td>
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</tr>
<tr>
<td>Syngas Energy Holdings (St. James Parish, LA)</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Valero Energy (methanol plant at St. Charles, LA)</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Westlake Chemical (Lake Charles, LA; Sulphur, LA; Geismar, LA)</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Williams Olefins (expanding ethylene, propylene capacities and possible second cracker at Geismar, LA)</td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yuhuang Chemical (methanol plant and derivatives at St James Parish, LA)</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Sources: Energy Information Administration, OpenStreetMap, Federal Highway Administration, National Bridge Inventory, American Society of Civil Engineers, U.S. Army Corps of Engineers, MarineCadastre.gov, World Shipping Council, National Energy Education Development Project.
LNG Export Terminals & Proposed Bayou Bridge Pipeline Expansions
Railroads

Railroads

Amtrak Stations
Union Pacific Railroad
North-South Expansion

2015 Union Pacific in Louisiana

Miles of Track: 1,152
Annual Payroll: $127.8 M
In-State Purchases: $19.5 M
Capital Investment: $140.7 M
Employees*: 1,187
U.S. Jobs Supported**: 5,341.5
Charitable Organizations: 82

*Fourth quarter 2015 average
**Each American freight rail job supports 4.5 jobs elsewhere in the U.S. economy. (Association of American Railroads)

$600 + Million Invested Infrastructure

US Ports & Inland Waterways

Sources: Energy Information Administration, OpenStreetMap, Federal Highway Administration, National Bridge Inventory, American Society of Civil Engineers, U.S. Army Corps of Engineers, MarineCadastre.gov, World Shipping Council, National Energy Education Development Project.
New Era of Trade
Freight Flows Throughout the Americas

- Cuba as an intermediate shipment location on SSS demand from economic actors in the US and Cuba.
- Cuba could contribute to NAFTA-related freight flows by serving as transshipment hub in the Gulf of Mexico.
- The Jones Act and Harbor Maintenance Tax currently serve as major barriers to increase SSS in NAFTA trade.
Economic Success in the Americas

The LPI analyzes 160 Countries in areas such as Customs, Infrastructure, Logistics, Competence, and International Shipments, among others.

<table>
<thead>
<tr>
<th>Country</th>
<th>LPI Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Germany</td>
<td>1</td>
</tr>
<tr>
<td>USA</td>
<td>10</td>
</tr>
<tr>
<td>Canada</td>
<td>14</td>
</tr>
<tr>
<td>Panama</td>
<td>40</td>
</tr>
<tr>
<td>Chile</td>
<td>46</td>
</tr>
<tr>
<td>Mexico</td>
<td>54</td>
</tr>
<tr>
<td>Brazil</td>
<td>55</td>
</tr>
<tr>
<td>Bahamas</td>
<td>78</td>
</tr>
<tr>
<td>Jamaica</td>
<td>119</td>
</tr>
</tbody>
</table>
NAFTA & Transportation

NAFTA partners are committed to trade liberalization but they ignored transportation, security, and immigration concerns

• Transportation system mismatch
  – Pre-NAFTA, respective systems developed in isolation
  – Canada and US developed infrastructure based on east-west flows while Mexico developed based north-south flow patterns (Bradbury, 2002)
  – NAFTA forced Canada and US freight flows north-south
  – Result has been increased transborder congestion
NAFTA-Related Infrastructure Projects: TEA-21, ISTEA, FAST Act

- I-95, I-87, I-69
- The current administration’s shift away from a focus on high priority international freight corridors aligns with the president’s desire to renegotiate or alter NAFTA
- One of the reasons NAFTA has yet to fulfill its full economic potential, especially within the United States – is that its coherent regulations are not matched by similar freight transportation policies
Short sea shipping (SSS) can promote economic development within the US and Mexico. SSS provides a viable solution to the current chokepoints and is a cost-effective means of transportation. The evolving diplomatic relations with Cuba affect shipping lanes and trade agreements.
U.S.-NAFTA freight totaled $89.2 billion as all five major transportation modes carried more freight by value with North American Free Trade Agreement (NAFTA) partners Canada and Mexico in July 2017 compared to July 2016, according to the TransBorder Freight Data released today by the U.S. Department of Transportation’s Bureau of Transportation Statistics (BTS) (Figure 2, Table 1).

The 6.5 percent rise from July 2016 is the ninth consecutive month in which the year-over-year value in current dollars of U.S.-NAFTA freight increased from the same month of the previous year (Figure 1).
The value of commodities moving by vessel increased 24.0 percent, pipeline by 23.1 percent, rail by 4.4 percent, truck by 4.0 percent, and air by 2.3 percent (Figure 2, Table 2). The large percentage increase in the value of goods moving by vessel and pipeline is due in part to an increase in the volume of mineral fuel imports.

Trucks carried 63.2 percent of U.S.-NAFTA freight and continued to be the most utilized mode for moving goods to and from both U.S.-NAFTA partners. Trucks accounted for $28.9 billion of the $47.6 billion of imports (60.7 percent) and $27.5 billion of the $41.6 billion of exports (66.2 percent) (Table 2).

Rail remained the second largest mode by value, moving 15.1 percent of all U.S.-NAFTA freight, followed by vessel, 7.1 percent; pipeline, 5.6 percent; and air, 3.9 percent. The surface transportation modes of truck, rail and pipeline carried 84.0 percent of the total value of U.S.-NAFTA freight flows (Table 2).
US Trade by Truck with Mexico

American Trucking Associations

US exports to Mexico are up 355% since 1995.

The value of goods transported totaled $376.6 BILLION in 2015.

That's a 377% increase since 1995.

Trucks haul 83% of goods across the Mexican border.

Truck exports account for 43% of total truck transported trade with Mexico.

Which requires 5.5 MILLION truck movements across the U.S.-Mexican border.

Billions of US $

1995 $0 $50 $100 $150 $200 $250

2015

Exports • Imports

Number of Border Crossings (in millions)

1995 2 4 6

2015
Imports and Exports

US ↔ Mexico

The two largest exported commodities account for 45% of truck transported trade into Mexico.

Top 5 Imports
1. Electrical Machinery (27%)
2. Computer-Related Machinery (20%)
3. Vehicles Other Than Railway (16%)
4. Measuring and Testing Equipment (6%)
5. Furniture (5%)

Top 5 Exports
1. Electrical Machinery (23%)
2. Computer-Related Machinery (22%)
3. Plasctics and Articles (9%)
4. Vehicles Other Than Railway (8%)
5. Measuring/Testing Equipment (3%)

Top imports from Mexico include: electric motors, electric generators, and telecommunications equipment.
US Trade by Truck with Canada

US exports to Canada are up 93% since 1995.

The value of goods transported totaled $335.2 BILLION in 2015.

That’s a 80% increase since 1995.

Trucks haul 70% of goods across the Mexican border.

Which requires 5.8 MILLION truck movements across the U.S.-Mexican border.

Truck exports account for 56% of total truck transported trade with Canada.

Billions of US $

<table>
<thead>
<tr>
<th>Year</th>
<th>Exports</th>
<th>Imports</th>
</tr>
</thead>
<tbody>
<tr>
<td>1995</td>
<td>$50</td>
<td>$150</td>
</tr>
<tr>
<td>2015</td>
<td>$250</td>
<td>$150</td>
</tr>
</tbody>
</table>

Number of Border Crossings (in millions)

<table>
<thead>
<tr>
<th>Year</th>
<th>Crossings</th>
</tr>
</thead>
<tbody>
<tr>
<td>1995</td>
<td>4</td>
</tr>
<tr>
<td>2015</td>
<td>8</td>
</tr>
</tbody>
</table>
Imports and Exports
US ↔ Canada

The two largest exported commodities account for 37% of truck transported trade into Canada.

Top 5 Imports
1. Vehicles [Not Railway (19%)]
2. Computer-Related Machinery (12%)
3. Special Classification Provisions (7%)
4. Plastics and Articles (5%)
5. Electrical Machinery (4%)

45% All Other Exports
19%

10%
5%
3%

53% All Other Imports
19%
12%
12%
5%
7%
4%

Top 5 Exports
1. Computer-Related Machinery (19%)
2. Vehicles [Not Railway (18%)]
3. Electrical Machinery (10%)
4. Plastics and Articles (5%)
5. Measuring/Testing Equipment (3%)

Top imports from Canada include: tractors, motor vehicles, motorcycles, and related equipment/parts.
### Port Infrastructure Quality 2016

<table>
<thead>
<tr>
<th>Country</th>
<th>Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Netherlands</td>
<td>6.8</td>
</tr>
<tr>
<td>Panama</td>
<td>6.3</td>
</tr>
<tr>
<td>USA</td>
<td>5.7</td>
</tr>
<tr>
<td>Canada</td>
<td>5.5</td>
</tr>
<tr>
<td>Jamaica</td>
<td>4.7</td>
</tr>
<tr>
<td>Dominican Republic</td>
<td>4.5</td>
</tr>
<tr>
<td>Mexico</td>
<td>4.3</td>
</tr>
<tr>
<td>LAC</td>
<td>3.8</td>
</tr>
<tr>
<td>Colombia</td>
<td>3.6</td>
</tr>
<tr>
<td>Brazil</td>
<td>2.7</td>
</tr>
</tbody>
</table>
Cuba Port Infrastructure
<table>
<thead>
<tr>
<th>Country</th>
<th>million cubic feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chile</td>
<td>29,405</td>
</tr>
<tr>
<td>Mexico</td>
<td>27,470</td>
</tr>
<tr>
<td>Argentina</td>
<td>16,661</td>
</tr>
<tr>
<td>Brazil</td>
<td>9,196</td>
</tr>
<tr>
<td>Dominican Republic</td>
<td>2,945</td>
</tr>
<tr>
<td>Barbados</td>
<td>100</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>183,871</strong></td>
</tr>
</tbody>
</table>

Source: US Energy Information Administration
IMPROVING THE TRANSPORTATION PLANNING PROCESS
GIS-Based Multicriteria Simulations and Discussions Towards the Design of the Belo Horizonte Metropolitan Bypass

OBJECTIVES
● To promote the modernization of transportation planning
● To provide a robust but flexible approach
● To develop a comprehensive report for supporting replication of the model

RESULTS
● The model allows for real-time collaboration and mediation of disparate interests.
● The model processes results in a significantly reduced time compared to traditional transportation planning.

Authors
Rodrigo A. A. Nobrega, Jose I. Ferreira Junior, Leise K. Oliveira, Marcelo T. Oliveira, and Bethany Stich

UNO TRANSPORTATION INSTITUTE
CONCLUSIONS

• LNG as an export will exist in a “buyers market.”
• Natural Gas demand as a feedstock for the Gulf Coast petrochemical renaissance is growing.
• As the world moves to more regional trade, there is also a nationalistic movement sweeping industrialized countries
• Cuba is a much larger potential threat in an economy based on regional trade
• NAFTA renegotiation is crucial