



Measuring North Carolina Railroad Company's Impact on North Carolina

A report prepared for the
North Carolina Railroad Company
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About RTI International

RTI is a nonprofit institute with headquarters in Research Triangle Park, North Carolina, that provides research, development, and technical services to government and commercial clients worldwide. Our mission is to improve the human condition by turning knowledge into practice.



About the North Carolina Railroad Company

The North Carolina Railroad is one of North Carolina's most unique assets — a 317-mile ribbon of steel, spanning our State from Morehead City to Charlotte. Through its capital improvement program, the North Carolina Railroad Company has invested in bridges track improvements, sidings, double tracking, safety measures and other infrastructure to attract business and industry and create jobs.

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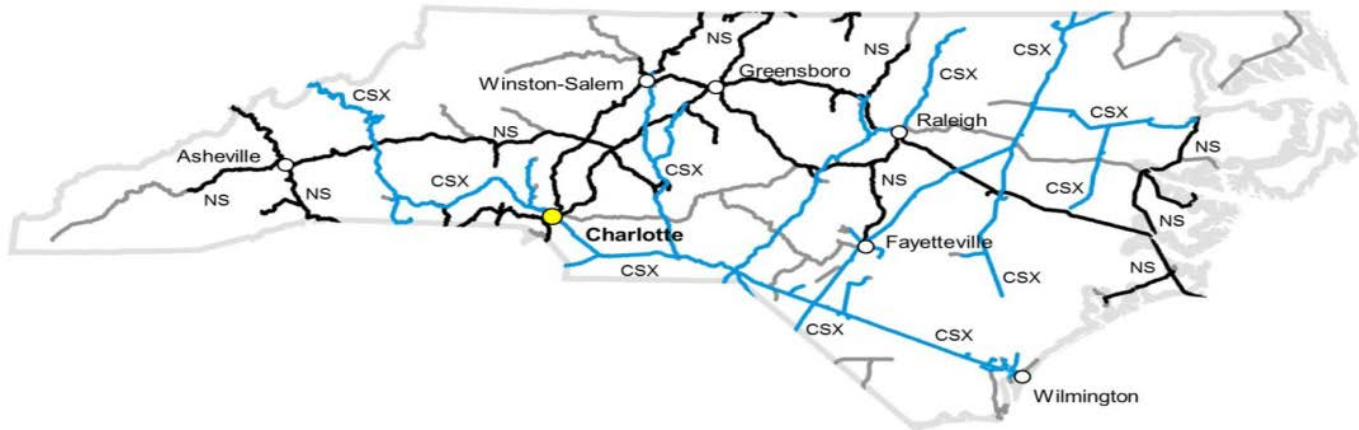
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Background and Context

- To better understand and measure their contribution to North Carolina, NCRRT asked RTI to estimate the economic impact of NCRRT on the State of North Carolina
- Updating 2007 economic impact study
- A one-year snapshot of the contribution of NCRRT to the State's economy, using 2013 data provided by Norfolk Southern

- A case study illustration of the value of rail to the NC economy

NCRR: an important part of a larger freight rail network



NCRR's share of NC Rail Freight Network

- NCRR is an important part of a much larger rail network in the State

	Miles	NCRR Share
NCRR	317	
All freight lines in NC	3,342	9.5%
Norfolk Southern	1,297	24%

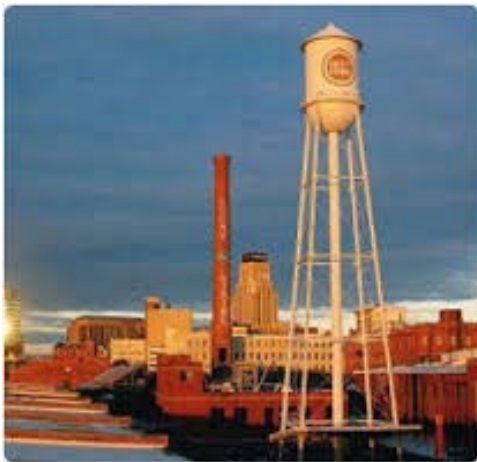
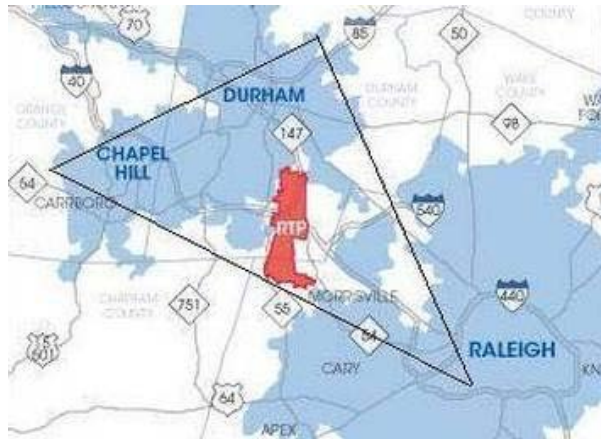
	Carloads	NCRR Share	Estimated Tons	NCRR Share
NCRR (2013)	159,400		11.3 million	
All freight lines in NC (2011)	835,400	19%	65.2 million	17%

The larger context

- Study estimates how much additional economic activity takes place in NC due to NCRR in 2013
- Quantifies only part of NCRR's impact – only freight, a single year
- Not considered but also a part of NCRR's impact over time
 - Industries that would not have located in NC without rail freight access
 - Value of projects that have located along NCRR's corridor
- Historically, NCRR enabled the growth of cities and industries along its corridor and throughout the State



Without NCRR...

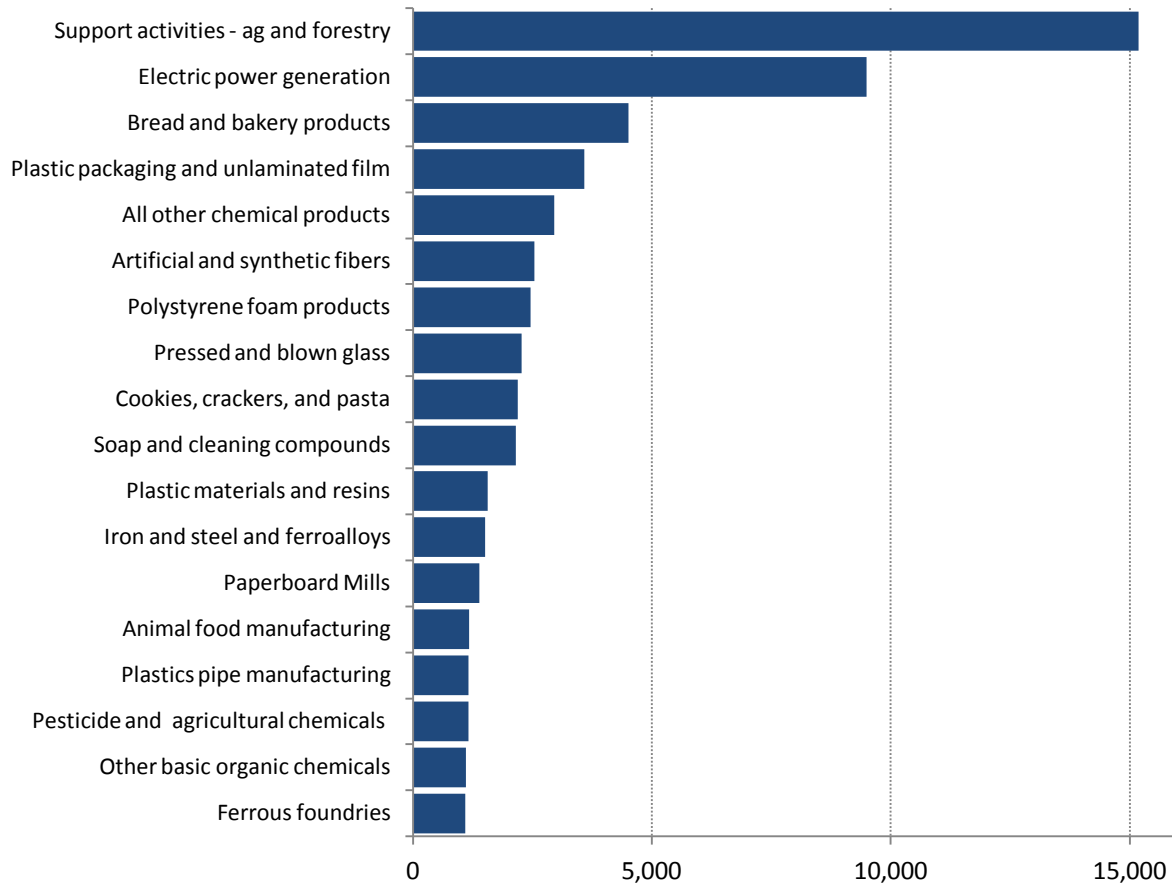


Can generalize many of our findings

- We quantified only NCR's impacts, but our findings illustrate the value of rail in general to NC economy
- Most NC manufacturing facilities in the state use inputs shipped by rail and/or transport their products by rail.
- Rail dependent industries employ 57,000 North Carolinians and produce \$14.6 billion worth of products within the state

Rail Dependent Industries (>1,000 employees)

NC Employment in Rail Dependent Industries



Source: RTI, IMPLAN 2012

Economic Impact

Background

- **Update and revise 2007 study**
 - Update key data inputs for the economic model
 - Specific consideration of intermodal transport
- **Scope**
 - 2013 freight data
 - Economic impact on North Carolina of lower transportation costs
 - External cost savings
- **Ongoing effort to understand and measure the railroad's impact**
 - NCRR's economic impact
 - The greater impact statewide

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Summary of NCRR Impacts

- **Traffic on the NCRR corridor**

- About 60 Norfolk Southern freight trains per day, about 10 Amtrak passenger trains
- 159,000 carloads and 188,000 containers originated or terminated on the NCRR corridor in 2013
- Equivalent to an estimated 11.4 million tons of freight

- **Direct impact on North Carolina economy**

- Due to the cost-savings that the NCRR corridor provides compared to the alternative of truck transport, North Carolina companies generate an estimated \$499 million in additional output

- **Total economic impact number**

- The direct impact results in a total output impact of \$794 million once supply chain effects and household income effects are accounted for using NC multipliers

Summary of Findings, Cont'd

- **Comparison to the 2007 study**
 - NCR 2007 study: \$338 million output impact
 - NCR 2014 study: \$794 million output impact
 - Estimate of 2013 total ton-miles is lower than ton-miles estimate from 2007 study
 - Difference in impact largely driven by higher estimated cost-savings of rail versus truck
- **External cost-savings**
 - Accounting for social costs such as congestion, accidents, and pollution, freight transported over the NCR corridor has an external cost savings of \$141 million
- **NCR allows NC to capture a larger amount of US market share than it would in the absence of the corridor**
- **Rail dependent industries**
 - Rail supports jobs in a diverse range of “rail dependent” industries in North Carolina such as agriculture, forestry, quarrying, paper, chemicals, and electricity generation.

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Methods and Approach

- **Hypothetical “what if” scenario**

- NCRRC rail corridor does not exist
- In the absence of the corridor, the next best alternative would be long-haul trucking
- Without NCRRC, businesses would face increased transportation costs

- **Key data and estimates**



Norfolk Southern freight carload and intermodal container data for shipments originating or terminating on the NCRRC corridor

Tonnage and distance estimates to translate carloads and containers into tons and ton-miles per commodity

Mapping commodities originating and terminating to industry sectors

Costs per ton-mile of freight rail and long-haul trucking

- **Estimated transportation cost savings by industry sector**

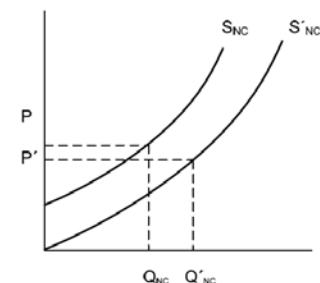
Methods and Approach, Cont'd

■ Economic Models

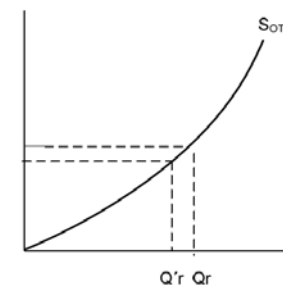
- Lower transportation costs leads to increased production for NC industries
- IMPLAN multipliers to determine the total impact on the North Carolina economy
 - Account for supply chain and household income effects
 - Measure the impact on output, State GDP, and jobs

■ Key model inputs and assumptions

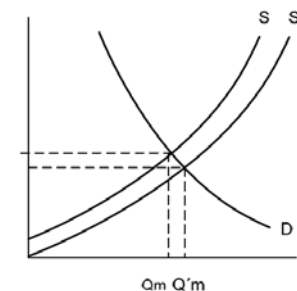
- Carload and container mapping to industries
- “Responsiveness” of 440 industries’ supply and demand to changes in cost
- Lower trucking sector revenue partially offsets the positive effects of rail



North Carolina



Other U.S.



Market

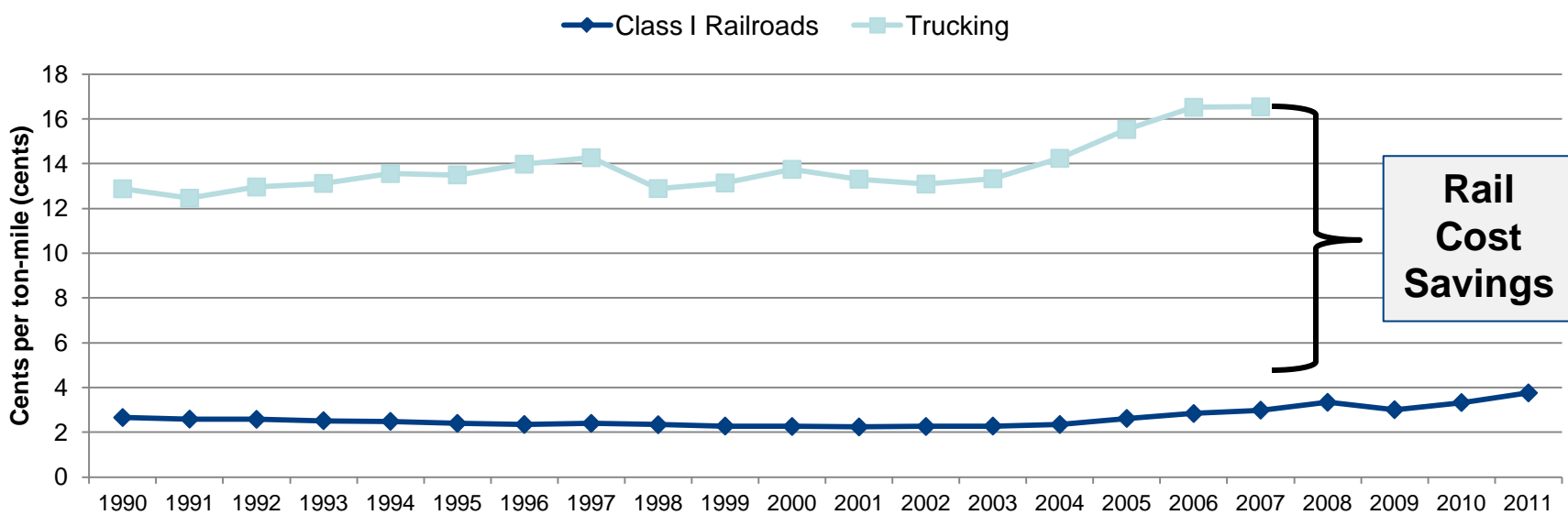
Rail Cost-Savings Lead to Economic Impacts

Revenue per ton-mile (cents)

Cost of rail	Cost of intermodal rail	Cost of freight trucking	Cost savings of rail over truck	Cost savings of intermodal rail over pure truck
3.8 ¹	7.0 ²	16.5 ¹	12.8	9.6

- 1. BTS (2011, 2007)
- 2. Weighted average; Dewey (2002)

Revenue per Ton-Mile

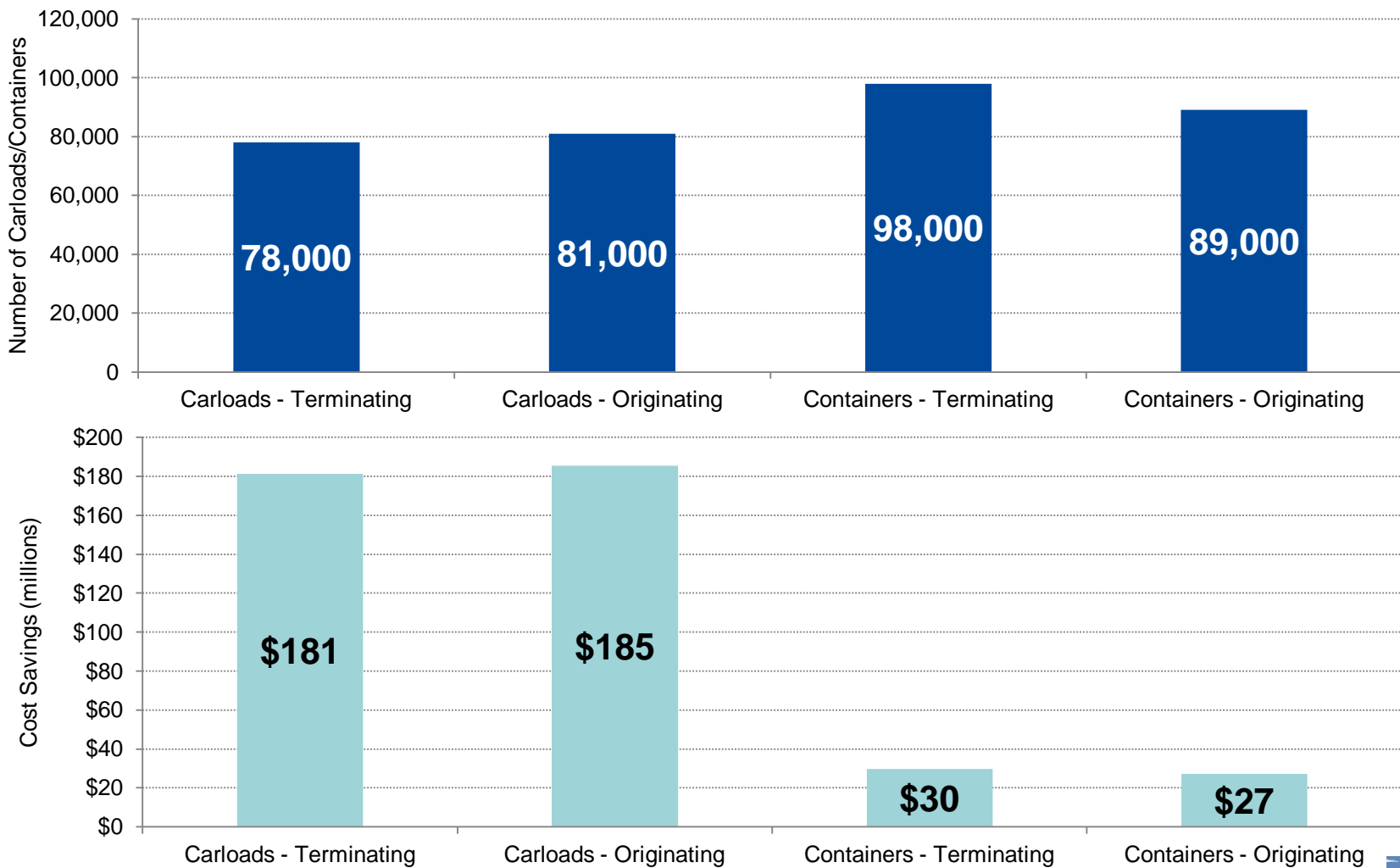


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Rail Traffic on the NCRR Corridor

Total Carloads/Containers and Total Cost Savings on the NCRR Corridor



Note: intermodal container shipments include Greensboro, Linwood, and Charlotte intermodal facilities

Top Ten Industries by Cost Savings due to NCRR

- Industry-specific cost savings depend on the Norfolk Southern freight data combined with our assumptions about trip length, tonnage, and commodity-industry linkages

Terminating

<i>IMPLAN Description</i>	<i>Cost Savings</i>
Pharmaceutical preparations	\$9 M
Maintenance /repair of nonresidential	\$ 8M
Construction of other new nonresidential	\$8 M
Petrochemicals	\$7 M
Construction of other new residential	\$6 M
Personal and household goods repair and maintenance	\$6 M
Other animal food manufacturing	\$6M
Poultry and egg production	\$6M
Food services and drinking places	\$5M
Plastics material and resin manufacturing	\$5 M

Originating

<i>Industry Name</i>	<i>Cost Savings</i>
Other basic organic chemicals	\$33 M
Lime and gypsum products	\$20 M
Mining and quarrying	\$18 M
Soybean and oilseed processing	\$12 M
Rolling mill and other metalworking machinery manufacturing	\$12 M
Other basic inorganic chemicals	\$11 M
Grain farming	\$10 M
Plastics material sand resins	\$8 M
Paperboard Mills	\$7 M
Petroleum and coal products	\$7 M

Supply and Demand Framework Results

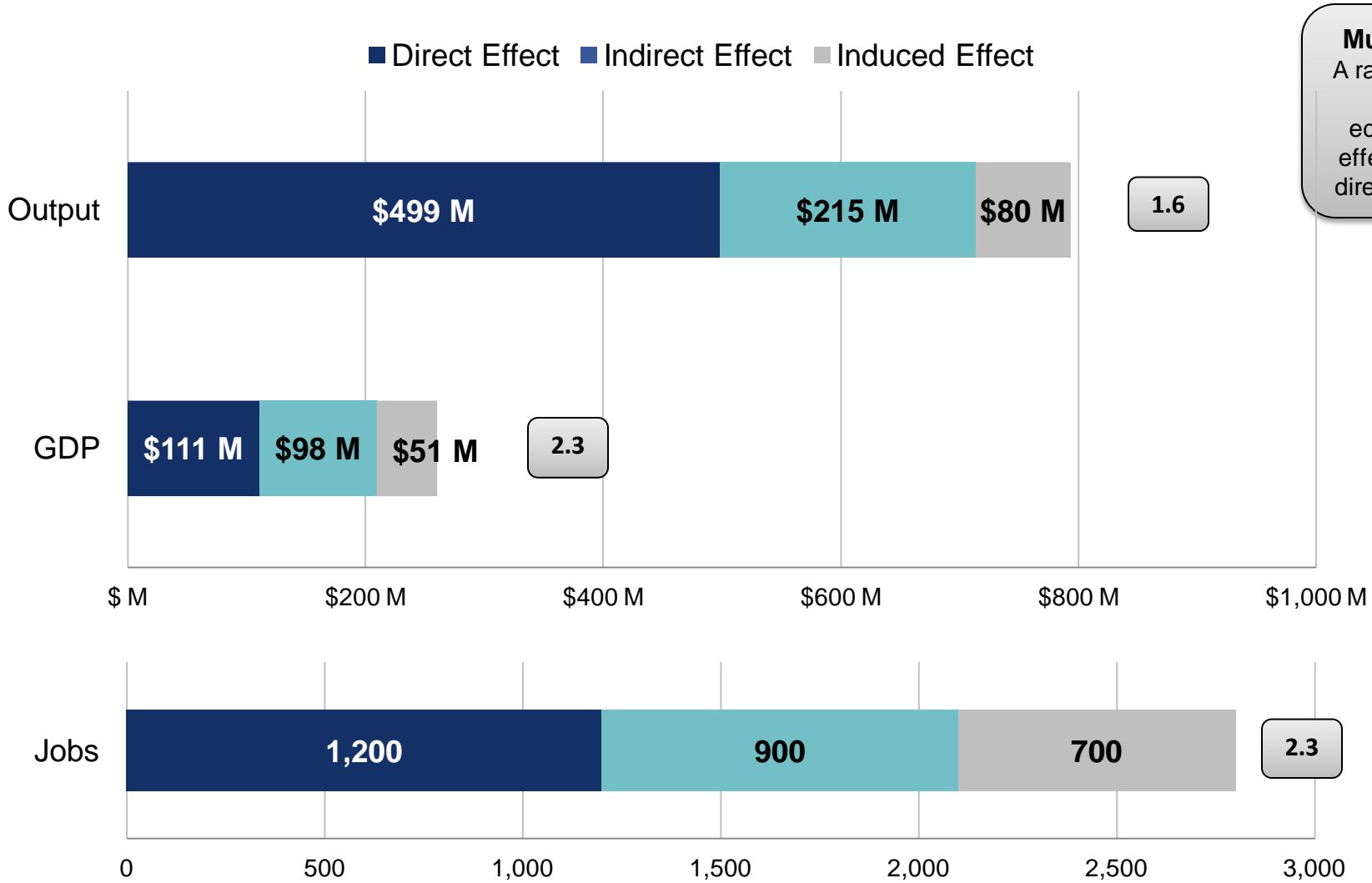
- Compared to the “what if” scenario (an absence of the NCRS corridor), North Carolina companies
 - **save an estimated \$424 million dollars** versus shipping by truck
 - **generate \$499 million in net additional output** (i.e., sales) and
 - **NC industries gain US market share**
- Economic impact of NCRS is **partially offset by estimated revenue losses in the trucking sector**

Other direct NCRR impacts

- NCRR invests in the rail network¹
 - **\$9.6 million invested on rail infrastructure improvements in 2013**
 - Supports “rail dependent” industries by increasing efficiency, driving down transportation costs
 - Decreases external costs on society (e.g., accidents) with targeted investments



Economic Impact Model Results



Multiplier
 A ratio of the total economic effect to the direct effect.

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External Costs

- In addition to costs experienced by shippers and passengers, transportation imposes **externals costs**
 - **Costs experienced by individuals who are not directly involved in the transportation sector.**
- Examples of external costs
 - Congestion delays
 - Accidents
 - Air pollution (health costs)
 - Noise pollution



External Cost-Savings due to NCRR

- The net external cost of switching to truck would be about **1.6 cents per ton-mile**
- Based on our calculations, approximately **8.7 billion ton-miles** originated or terminated in North Carolina
- Assuming conservatively that only a portion of the external costs are experienced by North Carolinians, we estimate a **reduction in external cost of \$141 million**.

External Cost Category	Trucking cost/ton-mile	Railroad cost/ton-mile	Net External Cost of Switching to Truck	Discount Factor	NC External cost/ton-mile burden
Congestion delay	\$0.00410	\$0.00030	-\$0.00380		-\$0.00380
Accident	\$0.01130	\$0.00240	-\$0.00890		-\$0.00890
Air pollution (Health)	\$0.00890	\$0.00195	-\$0.00695	0.5	-\$0.00348
Noise	\$0.00050	\$0.00050	\$0.00000		\$0.00000
Total	\$0.03970	\$0.00775	-\$0.03195		-0.01618



$$\begin{aligned}
 & \$0.016 \\
 & \times \\
 & 8.7 \text{ billion} \\
 & \text{ton-miles} \\
 & = \\
 & \text{\$141 million} \\
 & \text{external cost} \\
 & \text{savings}
 \end{aligned}$$

Source: RTI, GAO 2011

Summary

- **The NCRR makes businesses in NC more competitive by decreasing transportation costs for rail users**
 - NCRR's supports additional output, GDP, and jobs in NC
- **NCRR decreases the external costs of transporting goods**
- **Our approach is limited to 2013 impacts of the NCRR**
 - Since it's creation in 1848, NCRR has helped shape the State's economic geography
- **NCRR's impact is a case study of the impact of the statewide rail network**
 - 10% of railroad miles operated in NC
 - 17% of carloads and containers originating and terminating in NC
 - 19% of tonnage originating and terminating in NC

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Data Sources

Data Source	Information
Norfolk Southern	Freight carload and container data by STCC* (2013)
Association of American Railroads	Average cost per ton-mile, rail (2010-2012)
US DOT, Bureau of Transportation Statistics, National Transportation Statistics	Average revenue per ton-mile by mode of transportation (1960-2011)
US DOT, Bureau of Transportation Statistics, Commodity Flow Survey	Average miles per shipment in NC and US by SCTG** (2007)
US DOT, Surface Transportation Board, Carload Waybill Sample Reference Guide	US origin carloads and tonnage from waybill samples by STCC (2010-2012)
US DOT, Federal Highway Administration, Freight Analysis Framework Technical Documentation	STCC-to-SCTG crosswalk
US Census Bureau, Economic Census; EPA Elasticity Databank; literature	Economic data used to calibrate supply elasticities in the model
EPA Elasticity Databank; literature	Demand elasticities
IMPLAN, North Carolina Model	NAICS-to-IMPLAN crosswalk, economic impact multipliers, freight transportation demand, trade flows with other states, and economic indicators such as output, value added, and jobs (2012)
IMPLAN, US	US total output by sector (2010)
Government Accountability Office	External costs per ton-mile (2011)
BTS, America's Container Ports (US Dept. of Commerce)	Intermodal information: container-to-carload ratio, commodity mix
IMPLAN and NS data	Intermodal industry mix

*STCC = Standard Transportation Commodity Code

**SCTG = Standard Classification of Transported Goods

References

Dewey, James, David Denslow, David Lenze, and Eve Erwin. 2002. The Response of Railroad and Truck Freight Shipments to Optimal Excess Capacity Subsidies. Florida's Surface Freight Transportation Market. University of Florida Bureau of Economic and Business Research.

EPA. 2003. Elasticity Databank.

Forkenbrock, D.J. 2001. External costs of intercity truck freight transportation. Transportation Research (Part A), 33: 505-526. <https://wiki.umd.edu/lei/images/9/96/Forkenbrock_2001.pdf>

IMPLAN Group, LLC, IMPLAN System (2012 North Carolina), 16740 Birkdale Commons Parkway, Suite 206, Huntersville, NC 28078

RailINC. 2013. 2012 Surface Transportation Board Carload Waybill Sample Reference Guide. <<http://www.stb.dot.gov/stb/docs/Waybill/2012%20STB%20Waybill%20Reference%20Guide%20-%20FINAL.pdf>>

Shoven and Whaley. 1992. Applying General Equilibrium.

U.S. Department of Transportation, Federal Highway Administration. 2002. Freight Analysis Framework, Technical Documentation, Report #8. <http://ops.fhwa.dot.gov/freight/freight_analysis/faf/faf2_tech_document.htm>

U.S. Department of Commerce, Census Bureau. 2007. Commodity Flow Survey. <http://www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/publications/commodity_flow_survey/index.html>

U.S. Department of Commerce, Census Bureau. 2007. Economic Census. <<http://factfinder2.census.gov/faces/nav/jsf/pages/searchresults.xhtml?refresh=t>>

U.S. Government Accountability Office. 2011. A Comparison of the Costs of Road, Rail, and Waterways Freight Shipments That Are Not Passed on to Consumers. <<http://www.gao.gov/new.items/d11134.pdf>>

Comparison with 2007 Results

- Larger cost differential per ton-mile between rail and truck than in 2007 study
- Difference in total ton-miles
 - 2013: 8.7 billion ton-miles
 - 2007: 9.9 billion ton-miles
- Different underlying commodity and industry mix based on carload data
- IMPLAN differences
 - Industry scheme and updated multipliers
- Other minor differences in methods and input data