

Transportation and the Economy

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"It is not the wealth of a nation that builds roads, but the roads that build the wealth of a nation." -- President John Kennedy

President Kennedy's words could have referred to transportation more generally. Each great power in the history of civilization has had the benefit of efficient transport to support its economic growth. Rome had its roads to move its armies and its commerce. For three hundred years the wealth and strength of the British Empire depended upon the sea. In America, the early settlers had the rivers, and later canals, to move their produce to market. In the second half of the 19th century and the first half of the 20th century, railroads moved the product of the nation's growing industrial economy. In the second half of the 20th century, interstate highways continued the post-war boom.

The importance of transportation to economic wellbeing is the topic of this paper. It reviews some of the literature and the experiences of other countries to argue that continued and reasonable investment in transportation is essential to the continued economic health of the country.

Summary and Conclusions

The economy of the Upper Midwest is unique in that it is heavily reliant on manufacturing and agriculture. Both generate significant amounts of freight and are dependent upon efficient transportation systems to remain competitive in the global market. Particularly for manufacturing and agriculture, global competitiveness is critical. Competitors in agricultural production are not in other parts of the U.S.; they are in South America. Competitors in manufacturing are also not in other parts of the U.S.; they are in Asia.

Economists tell us that investing in transportation increases productivity, which enhances competitiveness and brings prosperity. A large number of close correlations between measures of economic health and transportation activity and productivity support this view. The return on an investment in transportation in the US is high. It was highest when the productivity gains were greatest because the stock of transportation assets was low. Even at its low point, transportation investment return outpaced private return to capital and interest rates.

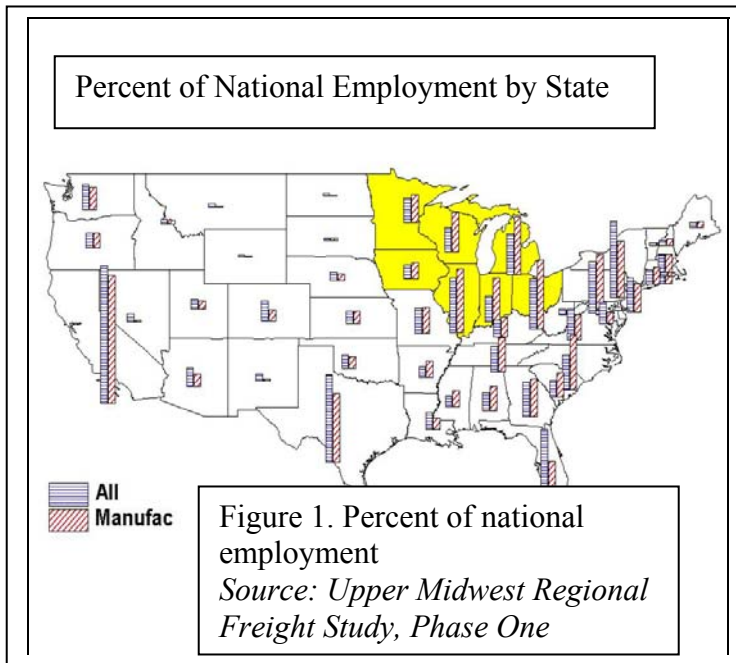
The actions of specific firms either individually or collectively also tell the story of the importance of transport. The reduction in inventory costs, which has saved the economy more than 4% of GDP over the past couple of decades, was made possible by two changes in logistics. The first is the movement in the manufacturing industry to just-in-time delivery systems. The second is the widespread adoption of "pull" logistic systems in retail distribution. Both require reliable transportation systems.

Finally, our global competitors are making investments that will enhance their competitive position in the world market place. Brazil and Argentina have

substantially closed the transportation cost gap in agricultural products. The European Union, India and China are each making huge investments in transportation. If the US is to maintain its place as an economic super power, it will have to take steps to maintain its efficient transportation systems as the demands upon it grow.

Regional Issues

The Upper Midwest is unique in its economy in several respects. First of all, it is much more dependent on manufacturing than is the nation as a whole. Next it is very dependent on agriculture. Finally, it has a robust trade within the region and with Ontario.



Manufacturing is much more dependent on freight services than other economic activities. Goods must be brought to the place of manufacturing and finished product must be moved to wholesalers and retailers. Figure 1 illustrates the relative importance of manufacturing in the region in terms of percent of national employment. Each state in this region has a larger percent of the national manufacturing employment than it has of the total national employment.

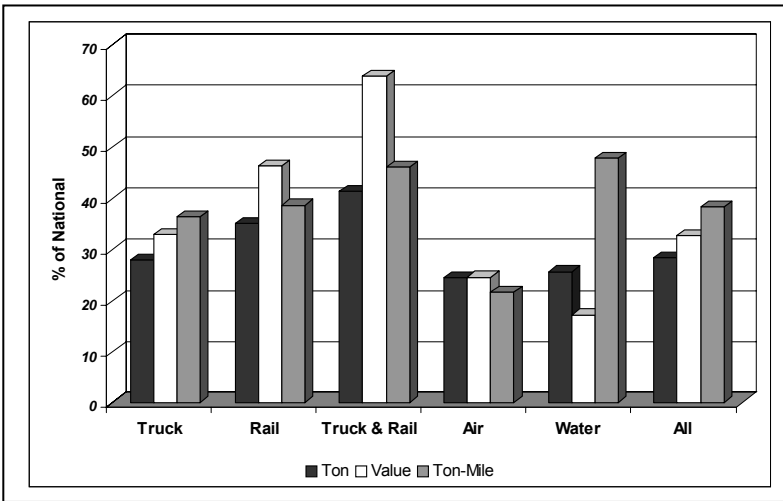
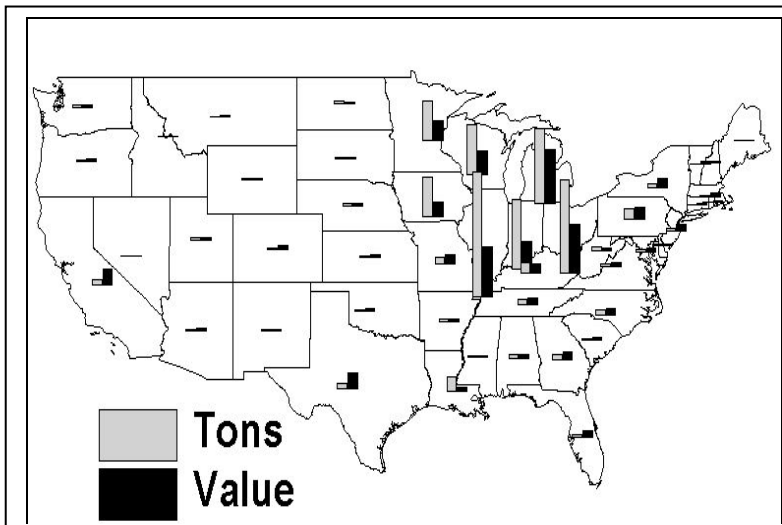


Figure 2. Percent of national freight with either origin or destination in the region
 Source: Midwest Regional University Transportation Center: Upper Midwest Regional Freight Study, Phase

This dependence on manufacturing also helps to explain a greater than national average presence of freight in the region. Figure 2 illustrates the portion of the total national freight that has either an origin or a destination in the region. More than 40% of the ton-miles of freight of the nation either start or stop in the seven states of the region.

Agriculture is another key part of the region's economy. All seven of the states are ranked in the top ten corn producing states. Five of the seven are ranked in the top ten soybean producers. Some of the states are among the top wheat, produce, cattle and hog producing states of the nation. Like manufacturing, agriculture requires sound transportation. In fact, agriculture-related products rank high on the list of leading goods moved in the region when measured both by tonnage and by value. The seasonal nature of most agricultural products adds to the complexity of freight movements in the region. Finding sufficient rolling stock, either trucks or rail cars, has been a challenge in some years as the grain crops are harvested.



Trade within the region is also very important. Figure 3 illustrates the destinations of freight with an origin in our region. The bulk of the freight that starts within the region stays within the region. The states of the region are their own best trading partners.

Figure 3. Destinations of freight with an origin in the Upper Midwest
 Source: *Midwest Regional University Transportation Center: Upper Midwest Regional Freight Study, Phase*

International trade is a significant and growing part of the trade in the region. Domestic trade ranges from more than

90% for some states to about 60% for Michigan. Figure 4 and 5 illustrate domestic

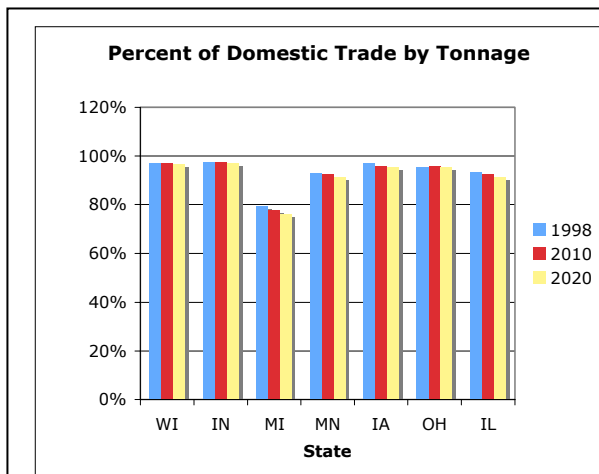


Figure 4. Domestic trade by tonnage
 Source: *Federal Highway Administration: Freight News*

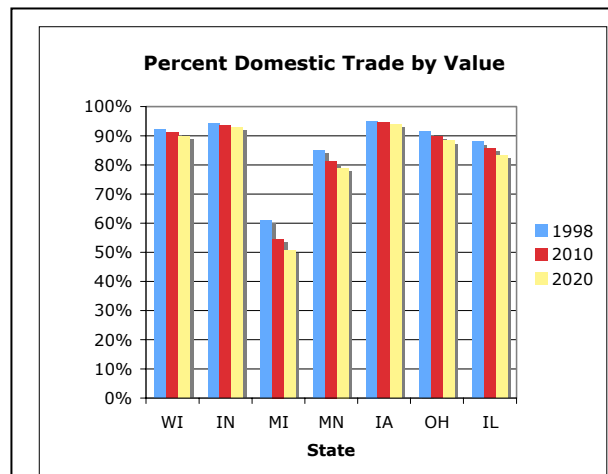
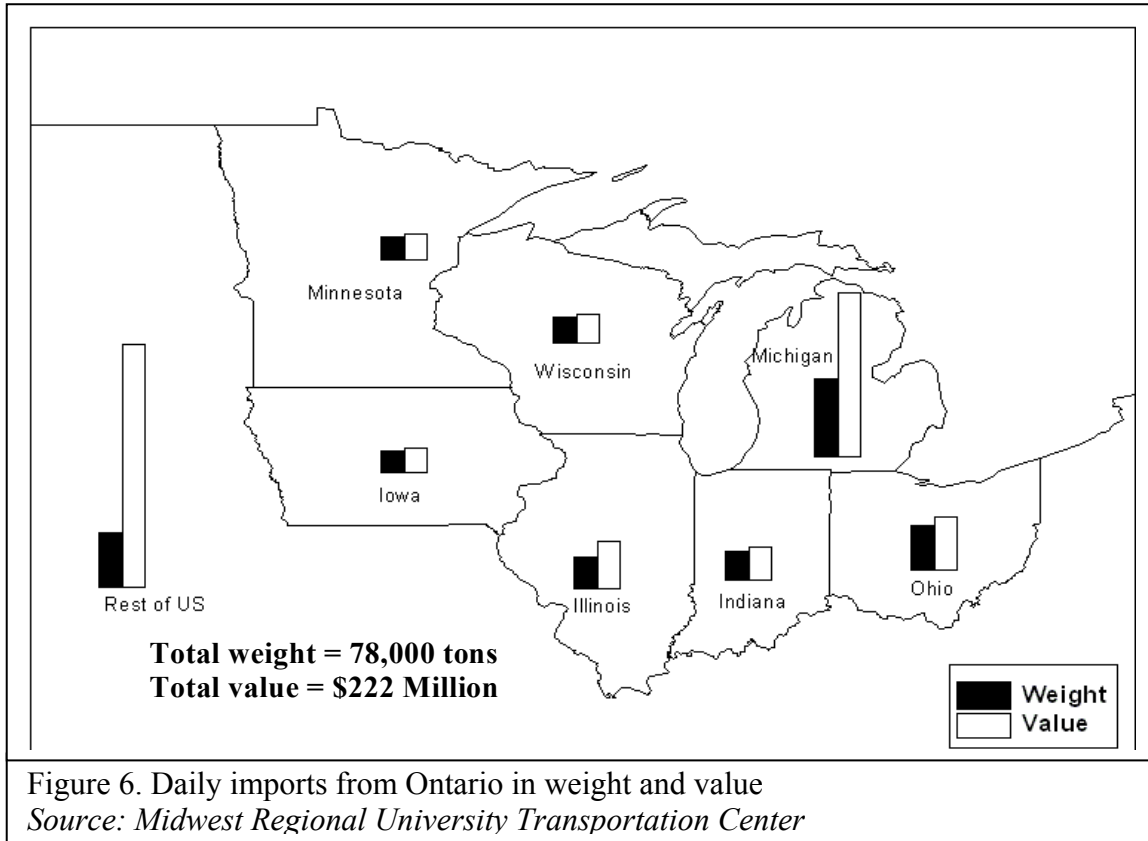


Figure 5. Domestic trade by Value
 Source: *Federal Highway Administration: Freight News*

trade by tonnage and by value.

Figure 5 also illustrates a projected trend. According to the Freight Analysis Framework (FAF), domestic trade will comprise a shrinking proportion of the total value of trade for all states of the region by 2020.



Finally, Ontario represents a significant international trading partner for the region. All states of the region benefit from it. Figures 6 and 7 illustrate the destination of trucks moving from Ontario into the US and the origin of trucks from the US going to Ontario.

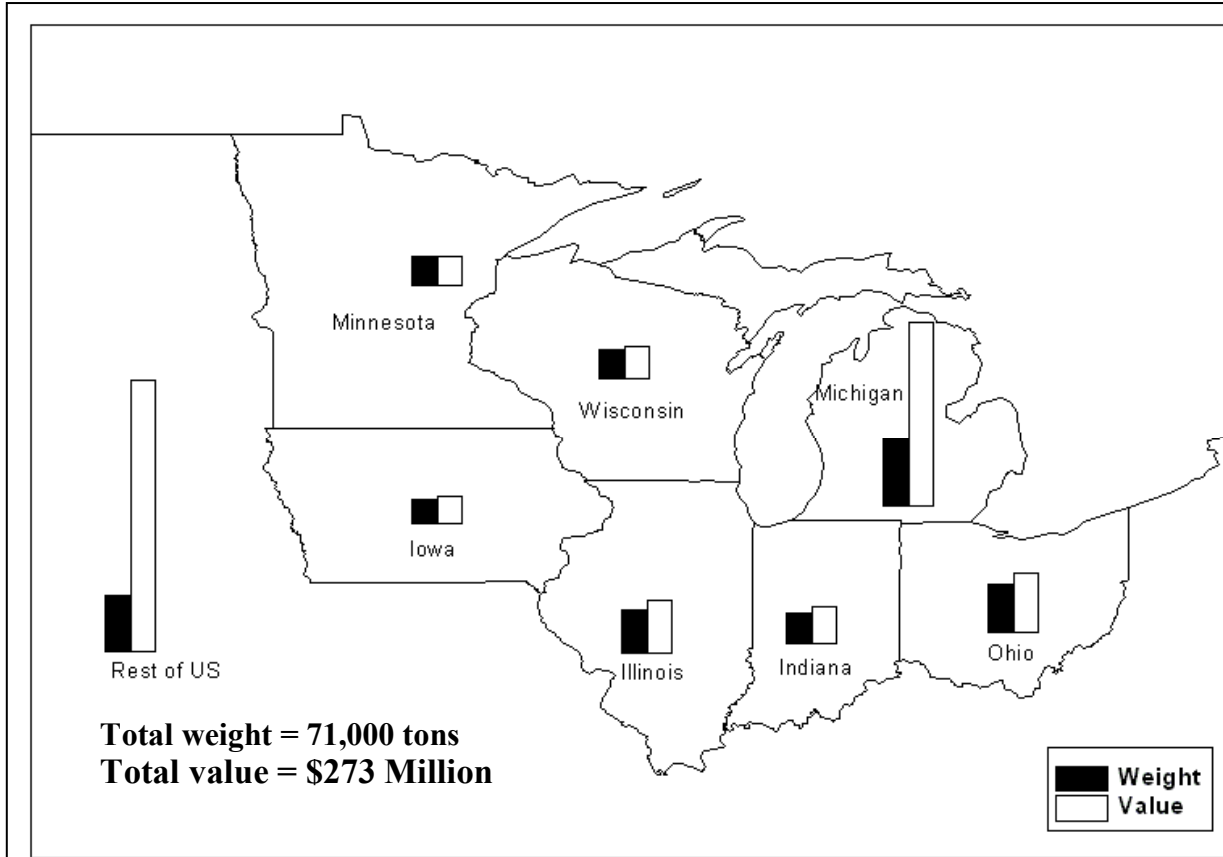


Figure 7. Daily exports to Ontario from the US
 Source: Midwest Regional University Transportation Center

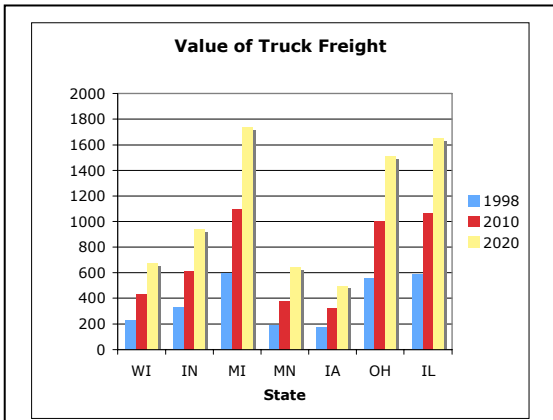


Figure 8. Value of truck tonnage
 Source: Federal Highway Administration: Freight News

Clearly, Michigan is the primary trading partner with Ontario in both directions. Cumulative trade for other states in the region surpasses the rest of the US, as well as Michigan.

These unique features of the economy in the region translate into a growth in freight. Figures 8 and 9 show the current FAF projections truck traffic in each state both in terms of tonnage and value. While the projections show an increase in all of the modes, the growth rate, combined with the base numbers make truck the most striking.

Figure 8 shows a projected growth in the value of truck borne freight of more than 100% between 1998 and 2020 for each of the states. Figure 9 shows a near doubling of tonnage across the region.

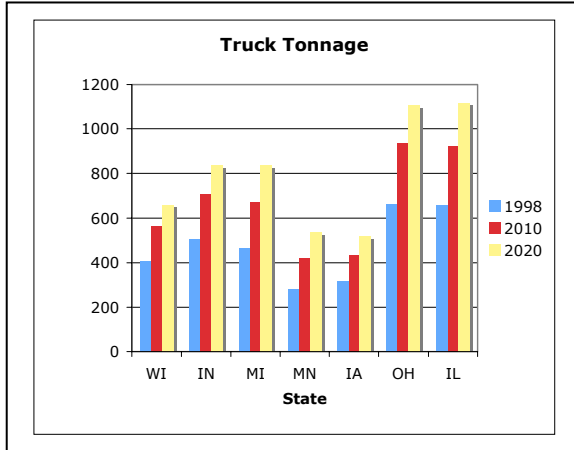


Figure 9. Truck Tonnage
 Source: Federal Highway Administration: Freight News

From the Literature

Economists use three different arguments to link transportation to economic growth. The first is a macroeconomic view that looks at economic indicators and finds correlations to transportation investment and efficiency. The second is a microeconomic perspective that considers that actions of specific companies in response to improvements in transportation services or reliability. The third is an equilibrium model that argues that improved transportation allows for economic specialization, with trade leading to prosperity. While these arguments each have distinctive bases,

they share the view that better transportation leads to economic prosperity.

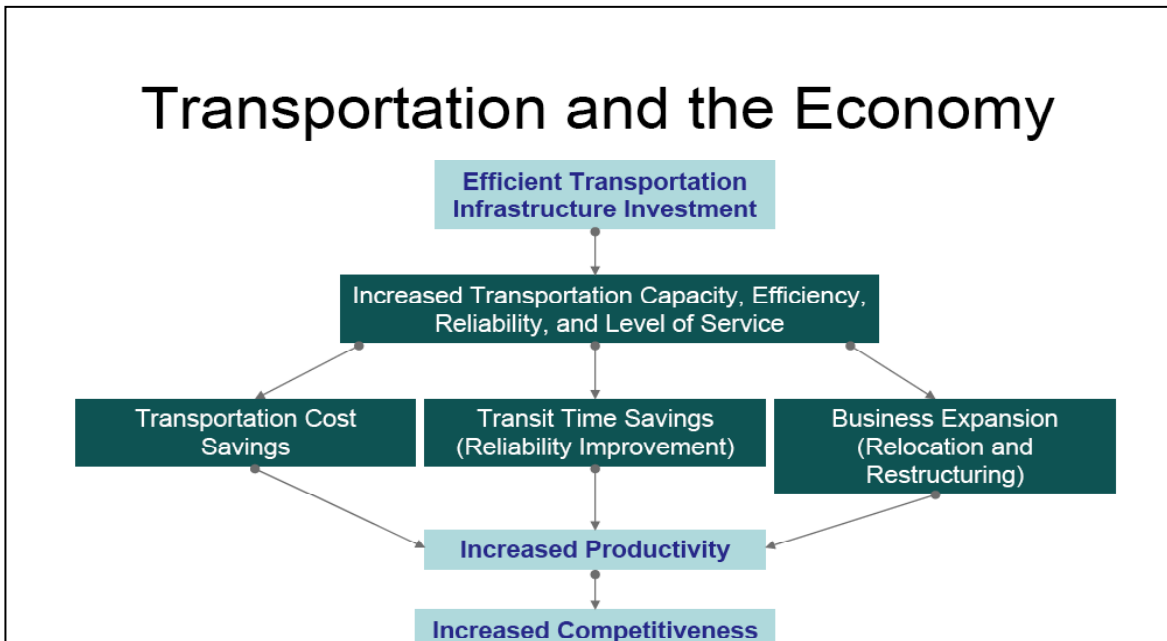


Figure10. Transportation and the Economy
 Source: Penne

Macroeconomic View

The macroeconomic view considers transportation to be a component of economic productivity. As outlined in the Figure 10, investments in transportation lead to increased capacity, efficiency, and reliability. This produces cost savings, time-savings and business expansion. Increased productivity and competitiveness are the

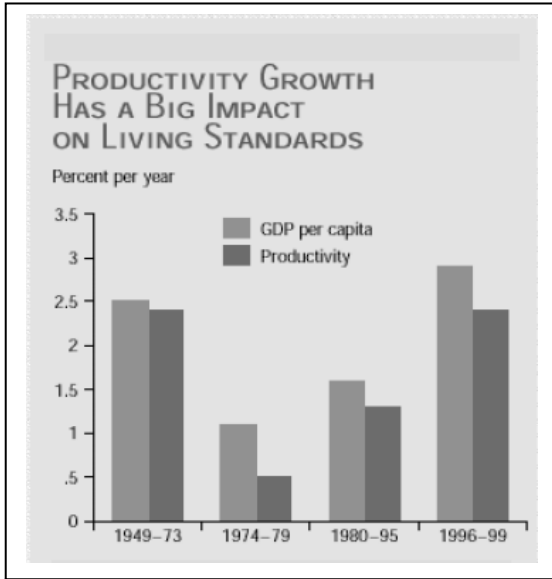


Figure 11. Productivity and GDP
Source: FHWA, Freight Transportation

result, which in turn causes economic growth. This approach seems defensible, since a close correlation exists between productivity and economic growth, as shown in Figure 11. For each of four very different periods in the economic history of the country, productivity and GDP parallel each other very closely.

Figure 12 provides another view of the correlation. Throughout the years between 1990 and 2003, real GDP per capita, the black line, and trucking productivity, the red line, have changed in almost exactly the same way. In the later years of the period, manufacturing and rail productivity, the green and yellow lines, have grown more quickly, but in the same pattern as GDP.

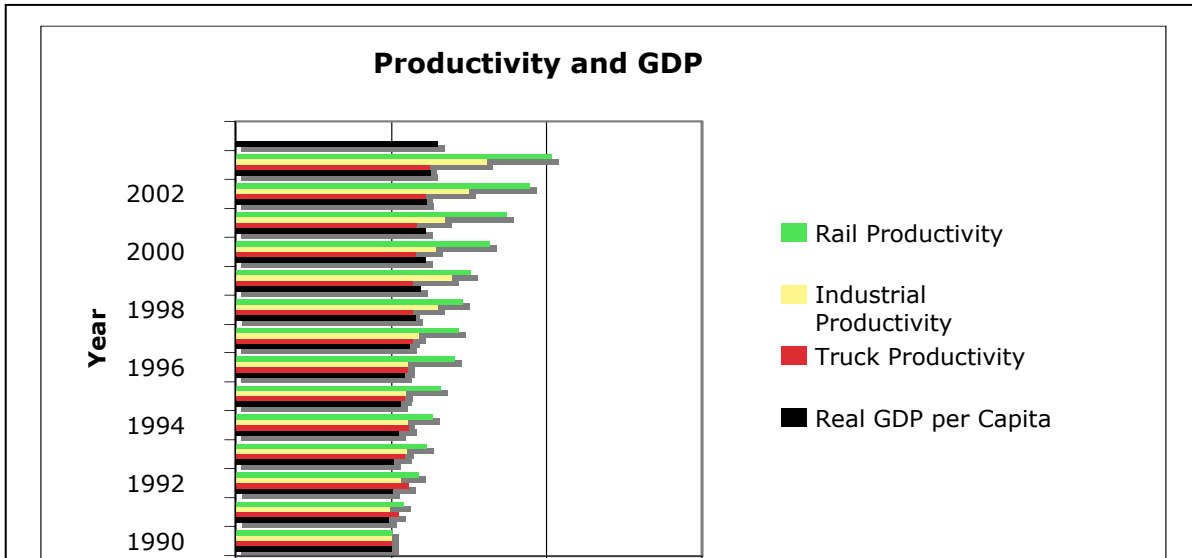


Figure 12. Productivity and GDP in the '90s
Source: BLS: Major Sector Productivity

Finally, another set of correlations is found in Figure 13. In this case, the Transportation Services Index (TSI), which is a measure of transportation efficiency reported monthly by the U.S. DOT, is related to total payroll, personal consumption and employment. The lines move in very similar ways. Moreover, they respond similarly during a recession, which are indicated by the gray bars on each graph.

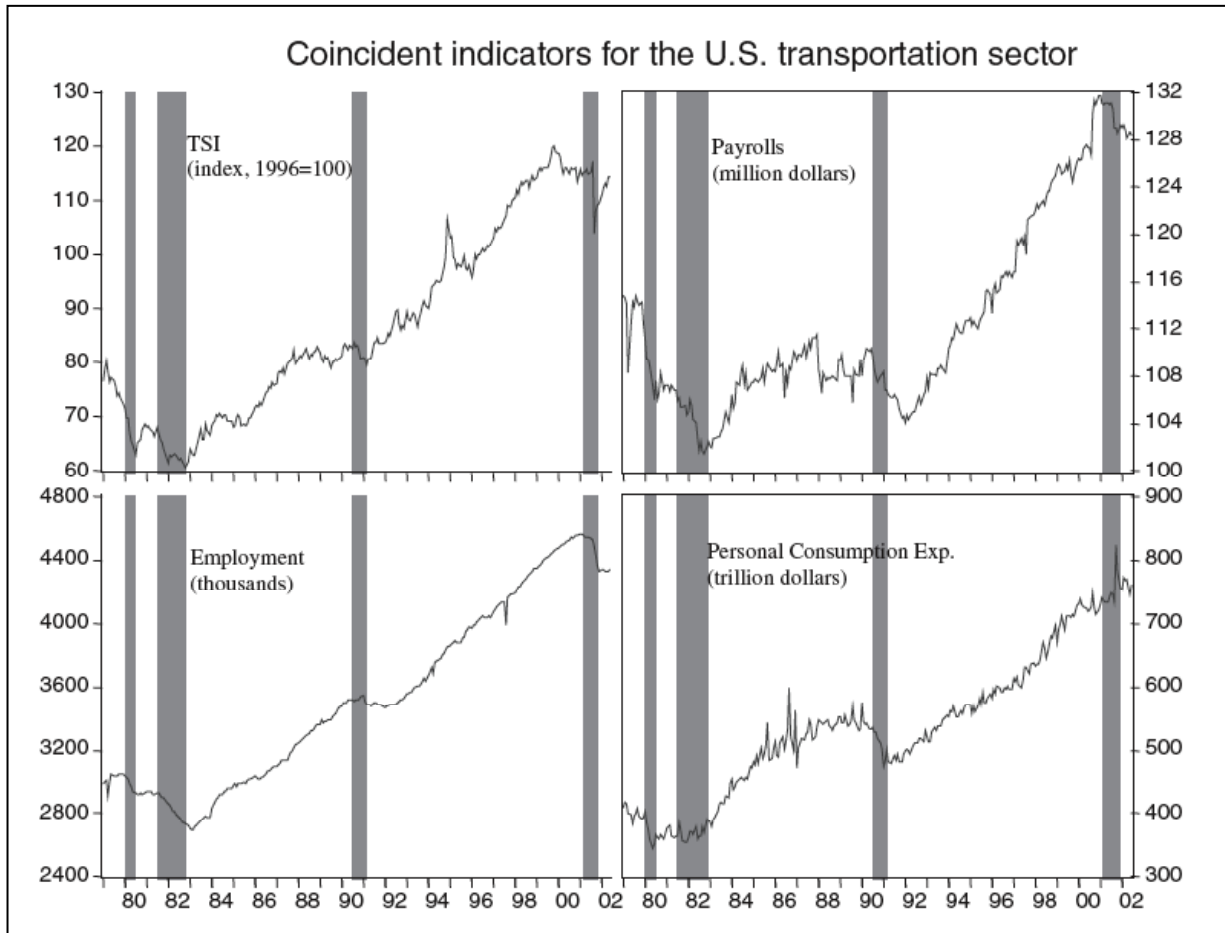


Figure 13. Coincident Indicators for the U.S. Transportation Index

Source: Lahiri: Predictive Power

Average Net Rates of Return per dollar Invested in Highways				
	1960-69	1970-79	1980-91	1960-91 Average
Highway Capital	0.54	0.27	0.22	0.32
Private Capital	0.16	0.18	0.17	0.17
Interest Rate	0.05	0.08	0.10	0.08

Figure 14. Rates of Return per Dollar Invested in Highways

Source: Penne

Benefit cost analysis (BCA) is another way of measuring this macroeconomic impact. Not surprisingly, the benefit of investing in highways was greatest when the total stock of highways was lowest, as the interstate was being built in the 1960s, as shown in Figure 14. In the 1970s and '80s, with the stock of highway capital expanded, the return on new investments was reduced, because those investments failed to provide the same productivity gains received earlier.

To summarize, transportation investments produce productivity improvements and productivity improvements foster increases in GDP. Measures of productivity correlate very closely with GDP and other measures of economic growth. The return on investments in highway capital is greater than on other average investments. Historically, it has been highest when the existing highway capital was smallest, which supports the theory of the importance of productivity gains.

Microeconomic View

The microeconomic view is more difficult to quantify since it deals with the actions of specific businesses as they respond to changes in the efficiency or reliability of

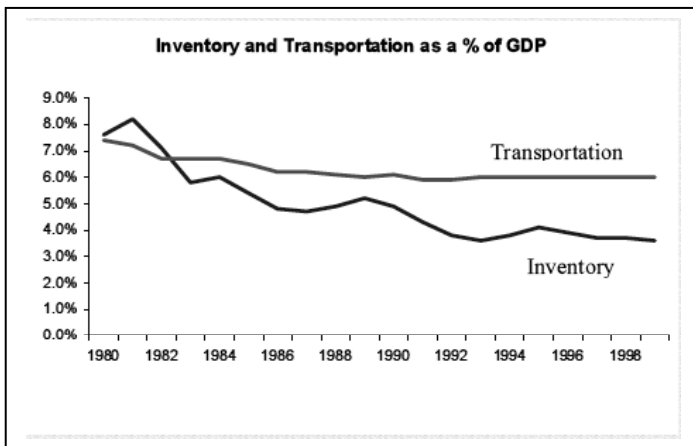


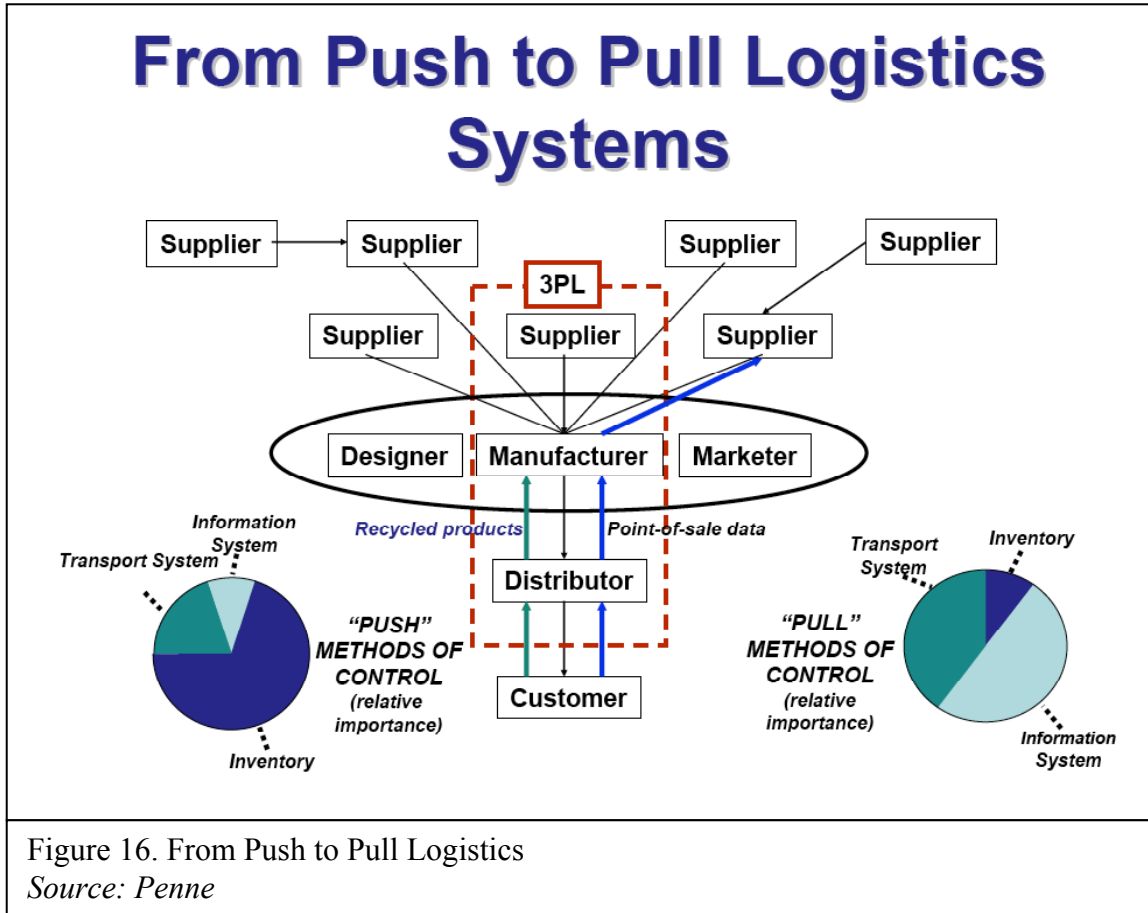
Figure 15. Inventory and Transportation Costs as a Percent of GDP

Source FHWA: *Freight Transportation*

transportation services. Two major events in logistics of the last two decades are major examples of individual businesses responding to changes in transportation. The first was the movement to just-in-time delivery, which significantly reduced inventory costs for many businesses. Between 1981 and 1999, inventory costs in the US fell from over 8% of GDP to less than 4%, as shown in Figure 15. This change was only possible because firms felt comfortable enough with the reliability of the transportation system to risk

shutdowns of their production lines if materials failed to arrive as planned. The method clearly worked, saving the economy over 4% of GDP, which had previously been consumed in inventory carrying costs.

The second major change, which was adopted by most manufacturing and retail companies, was the “pull” distribution system. As shown in Figure 16, the “pull” system depends upon reliable transportation services and advanced communication services to pull products from the manufacturer or the warehouse as they are needed. The old system had products “pushed” from the manufacturer or the warehouse to retailers who then had to deal with selling them. The result of this change is a further reduction in inventory costs and a more responsive retail system. Goods can be changed in the stores as consumers demand change, rather than as inventories are refreshed. As the two pie charts in Figure 16 illustrate, the importance of transport and information systems is much greater under the “pull” approach to logistics management. Indeed, without those key tools, the approach would not be possible. Again, the cost of inventory is reduced.



Specific company responses to changed transportation systems can also be cited. Many represent efforts to make the logistics system more responsive. For example, the Ford Motor Company reduced its delivery time to dealers by implementing regional “mixing” centers for automobile distribution (FHWA). Rather than waiting at the factory until truckloads are ready for shipment to dealers, the mixing centers move completed autos into regions closer to the dealers. As orders are received they are filled efficiently and quickly. The concept made the company more responsive to its customers, but the change was made possible because of dependable transportation services.

Equilibrium

The notion of equilibrium has been a staple of the economic world for two centuries. Regions, countries or firms should do those things they are most efficient in doing and rely on trade to gain the benefit of each country’s, region’s, or firm’s greatest efficiencies. Economic growth through trade is the basis for much of the economic policy of the past sixty years. The World Trade Organization, the North American Free Trade Agreement and dozens of other trade agreements are based on this premise. In the US, economists have pointed to the benefit that Americans have received from inexpensive imports of everything from clothing to electronics. No one can deny that Americans enjoy more things now than they would if global trade did

not exist. But global trade and production equilibrium are only possible if transportation systems are inexpensive and dependable.

International Competition

Figure 10 tells us that increased productivity brought about by transportation investment leads to increased competitiveness. To understand the significance of this competitive position, it is important to understand the source of our competition. In the 1960s and 1970s American competition was largely regional. The New England states were in competition with the Southeastern states in the textile industries. The Midwest was in competition with the South in the auto industry. While we may have some residual effects of that regional competition, our competitors in the 21st Century are foreign countries. Therefore, if those countries are making investments in transportation to increase their productivity and to enhance their competitive position, the US should take note.

A simple example of importance to the agricultural community in our region is soybean production. As Figure 17 illustrates, until the recent decades Argentina and Brazil were not players in the world soybean markets. They are now major players. As Figure 18 illustrates, the US has historically had a major advantage over these countries in the cost of transportation, but that advantage is disappearing (note: Mato Grosso is a Brazilian port; Parana, Argentine). In fact, when the total cost of production and transportation to overseas ports are considered, the advantage is gone, as illustrated in Figure 19.

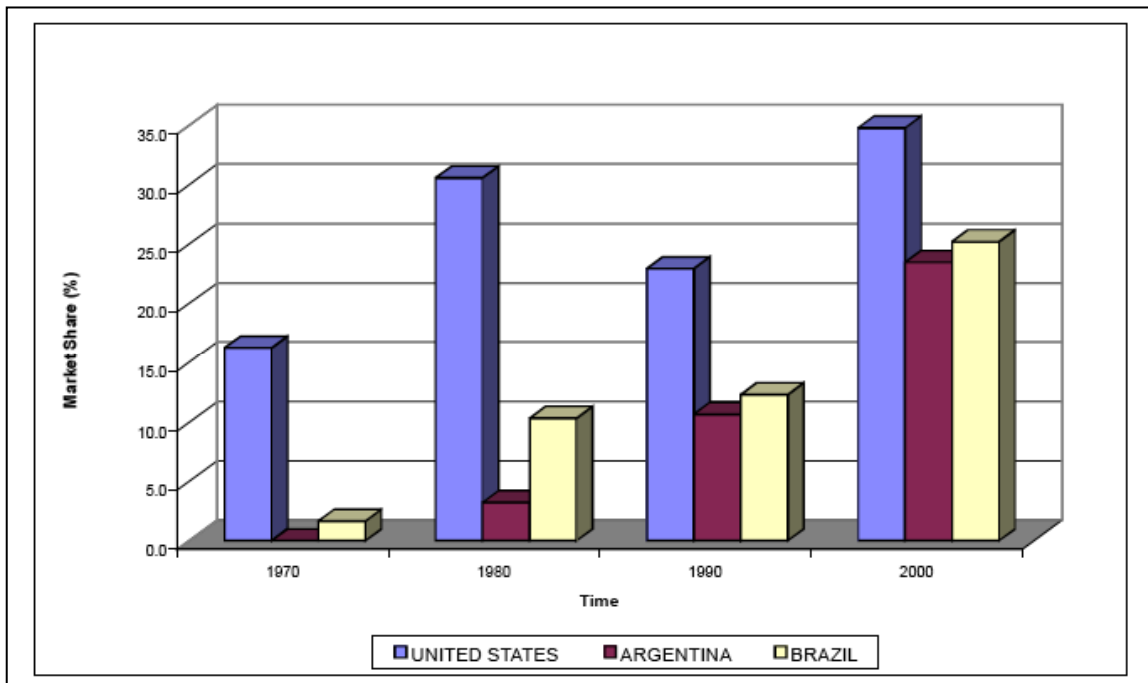


Figure 17. Soybean market share
Source: North Dakota

Brazil and Argentina are not alone in understanding the importance of transportation for economic success. Both countries have reduced their internal transportation costs through investments in waterways, rail and roads. Those investments are continuing.

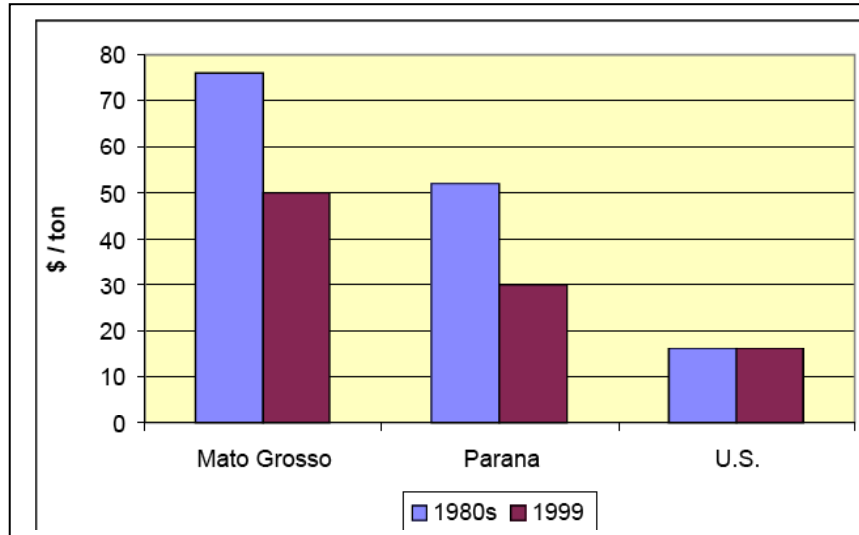


Figure 18. Cost per ton to move soybeans to port
Source: North Dakota

<i>Cost Item (\$/bu.)</i>	<i>US</i>	<i>Brazil</i>	<i>Argentina</i>	
	<i>Hinterland</i>	<i>Mato Grasso</i>	<i>Parana</i>	<i>Santa Fe</i>
<i>Production cost</i>	5.11	4.16	3.89	3.92
<i>Internal transport & marketing cost</i>	0.43	0.85	1.34	0.81
<i>Cost at border</i>	5.54	5.01	5.23	4.73
<i>Freight to Rotterdam</i>	0.38	0.57	0.57	0.49
<i>Price at Rotterdam</i>	5.92	5.58	5.80	5.22

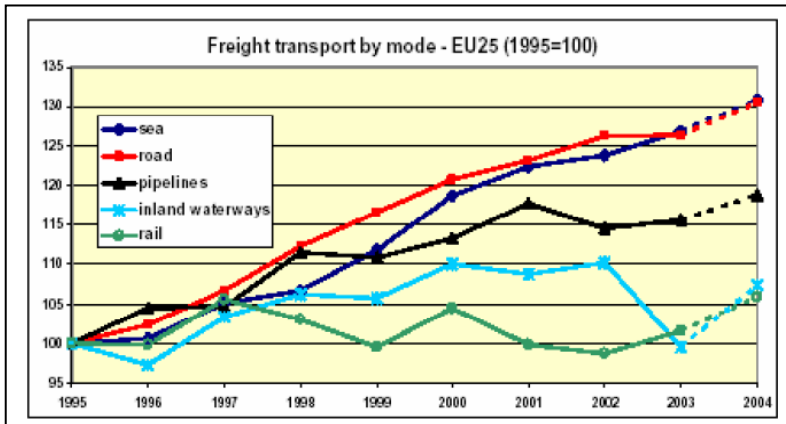
Figure 19. Comparative total cost of soybeans delivered to Rotterdam
Source: North Dakota

The European Union (EU) has articulated its approach in a policy statement dealing with its proposed, and partially implemented transportation system:

Modern economies cannot generate wealth and employment without highly efficient transport networks. This is particularly true in Europe where, for goods and people to circulate quickly and easily between Member States, we must build the missing links

and remove the bottlenecks in our transport infrastructure. The trans-European transport network is a key element in the re-launched Lisbon strategy for competitiveness and employment in Europe for that reason alone: to unblock major transport routes and ensure sustainable transport, including through major technological projects. (Directorate General)

The EU is dealing with increased demand for transportation, in keeping with the above vision, in several ways. The first is an effort to diversify its system to move more goods from highways to rail and water. As Figure 20 indicates, it has been



partially successful in that effort. While road (red line) remains near the top in terms of growth, short-sea-shipping (dark blue line) has responded to the effort the EU has placed on the promotion of the mode. Inland waterways and rail also seem to be responding in the later years.

Figure 20. Freight transport modal split in the EU25
 Source: Directorate General: Consultation document on logistics for promoting freight

The EU has also devoted much energy to promoting intermodal

freight (short-sea, rail, inland waterway and truck) through a program called Marco Polo. Through this program the EU is funding projects that will better connect the modes. (EU Commission, Europe at a Crossroads)

Closely tied to the Marco Polo program is Galileo, the EU's version of the Global Positioning System (GPS). Unlike America's GPS, Galileo was designed primarily with transport in mind. When completed, it will allow transit times to be monitored, allowing advanced warning of road system breakdowns. It will also assist in tracking goods, making intermodal more attractive. (EU Galileo)

It also has ambitious plans for improved roadway, rail, inland waterway and short sea shipping connections between its member countries. This has become a higher priority with the recent and continued expansion of the EU. Efficient transport is needed to bring the benefits of membership to all parts of the continent. Budget constraints have slowed the implementation of these plans, but progress is being made. For example, the map of Ireland in Figure 21 shows sections of completed and under construction railways.

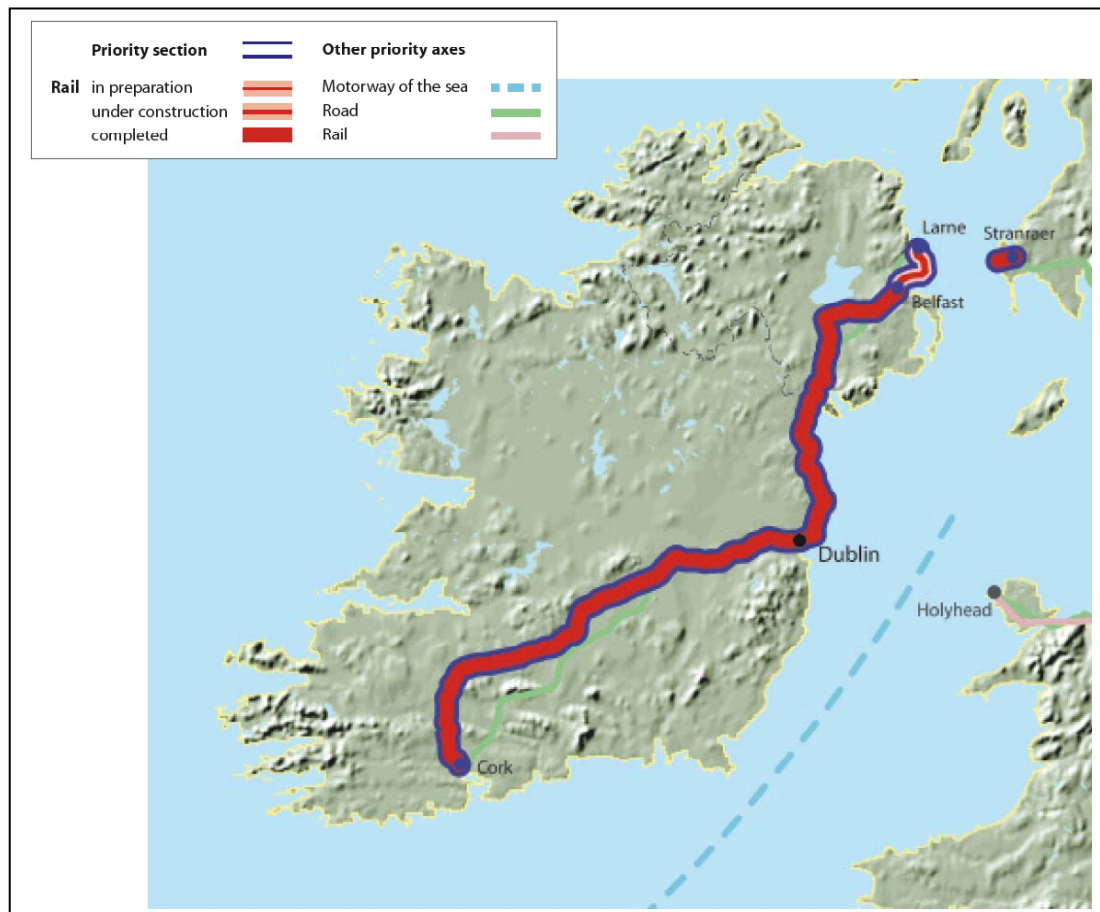


Figure 21. Priority projects in Ireland

Source: Directorate General: Trans-European Transport Network: TEN-T Priority Axes and Projects, 2005

Similar efforts are underway throughout the EU. Roads, waterways and railways are being improved to bring the continent closer together and to improve its productivity and competitive position.

India is another growing economic power that is investing in transportation to stimulate economic activity. Figure 22 outlines the achievements of the country's road building program in recent years. Its accomplishments are significant. Just in the 2004-2005 annual plan, nearly 2,400 kilometers of roadway were widened from two lane to four and nearly 3,000 kilometers of roadway were strengthened.

Physical Targets and Achievements for National Highways During Ninth Plan & Tenth Plan Periods						
S. No.	Activity	Targets/ Achievements	Ninth Plan (1997-2002)	Annual Plan (2002-03)	Annual Plan (2003-04)	Annual Plan (2004-05)
1	Widening to 2-Lanes (km)	Targets	1791	829	701	832
		Achievements	1955	710	671	719
2	Widening to 4-Lanes (km)	Targets	944	582	2245	2944
		Achievements	797	418	799	2386
3	Strengthening weak 2 lane (km)	Targets	3042	1260	3016	3535
		Achievements	3511	1109	1489	2981
4	By-passes (Nos.)	Targets	59	21	20	12
		Achievements	30	12	6	5
5	Construction of Bridges/ROBs/RUBs including rehabilitation of Bridges (Nos)	Targets	633	175	182	232
		Achievements	442	143	123	105

Figure 22. Indian road construction achievements
Source: Indian road statistics

China is another new economic power that is making huge investments in transportation infrastructure. Ports are of great concern to an economy as dependent on trade as the Chinese. According to Robert Kledal, senior vice president and Regional Line manager for Maersk Sealand:

China has done an incredible job of planning for port infrastructure. The central government prioritized port infrastructure construction, and thus avoided the problem of wasteful, overlapping investments. China has also done a great job building ports ahead of time—growth has been 20-25 percent per year for the past 10 years.

Ports are not the only place China is investing in transportation. The US-China Business Council reports that the City of Beijing plans to spend \$11 billion by 2008 to complete a fifth and sixth ring road, refurbish its bus and light rail systems, and build six new subway lines.

The country is also making an effort to move manufacturing inland to provide economic benefit to a larger share of the country. The International Food Policy Research Institute in its Report 138 described the growth in road investment in China:

When the policy reforms began in 1978, the transportation infrastructure in China was poor. With rapid economic growth, the demand for road transport soared, and transportation shortages and congestion problems surfaced as a consequence. Since 1985, the government has given high priority to road development, particularly construction of high-quality roads such as highways connecting major industrial centers in coastal areas. In the 1990s, investment in infrastructure became a national priority and various policies were implemented to promote the rapid construction of highways. The development of expressways has been particularly remarkable, with the total length increasing from 147 kilometers in 1988 to 25,130 kilometers in 2002,

equivalent to an average annual growth rate of 44 percent.

This commitment to transportation is also reflected in the change in the country's total roadway system, as shown in Figure 23.

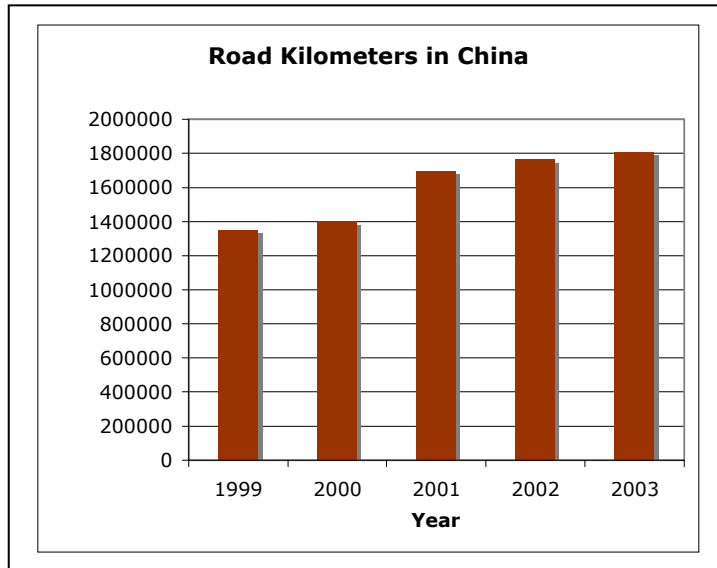


Figure 23. Road kilometers in China
Source: International Road Federation

Roads are not the only place China is investing. Railroads inland waterways and airports are also receiving attention.

To summarize, America's global competitors are making investments in transportation. Figure 10 tells us that investments in transportation increase productivity, thereby improving competitive position. This being the case, the nation must take note of the actions of our competitors and consider steps that will preserve some of the historic advantage that

American commerce has had.

Recommendations

Several steps are suggested by the discussion in this paper. While those recommendations are directed at the states of the Upper Midwest, most are also appropriate for the nation as a whole:

1. Recognize transportation as an investment rather than as a cost. American workers and companies can compete in the global market, but they cannot compete if American governments—federal, state and local—fail to provide the tools needed for effective competition. Transportation is one of those key tools.
2. Think strategically in making transportation investments. All local roads, bypasses, freeways, railroads and ports are not equal. Investments in some will yield much greater benefits to the economy than investments in others.
3. Think beyond jurisdictional boundaries. Freight does not stop at borders. It does little good for one state to have a wonderful transportation system, if the next has bottlenecks.
4. Think multi-modally. To meet the demands for capacity as well as demands for efficiency and environmental protection, the best attributes and the capacity of all modes will have to be employed. Our challenge will be to link them and manage them as an integrated system.

5. Make some tough decisions. American governments spend a lot of money, but increasingly they are buying less of the traditional public goods of which transportation is a prime example. If they are to buy more transportation, they will have to either spend still more money, or they will have to buy less of something else. Both call for tough decisions.

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