



Transportation Infrastructure: paving the way

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Acknowledgement and Use

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Executive Summary

“Successful corporate strategy is becoming more and more tied to the speed of the supply chain and how quickly a company’s goods can be moved from their creation to the customer.”

Michael McBreen, President of Global Operations for Wolverine World Wide, Inc. Former VP of Supply Chain and Logistics at Furniture Brands International, Inc. and Director of Global Supply Chain Operations at Nike. (Carr and Bowman, 2010)

You might say that the 2011 release of the Transportation Performance Index (TPI) comes with some good news and some bad news. First, the bad news – the US continues to fall in the international rankings for global competitiveness, in no small part due to the performance of transportation infrastructure. Transportation infrastructure remains an obstacle to business in the US. In this report, we highlight the efforts that transportation-dependent companies have to make to “work around” the problem. US companies continue to find new and ingenious ways to get the inputs they need for production and to deliver their goods and services to customers around the country and around the world. We highlight a few examples of “Yankee Ingenuity” at its best.

Now the good news – it’s not as bad as it was in 2008. The TPI score for 2009 increased to 56.6, higher than it has been since we began measuring it at 1990. The sudden improvement in 2009 transportation performance stands in sharp contrast to the 5-year moving average trend line we looked at in September. The improvement is at least partly the result of the 2009 American Recovery and Reinvestment Act (“Stimulus Package”). State and local governments contribute about 75 cents of every dollar spent on highways and roads (including bridges, tunnels, ferries, etc.). Many projects received the final dollars needed to kick-off construction and improvements as a result of the Stimulus’ “shovel ready” requirement.

The results of our economic analysis are only strengthened by using the additional observation on the TPI. We see the ongoing result as indicative of a real, sustainable economic impact that comes directly from the ability of businesses to be able to reliably (or not) get access to the resources that they need to produce goods and services and then to deliver their output to the market place.

We begin this working paper with a review of some new studies that are relevant to the subject of the connection between the performance of infrastructure and the economy. Although these newer reports continue to acknowledge the importance of the connection, no other measure of infrastructure performance compares to the TPI. We follow with a discussion of our updated economic analysis. Along the way, we highlight some of the innovative ways that US businesses continue to find their way through transportation obstacles and a few real-life examples of transportation projects that contribute to improved performance. Finally, we discuss some of the possible solutions being put forward in theory and in practice around the world.

According to the American Road & Transportation Builders Association, the stimulus package added more than 97 percent to Maine's regular federal highway funds. By March 2010, there were 72 stimulus-financed highway construction projects underway or completed in Maine.

Atlanta's Oldcastle Materials, part of the U.S. operations of Ireland-based CRH, employs over 18,000 Americans in 44 states. Pike Industries, an Oldcastle Materials company, headquartered in Belmont, New Hampshire, completed Maine's first federal-stimulus-funded project during the summer of 2009.

Pavers, truck drivers, equipment operators, and subcontractors helped reconstruct Interstate 295 northbound, laying 200,000 tons of asphalt to pave 23 miles between Topsham and Gardiner. Interstate 295 constitutes an urban loop from Interstate 95 and the Maine Turnpike through the city of Portland. The freeway serves the central business district and nearby suburbs of South Portland and connects to Interstate 495 near Falmouth. The \$35.3 million paving project began April 1, 2009, with work on a four-mile section of interstate that needed to be completed by June 15. The next phase involved paving 17 miles of closed road. To meet tight deadlines amidst near-record rainfall in June and July, Pike Industries deployed portable asphalt-production and drying equipment. Despite the challenges, the company finished the project three weeks ahead of schedule.

Excerpt from Slaughter (2011).

I. Update: recent studies

Since our initial report on the economic impact of transportation performance, four reports have come to our attention which bear on the subject. McKinsey released a report entitled *Retooling America's Economic Engine* that includes a section on infrastructure. The Organization for International Investment released a report that highlights some best practices that are being implemented in the US by their multi-national membership. The RAND Corporation released a meta-study – a study of other studies – examining what is being measured and analyzed in regard to highways and the US economy. Finally, the Congressional Budget Office submitted testimony on funding to Congress which addressed some issues of performance but clearly summarized the options for action at the federal level. Since the other three reports present recommendations that are more relevant to funding than specific projects to improve performance, we conclude with a brief summary of the CBO's findings.

McKinsey Global Institute (MGI)

The impetus of a recent series of reports from MGI is to focus attention on “how to drive growth and renewal in the United States after the recession.” The February report, *Growth and Renewal in the United States*, examines and explores ways to renew the economy through improvements in productivity. In a brief chapter titled “Build 21st-Century Infrastructure”, the report (Manyika, et.al. 2011) discusses the full range of infrastructure which support economic activity, including “virtual such as broadband connection”. In addition to reporting the World Economic Forum survey results (see below and appendix for our coverage on those rankings), Manyika et. al. suggest some “best practices in infrastructure development from project selection to financing and delivery” plus using “demand management techniques (e.g., congestion pricing)”. Under financing options they discuss the \$1.2 billion P3 Canada Fund and “full market” infrastructure use-pricing that would provide a revenue stream sufficient to attract structured securities investors. A short paragraph on project productivity offers more of a critique of the current process than any specific solutions. The chapter concludes with vague reference to “economist” who “tend to agree” that congestion pricing is a sound idea, with no specific references to where to look for cases of “best practice”. Congestion pricing (i.e., using tolls to pay for building more road capacity; see example in Fields, et. al. (2009)) is not a new idea. There are other innovative ways to look at the problem,

which we discovered (and discuss in the closing section below). In the final analysis this is more a report on funding than fixing. The MGI report is part of a “multiyear and multifaceted effort” to keep McKinsey in the discussion on the broad question of reviving the US economy.

Organization for International Investment (OFII)

In a report commissioned by OFII, Slaughter (2011) highlights some of the “best practices in infrastructure investment and innovation from around the world” that are already being used in the U.S. (See sidebar “Shovel-read in Maine” in this report for one example.) Although focused on the activities of multinational companies with production and service sites in the US, the report highlights many of the same issues we discussed in September 2010 with the initial release of the TPI. With this international focus, Professor Slaughter points out that we are not just struggling to recover from the recent recession and financial crisis. The US needs to build “an economic recovery that also advances America’s global competitiveness.” Best practices highlighted in the OFII report include congestion pricing for roads, plus public-private partnerships to fund, build and operate infrastructure. There are a few specific project ideas (e.g., high speed rail) suggested for improving the performance of transportation infrastructure.

RAND Corporation

Similar to our review of existing studies on the subject, Shatz et. al. (2011) also did not find any US studies that attempted to connect transportation infrastructure *performance* with the economy. As a result, they limited their examination to studies that measured *investment* in infrastructure – in particular, investment in highways (i.e., spending on roads at the federal, state and local level). That puts this RAND report into our collective designation of studies that measured “infrastructure” as “spending”. The RAND study concludes that there needs to be research on the *condition* of infrastructure. Essentially, they recommend further research on performance which is the purpose and product of this US Chamber project (see, especially, Oswald, et. al. 2011).

Most of the other research papers we reviewed and included in the references in our September 2010 report are also in the RAND review. The RAND report has more references for “roads” because they did not include the other pieces of “transportation infrastructure” – the US Chamber’s TPI encompasses roads, transit, waterways (ports), airports, and railroads. The RAND study notes as we did that there is a lack of comprehensive transportation infrastructure research: it’s either just roads or it includes roads with other infrastructure pieces described as “public capital” (i.e., roads lumped in with sewers, schools and parks). Finally, the RAND report concludes by emphasizing the need for research measuring all parts of transportation infrastructure, which is what the US Chamber’s TPI project does. As Shatz et. al. point out a comprehensive examination is needed to get a better picture of the true, long-run economic impact of transportation infrastructure performance. As we wrote in September 2010, the TPI allowed us to do just such an examination.

Congressional Budget Office (CBO)

The CBO published three reports since November 2010 on infrastructure financed by the public sector (Kile 2011). CBO Assistant Director Kile testified in May before the Senate Finance Committee on how the US raises money for highways, how the federal government should direct the use of that

Logistics Depend on Infrastructure

Predictable logistics are important to efficient trade. Globally, logistics costs have fallen from about 20 percent of GDP in the early 1980s to less than 10 percent. However, delays and unpredictability greatly outweigh direct transportation costs (Arvis, 2010). Delays are mostly related to the performance of road, rail and port – not border crossings, the price of fuel, service pricing etc.. The lack of intermodal-connectivity and variable transit times does more than cause delays and raise costs. They also hamper the ability of firms to compete. Longer delays in transit mean having to hold higher inventories (e.g., to avoid shortages of inputs) – bearing the higher risk associated with warehousing and tying up capital for longer periods of time.

Exports are an important element in the economic recovery. Rising exports accounted for half of US economic growth in 2010, the largest share since 1946. Farm exports in the US reached an all-time high of \$75 billion in the first half of fiscal 2011 – March was the highest grossing-month ever for US agricultural exports (Omaha World-Herald, June 20, 2011, p 6B(c1)).

US Exports to China grew 10 percent to 30 percent – faster than GDP – every year from 2000 through 2008. The largest categories of US exports to China are electronics, power generation equipment, agricultural products and aircraft. The top 5 states exporting to China in 2008 were California, Washington, Texas, Louisiana and New York. (Carr and Bowman, 2010).

money and how much should be spent on highways. According to CBO, the Highway Trust Fund will run out of money next year. Kile presented the Senators with a clear cut review of the options available under each part of the problem.

The CBO reports that outlays for mass transit (under the Highway Trust Fund) will exceed revenues and interest by \$2.5 billion this year and that the account will run out of money in 2013. As the Highway Trust Fund runs out of money, the states – cash-strapped and already bearing 75 percent of the cost of highways – would receive fewer and slower allocations.

The CBO concludes the section on how much should be spent by laying out the options for Congress' difficult decision. In addition to spending/revenue choices, they suggest a cost/benefit analysis prior to project funding and – as did all the other studies we reviewed in this section – “imposing congestion pricing during periods of peak demand.” As to directing the use of funds, CBO discusses the current processes. They report that proposals for new mechanisms are unlikely to make a difference. For example, an “infrastructure bank” would not make a significant impact because most transportation projects do not generate revenues (like tolls) so they have no source of income to repay loans to the bank. The same problem arises when attempting to use public-private partnerships to solve the funding problem. Existing solutions such as having the states assume some of the risks for revenue shortfalls have an end result that is in line with existing financing methods. Finally, regarding the source of funding for transportation infrastructure, the CBO reports that 90 percent of all funding comes from user fees (e.g., 44 percent from vehicle and fuel taxes, 5 percent from tolls, 4 percent from property taxes, etc.). Only 21 percent comes from general fund appropriations from government at any level. Furthermore, users pay 77 percent of the debt service on bond issues, which account for 10 percent of all spending. Passenger vehicles, both urban and rural, accounted for 92 percent of all vehicle-miles traveled in 2008.

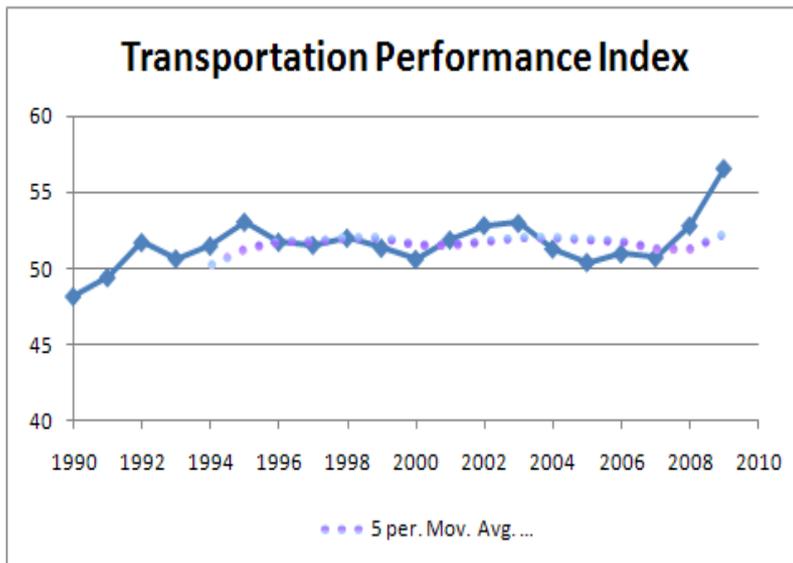
In closing CBO discussed several ways to fund infrastructure improvements and identified two arguments to support the use of increased income taxes: the cost of additional collections is negligible and small changes in tax rates could result in large collections. The primary deterrent, however, would be problems of economic efficiency – theoretical “reductions in work and saving, shifting of income from taxable to nontaxable forms, and shifting of spending from ordinary to tax-deductible goods and

services” might thwart the effort. In our view, congestion pricing could also create problems in the future. As congestion pricing drives down the amount of traffic, it will also reduce the available revenues for future maintenance.

Three days after Kile’s testimony, *This Week in Washington* reported (May 20, 2011, p1-1) that the:

U.S. Senate Finance Committee conducted a hearing on financing a 21st-century infrastructure. During the hearing Senator John Kerry (D-MA) showed his frustration with the Congressional process, stating that the nation is in a "crazy place right now" and complained that "we no longer have the will to build anything." On the other hand, Ranking Member Orrin Hatch questioned transit's share of shrinking Highway Trust Fund revenues, yet also criticized talk of raising taxes to pay for increased infrastructure investment.

II. Our Model: stronger results



With the inclusion of an additional observation on the performance of transportation infrastructure, the results of our economic model (US Chamber 2010) are only strengthened. A comparison of the statistical results is available in the Appendix. Our original finding of about a 0.3 improvement in the economy for incremental improvements in the performance of transportation infrastructure represents real, sustainable progress toward American prosperity. Our finding is different from studies on how infrastructure spending creates jobs in the construction industry or any of a multitude of cost/benefit studies in use today. By controlling for the primary factors known to impact economic development, we are able to segregate a change in the economy that is most likely attributable to the performance of transportation infrastructure.

The World Economic Forum’s Global Competitiveness Index (GCI), created by Sala-i-Martin upon whose primary economic development research our own model is based, shows the US falling

The United States has long been a source of innovations used around the world:

“The Colt revolver, the McCormick reaper, the Singer sewing machine, and the typewriter were among the labor-saving devices which poured forth from Yankee ingenuity. They quickly led to manufactured exports and subsequently to subsidiary factories abroad. The roots of the multinational corporation in manufacturing, usually thought of as a product of the jet aircraft and transatlantic telephone 100 years later, stretch back virtually to the middle of the nineteenth century. The Colt revolver and the McCormick reaper scored successes at the Crystal Palace Exhibition of 1851 and the Paris Exposition of 1855.”
(Kindleberger, 1977)

“The concept is interesting and well-formed, but in order to earn better than a ‘C,’ the idea must be feasible.” – A Yale University professor in response to Fred Smith’s (founder of Federal Express) paper proposing reliable overnight delivery service. (Professor Sala-i-Martin at www.columbia.edu/~xs23/reject.htm)

Global producers increasingly turn to technology to work-around transportation problems. One supplier of technology is JDA of Arizona. JDA named gave PepsiCo their Best in Transportation & Logistics Management Real Results for 2011: “PepsiCo uses JDA solutions to plan and manage over 3 million shipments annually in the U.S. and Canada. ... PepsiCo can integrate its rolling assets, predict and manage transportation issues, track-and-trace shipments ...”. JDA software is used by companies in sixty countries. (www.jda.com)

further behind. Our model incorporates some basic requirement “pillars of competitiveness” (Sala-i-Martin et. al. 2011) which form the foundation of the GCI. Some of the pillars which keep the US in the top-10 overall competitive economies – innovation, market size, and labor market efficiency – are not part of our study using the TPI. The GCI indicates that the US also has competitive advantages in higher education and business sophistication. US businesses stay competitive by working around transportation problems.

The Logistics Performance Index, issued bi-annually by the World Bank (Arvis, et. al., 2010) shows the US ranked 15th based on 2009 surveys, down one position from 2007. An examination of the data for the US and our nearest competitor, Canada, emphasizes the inefficiencies in our land transportation. A Canadian exporter typically moves their goods for export 766 kilometers, versus a substantially shorter distance for US exporters of only 484 kilometers. The difference in total cost is about 10 percent (\$1,249 per container in the US versus \$1,123 in Canada). The big difference is that US producers need more than 2 extra days to cover nearly half the distance. When exporting through ports and airports, US producers are able to cover 50 percent more distance in about the same amount of time as Canadian firms, but at a cost that is almost 60 percent higher (even with similar security measures in place). These inefficiencies put a burden on US companies that their global competitors do not face.

IV. Real Companies, Real Costs

Not all the news is bad as reflected in the improved TPI. IMD World Competitiveness Scoreboard ranked USA first this year, as Singapore dropped to third. For Basic Infrastructure, the USA was ranked 11th in 2010 and 9th in 2011. Recognizing the multi-faceted nature of competitiveness (Garelli 2011), IMD highlights two factors in the press release this year: Government Efficiency and Business Efficiency. On the question of efficiency, IMD writes: “The overall competitiveness of the US is ‘rescued’ by its business efficiency.” Hong Kong, with whom the US shares the #1 ranking in competitiveness, ranks first in both business and government efficiency.

Despite some improvement between 2008 and 2009, the WEF Executive Survey recorded a continuing decline through 2011 in US road and railroad infrastructure (see tables in appendix). Eventually

Washington: Adding Capacity Strategically

In October 2009 Washington State Department of Transportation (WSDOT) completed a widening project on I-405 South between Tukwila and Bellevue. This project added a general purpose lane on both the north- and south-bound directions plus a southbound high-occupancy-vehicle lane to relieve commute congestion. The result was a 16-minute improvement in travel time despite a 16% increase in vehicle miles travelled (vmt) during the morning northbound commute and a five-minute improvement with a 3% increase in vmt during the evening southbound commute. Before the new southbound lanes were opened, traffic volume built through the morning and midday, reaching 3,500 vehicles per hour (vph) by about 2:00 pm, when congestion began to increase. Volume only dropped to about 3,000 vph, between 6:00 pm and 7:00 pm, with less congestion but continuing high demand. After the new lanes were opened, volume during the afternoon peak period continued to increase, and now exceeds 4,000 vph around 4:00 pm – an important increase in throughput combined with reduced congestion.

Similarly, a series of projects on I-405 between I-5 and SR 169 have also reduced congestion and improved throughput. Before and After results will be published in the August 2011 edition of WSDOT's annual Congestion Report.

(WA State Department of Transportation, 2010)

business has to go where it can perform and that means getting inputs to the place of production and getting goods and services to market.

In economics we talk about the efficient use of resources – getting the most out of the inputs you have to work with. In a new piece of research being undertaken at the University of Delaware, early results indicate that businesses are operating successfully in some states (e.g., California and Washington, D.C.) despite being hampered by congestion and lack of intermodal-connectivity. In this sense, the US may, in fact, be a benchmark for economic efficiency when it comes to transportation infrastructure.

We agree with IMD: American businesses are relying on improvisation for economic success. There are a wide range of views about what constitutes a direct or an indirect cost to business from traffic congestion. There are as many ways to measure the costs as there are different costs to be measured (CIE 2006). Some things that add up on the national level are undeniable: the cost of computer/satellite technology for monitoring congestion; the staffing costs for communicating with drivers about alternate routes; the cost of extra fuel for having to wait in traffic or drive around obstructions and congestion; driver overtime resulting from congestion; refunds to customers for missing guaranteed delivery deadlines, etc. etc. Companies like FedEx Freight use elaborate technology to “route trucks around huge bottlenecks, but this adds circuitous miles and costs” (Doug Duncan, retired CEO, Heavy Duty Trucking magazine, July 22, 2010).

III. Real Projects, Real Improvements

Not all the news is bad. The WEF Executive Survey recorded no decline or a slight improvement in US road and railroad infrastructure between 2008 and 2009 (see tables in appendix). In 2009 the American Recovery and Reinvestment Act expanded federal infrastructure investment. States and cities around the country moved quickly to put their “shovel-ready” projects on the table for funding. The Stimulus was widely criticized for putting pressure on the federal budget and, in some cases, for not producing the promised reduction in unemployment. But we believe the problem was in the promise and not in the execution. The promise was to create enough jobs to build our way out of the recession and to rush employment recovery – notoriously slow to



The first Diverging Diamond Interchange (DDI) in the nation opened to traffic on June 21, 2009, in Springfield, Missouri, the birthplace of historic US Route 66. The interchange in Springfield where the Kansas Expressway (MO-13) passes over I-44 is a huge success. At peak hours of the day, southbound traffic on MO-13 would back up to one mile and, at times, up to two miles during major traffic generating events. Now, the same traffic moves through the interchange within a matter of minutes. The interchange has been the subject of multiple news and journal articles and was chosen as one of the best new engineering innovations of 2009 by Popular Science magazine.



(Missouri Department of Transportation, 2010)

pick up after economic recessions (“jobless recovery”). We believe that the stimulus spending had direct impacts on the performance of transportation infrastructure. In the sidebars, we highlight a few of the specific projects – largely made possible through the use of that last 25 percent contribution of federal funding – that directly impacted indicators of performance we consider important.

Much of the improvement in the TPI may be attributed, in the final analysis, to the decline in economic activity in 2009. But that begs a question: If we can improve the performance of transportation infrastructure by stopping economic growth, is that progress? Of course, the answer is “no”. Stopping economic growth is not progress; it is not a solution to the problem of poor performing transportation infrastructure in America. Likewise, although raising gasoline prices to \$11 per gallon might solve the funding issue (Appleby 2009) it would have other consequences for economic activity.

In the economic analysis for the initial release of the TPI, we found that transportation infrastructure is a “leading indicator” of economic activity. In other words, infrastructure performance has to improve for a while – and stay improved – before economic activity will expand. Alternatively, infrastructure performance would have to decline for a while before businesses would leave, too. Think about it this way. From the perspective of a company already in business in a particular location, they would not pack up and leave town the day that, for example, traffic congestion slows down the delivery of products to their customers. For a while, they will find a way around congestion. Companies that depend on transportation infrastructure for their own performance plan logistic locations 20 years in advance – our model only uses a 3 year gap between change in performance and change in economy. According to our model, the improvement in the TPI for 2009 won’t fully be reflected in improvements in GDP per capita until 2012.

The point is that a one or two year improvement in performance won’t last without sustained effort. We will need to get out of our own way if we don’t want this to fall back again when the economy rebounds in 2012. Measuring the benefit of infrastructure by jobs created and the tax base is the old way. It could be 20 years from construction to full economic impact. Economic output, whether gross domestic product (GDP) or gross metropolitan product (GMP), is the end result not the impetus.

Businesses will leave town before you see the drop in GMP. By the time you see a drop, that company has already tried everything – every workaround – to do businesses in your community. When GDP drops, it's already too late.

V. Paving the Way Forward

The strategy applied by the US Chamber of Commerce for the infrastructure performance index project presents a model for developing the way forward. A stakeholder-centric approach allows you to measure the right things, communicate to the people in a language they understand and get to ACTION faster. The process, detailed in the Technical Report last summer (US Chamber 2010), is basically this:

1. Clearly define “transportation infrastructure” as the underlying structures that support the delivery of inputs to places of production, goods and services to customers, and customers to marketplaces. The structures are:

- Transit
- Highways
- Airports
- Railways
- Waterways (Ports)
- Intermodal Links

2. Clearly define “performance” as “the degree to which the infrastructure system serves U.S. economic and multi-level business community objectives.”

3. Based on input from the people (as labor and as consumers) and the businesses that use transportation infrastructure, define the broad criteria of performance as supply, quality of service and utilization (capacity to grow), as well as efficiency (getting from A to B without having to pass through C).

The first two steps can be completed by experts in the field, specialists, government entities, etc. But the last step is critical to successful planning for transportation performance and it is at this point that many DOTs and MTAs begin to fail in their improvement goals. They are not in the business of building roads or running transit railcars; that is a false starting point from which to attempt to implement the metrics and planning strategies that have been successfully applied in corporations. The product of DOTs and MTAs is to deliver inputs and labor to the place of production; to deliver goods and services to customers; and to bring customers to the retail marketplace. The entities that install and manage transportation infrastructure play a critical role in the economic process but they are not the economic purpose.

The “customer-centric” concept is one “best-practice” that the US needs to implement quickly. The TPI is designed with involvement from “the customer” – i.e., the users of transportation infrastructure – throughout the process. From the beginning definition of “performance” to the

technical calculations based on data, the TPI process designed by the US Chamber got answers from users about what they want transportation infrastructure to do and it incorporates user answers for what they think is most important into the data weights. The TPI doesn't measure how many roads and airports we have in the US, but how well they provide the structures necessary to support the activities of a prospering economy.

VI. More to Come

Despite some gains in transportation performance, the US will continue to fall in the world rankings for basic infrastructure. Energy and water are also in the backbone of American infrastructure. The US Chamber project will address these additional components later in the year.

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APPENDIX: Selected statistics on TPI, infrastructure and economy

Regression Results for Transportation Performance Index_{t-3} and US economy

	2010	2011
Index _{t-3}	0.0037	0.0042
Real GDP	0.6120	0.6189
Federal debt	-0.0025	-0.0017

US economy measured as GDP per capita is the dependent variable in all regressions. All coefficients significant at 99 percent level; all regressions significant at 99 percent level (F-statistic). Coefficients estimated with robust standard errors using Intercooled STATA 7.0 with 16 observations for 2010 and 17 observations for 2011.

World Competitiveness Yearbook Ranking for U.S. Basic Infrastructure

Year	U.S. Rank
2011	9
2010	11
2009	4
2008	2
2007	2
2006	2
2005	1
2004	1
2003	2
2002	2
2001	1
2000	15
1999	2
1998	1
1997	1

Source: IMD World Competitiveness Yearbook www.imd.org/wcy (IMD 2011).

World Economic Forum Global Competitiveness Index

WEF Basic Competitiveness Requirements rank based on Index scores

	2011	2010	2009	2008
Basic Requirements:	32	28	22	23
Institutions	40	34	29	33
Infrastructure*	15	8	7	6
Macroeconomic stability	87	93	66	25
Health and primary education	42	36	34	34
Overall Competitiveness	4	2	1	1

WEF Infrastructure rank based on Executive Opinion Survey

	2011	2010	2009	2008
Infrastructure quality overall*:	23	14	9	9
Roads	19	11	8	8
Railroad Infrastructure	18	17	11	14
Port Infrastructure	22	13	16	11
Air Transport Infrastructure	32	20	12	9
Airline seat kilometers**	1	1	1	1

Source: Schwab (ed., 2011).

NOTES: Executives are surveyed about their own country, i.e., these ranks are based on scores assigned by US executives to US infrastructure. The sample size in the US was 437 executives (the average sample size was 98); 45% of US respondents were from firms with 500 or fewer employees. WEF uses Partner Institutes to administer the survey in each country. There are no Partner Institutes in the US.

*Infrastructure and overall rankings include energy and telephony in addition to transportation.

** Available airline seat kilometers enters the infrastructure ranking but is measured with hard data. It is the number of seats available on each flight originating in the US multiplied by the distance of the flight (in kilometers) measured as the average capacity for one week in January plus one week in July. The US consistently ranks #1 due to its relative size. In 2010, the US had 31,076 available airline seat kilometers per week; #2 China had 9,126 and #3 United Kingdom had 6,067.

World Bank Logistics Performance Index

EXPORTS	Factory to FOB (port/airport)			Factory to Buyer (land)		
	Distance	Time	Freight Cost	Distance	Time	Freight Cost
Canada (#14)	291.9	2.8	\$ 731	766.0	2.6	\$ 1,123
Germany (#1)	972.2	3.6	\$ 612	407.2	1.4	\$ 354
Mexico (#50)	578.0	2.1	\$ 1,314	890.9	2.5	\$ 1,817
Singapore (#2)	224.1	2.2	\$ 422	119.1	2.4	\$ 298
United Kingdom (#8)	—	—	—	1040.0	3.7	\$ 1,225
United States (#15)	434.1	2.8	\$ 1,145	483.8	4.8	\$ 1,249

Source: Arvis et. al. (2010).

Distance (km), Lead time (days), Cost (US\$).

Factory to FOB is from the point of origin (the seller's factory, typically located either in the capital city or in the largest commercial center) to the port of loading or equivalent (for port/airport), and excluding international shipping (EXW to FOB).

Factory to Buyer is from the point of origin (the seller's factory, typically located either in the capital city or in the largest commercial center) to the buyer's warehouse (EXW to DDP).

Cost is the typical charge for a 40-foot dry container or a semi-trailer (total freight including agent fees, port, airport, and other charges).