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JERRY FRUIN

Compendium of Agricultural and Rural Transportation Publications, 2004-2006

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Introduction

One of the problems of the Agriculture and Rural Chapter of the TRF is a lack of geographic concentration. As a result, the only practical opportunity for face-to-face interaction is the annual meeting. However, since less than half of the chapter membership attends the TRF annual meeting in any given year, it is easy to get out of touch with the work of colleagues. In the middle 1990s, Michael W. Babcock and Ken Eriksen edited a research compendium that summarized the publications of TRF members who were doing research in rural and/or agricultural transportation. The time is overdue to renew this effort. The Research Compendium will enable TRF members to become familiar with the recent work of their colleagues, will unify TRF members interested in rural and agricultural transportation, and will help with recruiting new people to TRF.

The compendium contains summaries of rural and agricultural transportation publications of researchers working in this area. While not a comprehensive listing of all rural and agricultural transportation research conducted in the 2004-2006 period, the compendium contains nearly 125 publications primarily conducted by members of the Agricultural Chapter of TRF. The summaries of publications are mainly from the 2004-2006 period. However, there are a few publications from 2002 and 2003 as well as some from 2007.

Most of the publications in the compendium have more than one author. To avoid duplication, jointly authored work is listed by first author, although this rule was occasionally violated for various reasons. Affiliations and e-mail addresses are published for each primary author.

Tom Jirik of North Dakota State University and Kristi Hageman of Kansas State University provided valuable editorial assistance to the editors.

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Energy Use and Pollutant Emissions Impacts of Shortline Railroad Abandonment

BACKGROUND—MOTIVATION

Despite the important role of railroads in the U.S. transportation system, railroad mileage has been declining. Class I railroad mileage of the top 10 states in rail miles plunged 31.7% between 1975 and 2004. Total U.S. rail mileage of all classes of railroads fell 23% between 1987 and 2004. Railroad abandonment has potential negative effects, especially in rural areas that rely on railroads for outbound shipments of goods and inbound shipments of raw materials and other inputs. Among the potential negative effects are the following:

1. Higher transportation costs for railroad shippers.
2. Reduction of market options for rural shippers.
3. Lost economic development opportunities.
4. Loss of local tax base to fund basic government services.
5. Increased road damage costs.

OBJECTIVES

The principal objective of the paper was to develop a methodology to measure the impact on energy use and emissions resulting from potential abandonment of shortline railroads. The Kansas wheat market was used to empirically implement the methodology. Specific objectives included the following:

1. Develop a model that can measure wheat transportation ton-mile shifts resulting from hypothetical shortline railroad abandonment.
2. Measure modal energy use changes attributable to hypothetical shortline railroad abandonment.
3. Measure the modal emissions changes related to potential shortline abandonment.

FINDINGS

The study measures the changes described above between two scenarios—no abandonment of Kansas shortlines and complete abandonment. Combined truck-shortline ton-miles are 29% lower in the abandonment case. However, since Class I railroads are the dominant mode in the export wheat logistics system, and Class I ton-miles are unaffected by simulated shortline abandonment, total ton-miles are only 2% higher in the abandonment case.

Since energy consumption is directly proportional to ton-miles, the modal percentage changes for energy consumption are identical to the percentage changes in ton-miles. Due to the dominance of Class I railroads in the export wheat logistics system, combined with the same Class I energy consumption in both scenarios, the difference in total energy consumption in the two cases is small, 2.1% higher in the abandonment case.

Percentage changes in total emissions are relatively small for all emission types. Grand total emissions are 1.4% lower in the shortline abandonment case.

Source: Michael W. Babcock and James L. Bunch. "Energy Use and Pollutant Emissions Impacts of Shortline Railroad Abandonment." W. K. Talley and S.M. Dennis eds. Railroad Economics. London: Elsevier (2007): 225-257.

Should Shortline Railroads Upgrade Their Systems to Handle Heavy Axle Load Cars?

BACKGROUND—MOTIVATION

Motivated by lower cost per ton-mile, U.S. Class I railroads have been replacing 263,000-pound gross vehicle weight (GVW) covered hopper cars (primarily used to haul grain) capable of handling 100 tons with 286,000-pound GVW cars that can handle 111 tons. Since the quality of track on shortline railroads is less than that of Class I railroads, it is likely that increasing use of heavy axle load (HAL) cars will have a greater impact on shortlines. If light density rail lines are not upgraded to handle HAL cars, the percentage of the grain car fleet that can move on shortlines will decline, threatening the long-term viability of these railroads. If shortline railroads are abandoned, it could have negative consequences for U.S. rural communities.

OBJECTIVES

The purpose of the paper is to determine if shortline owners will likely upgrade their infrastructure or abandon the railroad. Specific objectives are to document the shift from 263,000-pound rail cars to 286,000-pound cars by Class I railroads, and to measure the number of route miles and bridges that will require upgrading to handle HAL cars (for a sample of Kansas shortlines). Other objectives include estimation of which branchlines are likely to be upgraded or abandoned using rate of return on investment analysis. Another objective is to measure the road damage to highways if shortlines (or parts of shortlines) are abandoned.

FINDINGS

The study found that none of the sample shortlines can earn an adequate rate of return on upgrading track and bridge investment with their current traffic densities and other characteristics. The cost to upgrade 1,583 miles of track and 1,352 bridges of five Kansas shortlines was $308.7 million. The study found that shortline external benefits are substantial since Kansas shortlines generate a minimum of $58 million a year in avoided road damage costs, justifying government financial assistance for upgrading.

Source: Babcock, Michael W. and James Sanderson. "Should Shortline Railroads Upgrade Their Systems to Handle Heavy Axle Load Cars?" Transportation Research Part E, The Logistics and Transportation Review 42(3), (2006): 149-166.

County-Level Impacts of Rail Line Abandonments: A Kansas Case Study

BACKGROUND—MOTIVATION

Despite the large quantities of freight being moved over the U.S. rail system, total rail mileage has been declining due to abandonment of lines. From 1975 to 2003, the top 10 states in track mileage lost 31.5% of their total track miles to abandonments. Because of the importance of the rail transportation system, abandonments represent a potentially significant problem for all these states and the U.S. economy.

OBJECTIVES

One of the objectives of this paper was to present the economic theory that explains how rail line abandonments affect local communities. Another objective was to develop a model that can be used to estimate the abandonment related effects. These effects included the county growth rates of real personal income, real transfer payments, real wages and salaries and full- and part-time employment. An econometric panel data model was developed to estimate the county-level effects, and the model was applied to rural, urban, and metropolitan counties in Kansas.

FINDINGS

Only a few statistically significant abandonment-related variables were found, and any adverse effects appear to be minimal. On the other hand, coefficients for non-abandonment-related variables often had the signs and magnitudes that were expected. Population growth had the strongest effects on the four economic measures at the county level followed by regional product growth.

The study found that abandonments are initially followed by net positive growth, some of which is temporary for some counties, and may suggest that adverse impacts appear with a time lag of a number of years.

Source: James Sanderson and Michael W. Babcock. "County-Level Impacts of Rail Line Abandonments: A Kansas Case Study." Journal of the Transportation Research Forum 44(3), (2005): 93-112.

The Impact of Jumbo Covered Hopper Cars on Kansas Shortline Railroads

BACKGROUND—MOTIVATION

Class I railroads have been replacing 263,000-pound (loaded weight) covered hopper cars capable of handling 100 tons of grain with 286,000-pound cars that can handle 111 tons. The motivation for the switch in car size is decreased rail cost per ton-mile. Using larger railcars results in a reduction in Class I railroad car and locomotive ownership costs, labor costs, fuel costs, car and locomotive maintenance costs, as well as an increase in rail system capacity.

Since the quality of track on Kansas shortlines is generally less than that of Class I railroads, it is likely that increased usage of the 286,000-pound car will have a greater impact on shortlines. Since shortlines account for 44% of the Kansas rail system, the impact of the 286,000-pound car on these railroads has great implications for the future of rail freight transport in Kansas. If universal adoption of the 286,000-pound car leads to abandonment of Kansas shortline railroads, it could have several negative consequences for rural Kansas communities including:

- Lower grain prices received by farmers
- Higher transportation costs and lower profits for rail shippers
- Reduction of market options for rural shippers
- Lost economic development opportunities for rural communities
- Loss of local tax base to fund basic government services
- Increased road damage costs on county roads and state highways

OBJECTIVES

Objective 1 – Document the shift from the 263,000-pound railcar to the 286,000-pound car by Class I railroads.

Objective 2 – For each Kansas shortline railroad, measure the number of route miles, sidings and yards, and bridges that will require upgrading and rehabilitation to handle the 286,000-pound car.

Objective 3 – Estimate which branchlines are likely to be upgraded and which will likely be abandoned based on rate of return on investment analysis.

Objective 4 – Measure the track upgrading cost per mile of mainline track, yards and sidings, and the cost of bridge rehabilitation.

Objective 5 – Measure the road damage cost to county roads and state highways if upgrading to handle the 286,000-pound railcar does not occur and shortlines (or parts of shortlines) are abandoned.

FINDINGS

According to representatives of the Kansas shortlines, about 70% of the total mainline route miles will need to be upgraded to handle the larger cars. They also stated that 86% of the bridges on shortlines would have to be upgraded to handle the heavy axle-load (HAL) cars. The representatives of the five Kansas shortlines in the study estimated that the combined total cost to upgrade mainline track and bridges was $309 million.

The majority opinion of the representatives of the five Kansas shortlines was that increased use of HAL cars would increase their operating and maintenance costs and not increase their operating revenue. The internal rate of return to upgrading is negative for all the Kansas shortlines when their actual average traffic and other characteristics are assumed. The study concluded that if the five Kansas shortlines conclude that the rate of return to upgrading doesn't justify the investment, and subsequently abandon the railroads, Kansas' annual road damage costs will rise by over $58 million.

Source: Michael W. Babcock and James Sanderson. "The Impact of Jumbo Covered Hopper Cars on Kansas Shortline Railroads." Topeka, Kansas, Kansas Department of Transportation, 2004.

Case Studies of the Economic Impact of Highway Bypasses in Kansas

BACKGROUND—MOTIVATION

The construction of highway bypasses has resulted in many economic benefits both for intercity motorists as well as residents of towns with bypasses. Despite the benefits of bypasses, they remain controversial. Local business owners in the town being bypassed fear that the reduction of traffic passing through the town will adversely affect their sales.

OBJECTIVES

The purpose of the study was to add to the literature concerning the economic impact of highway bypasses on small rural towns. The measured impacts are (1) total employment of bypass towns, (2) retail sales of the towns' travel-related businesses, (3) employment of the towns' travel-related businesses, and (4) the bypass town as a whole.

FINDINGS

The statistical results of the study are consistent with the conclusion that the bypasses did not have a statistically significant effect, either positive or negative, on total employment in the bypass towns. Most of the representatives of travel-related businesses in the bypass towns were interviewed regarding the impact of the bypass on the company's retail sales, employment, and on the town as a whole. Most of the representatives perceived that the bypasses had a negative effect on the retail sales and employment of travel-related businesses in the nine sample bypass towns. About three-fourths (76%) of the firm representatives thought their retail sales would have been higher if the bypass had never opened. About half the business owners and managers thought their company's employment would have been higher in the absence of the bypass. A large majority (67%) of the firm representatives thought the bypass had a negative effect on the town as a whole.

Source: Babcock, Michael W. and Jose A. Davalos. "Case Studies of the Economic Impact of Highway Bypasses in Kansas." Journal of the Transportation Research Forum 43(1), (2004): 55-75.

Approximation of the Economic Impacts of the Kansas Comprehensive Transportation Program

BACKGROUND—MOTIVATION

Michael W. Babcock conducted two economic impact studies of the Kansas Comprehensive Highway Program (CHP) in the 1990s. The first study examined economic impacts of CHP K-jurisdiction contracts (intercity highways) between July 1, 1991, and May 19, 1994. The second study measured economic impacts of $2.86 billion spent on K-jurisdiction CHP highway projects between July 1, 1989, and June 30, 1997.

In 1999, the Kansas Legislature approved a 10-year transportation program that contains billions of dollars for Kansas road and bridge projects. It is important and appropriate to measure the construction economic impacts of the Kansas road and bridge program to facilitate an evaluation of the state's investment in highways, and the implied cost if highway expenditures are reduced.

OBJECTIVES

Given the need for measuring the construction impacts of the Kansas Comprehensive Transportation Program (CTP), the objectives of the study are:

1. Approximate direct output, income, and employment impacts by highway improvement type for CTP projects let between July 1, 1999, and October 31, 2004.
2. Approximate indirect and induced output, income, and employment impacts by highway improvement type for CTP projects let between July 1, 1999, and October 31, 2004.

The output impact is the increase in Kansas production as a result of the expenditure for CTP highway and bridge construction projects. The income impact is the increase in Kansas wages and salaries in response to an increase in the income of workers employed on CTP road and bridge construction projects. The employment impact is the gain in Kansas employment attributable to CTP highway and bridge construction projects.

The direct impact is the CTP program induced output, income, and employment within the highway construction industry itself, while the indirect impact is the CTP induced output, income, and employment of the industries that supply the construction industry with goods, services, and materials. The induced impact is the additional output, income, and employment in various consumer markets produced by the increased consumer spending of people employed on CTP construction projects.

The objectives were accomplished by utilizing the output, income, and employment multipliers from the 1997 study referred to above.

FINDINGS

The approximated economic impacts of the CTP during the analysis period are as follows:

1. The output impact is $7.1 billion (2.6 times the value of the highway contracts).
2. The income impact is $1.4 billion (2.4 times greater than direct wages and salaries).
3. The employment impact is 114,635 jobs (41 jobs per $1 million of highway contract value).

Source: Babcock, Michael W. "Approximation of the Economic Impacts of the Kansas Comprehensive Transportation Program." Topeka, Kansas, Kansas Department of Transportation, December 2004.

Case Studies of the Economic Impact of Highway Bypasses in Kansas

BACKGROUND—MOTIVATION

The construction of highway bypasses in Kansas has resulted in important economic benefits. Perhaps the most significant benefit is the travel time savings of through motorists who avoid the slower speeds, stops, and congestion associated with driving through central business districts. Highway bypasses also result in benefits for residents of towns with bypasses. For example, by diverting trucks and other through traffic away from downtown, traffic congestion and noise is reduced. Also traffic safety is enhanced due to reduced pedestrian-vehicle conflicts, and the local population is less exposed to health-threatening vehicle emissions and hazardous materials. In addition, highway bypasses enable local motorists to realize travel time savings when driving from one end of the town to the other.

Despite the benefits of highway bypasses, they remain controversial. Some local business owners in the town being bypassed may be concerned that the reduction of traffic passing through the town will adversely affect their sales. In addition, when a bypass or new highway alignment is constructed, the old alignment is refurbished (if needed) by the state and then given back to the local unit of government (city and/or county) which contains the old route. The added expenditure for the local government of an additional road may result in a reduction of maintenance on other city/county roads. Case studies of the economic impacts of highway bypasses on individual towns are needed since the effects of bypasses may vary a great deal from place to place.

OBJECTIVES

The objectives of the research were as follows:

1. Assess the impact of the bypass on the town's total employment.
2. Measure the impact of the bypass on retail sales of the town's travel-related businesses.
3. Measure the impact of the bypass on employment of the town's travel-related businesses.
4. Measure the impact of the bypass on labor costs per employee of the town's travel-related businesses.
5. Assess the incremental impact on the county's road maintenance expenditures of assuming maintenance responsibility for the previous road alignment.

FINDINGS

The study concluded that the bypasses did not have a statistically significant effect on total employment in eight of the nine Kansas sample bypass towns. A majority (76%) of the representatives of the sample of 54 travel-related businesses thought that sales of their company would have been higher if the bypass had never been built. Nearly half (49%) of the business owners and managers thought that employment in their company would have been higher in the absence of the bypass. A large majority (77%) of the firm representatives thought that the bypass had no effect on labor cost per employee. Two-thirds (67%) of the representatives of the travel-related businesses thought the bypass had a negative effect on the town as a whole. Finally, total road and bridge maintenance expenditures in the sample Kansas counties increased an average of 2.3% per year over the five-year period of the study.

Source: Michael W. Babcock and Jose A. Davalos. "Case Studies of the Economic Impact of Highway Bypasses in Kansas." Topeka, KS: Kansas Department of Transportation, 2004.

Doug Benson, North Dakota State University (UGPTI), doug.benson@ndsu.edu

The Importance of Short Line Railroads to Rural and Agricultural America

BACKGROUND—MOTIVATION

While the cost savings and service improvements of short line operations over Class I operations on light-density lines have been well documented, the nationwide importance of short lines, particularly for rural and agricultural communities, has not been quantified. In fact, simple statistics, such as the proportion of all carloads or tons originated that are accounted for by short lines, the number of customers that depend on short line railroads for rail service, and the role played by short lines in enhancing intramodal and intermodal competition were not compiled prior to the previous version of this study.

OBJECTIVES

The study: (1) attempts to quantify the importance of local and regional railroads to the U.S. rural and agricultural economy, (2) examines factors affecting short line viability and future prospects for a viable short line network in the future, and (3) reviews policies aimed at enhancing the future viability of the short line railroad industry.

FINDINGS

This report validates the importance of short line railroads in the United States. Of the 555 railroads in operation in 1999, 546 were short line railroads. Short lines participate in a significant number of movements, especially in rural states dependant on agriculture. These lines are invaluable to rural areas that otherwise would not have access to Class 1 railroads. In 24 continental states, 30% or more of railroad miles are operated by short lines.

This report identified several factors critical to the success of short line rail roads. Success was measured and analyzed by looking at variables related to traffic volume, backhaul traffic, reliance on industries and/or commodities, number of shippers, flexibility of labor, track conditions, management, and transportation competition. Using operating ratio to distinguish profitable railroads from those that are not profitable, T-test results indicate profitable railroads are better at keeping expenses down. When compared to unprofitable ones, profitable railroads have higher traffic levels, serve more industries, have more customers, and have more productive employees.

Source: Benson, Douglas, John Bitzan, Kimberly Vachal, and Tamara VanWechel. "The Importance of Short Line Railroads to Rural and Agricultural America." Departmental Publication 152, Upper Great Plains Transportation Institute, North Dakota State University, Fargo, North Dakota, August 2003.

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N.D. Strategic Freight Study on Motor Carrier Issues

BACKGROUND—MOTIVATION

This study discusses truck size and weight regulations in North Dakota and the local permitting policies and their effects on motor carriers and shippers. The focus is on intrastate motor carrier movements of freight.

The study analyzed the economic impacts of load limits and the benefits for establishing a statewide program to coordinate the administration of permitting. Truck size and weight regulations and state and local permitting policies and costs for various types of permits in North Dakota are examined. Permitting information was gathered from the state's 53 counties. The information gathered identified 16 counties in the western portion of the state which are part of the North Dakota Association of Oil and Gas Producing Counties (NDAOGPC) uniform permitting system and four counties in the southeastern part of the state that have developed multiple county permit systems. Examining the permit policies in each of the 53 counties reveals inconsistencies that prohibit seamless freight transportation.

OBJECTIVES

The primary objective was to analyze the economic impacts of load limits and the benefits of establishing a statewide program to coordinate the administration of load limits within North Dakota. A secondary objective was to provide information on truck size and weight regulations and the in-state permitting system and evaluate costs associated with impediments to freight flow, including county road restrictions and seasonal load restrictions.

FINDINGS

Uniform regulatory and permitting processes would enhance the seamless movement of freight within the state. Harmonizing state and local truck size and weight regulations and permitting processes would reduce confusion, promote regulatory compliance and, most importantly, improve commerce.

Source: Berwick, Mark, Mark Lofgren, and Junwook Chi. "N.D. Strategic Freight Study on Motor Carrier Issues." Departmental Publication 185, Upper Great Plains Transportation Institute, North Dakota State University, Fargo, North Dakota, September 2005.

Regional Strategic Freight Study on Motor Carrier Issues

BACKGROUND—MOTIVATION

This study explores the regulatory environment that shippers face in moving freight by truck throughout the region (North Dakota, South Dakota, Minnesota, Iowa, Wyoming, Montana, Nebraska, Manitoba, Saskatchewan, and Alberta) and highlights differences in regulations that exist among the region's states and provinces. Truck size and weight regulations in the region's states and provinces are controlled and specified by state departments of transportation and provincial departments of highways, rural municipal councils, major urban transportation agencies, U.S. Department of Transportation, national parks, public works, tribal governments and other government agencies and services. Because of the inconsistencies in size and weight regulations, problems exist. This study provides a snapshot of current regulations and conditions, and the reader should note that truck size and weight laws are continually evolving.

OBJECTIVES

This project's three objectives were to provide:

1. economic and safety information of the impacts of a regional uniform size and weight regulatory and permitting system,
2. information on the differences in size and weight regulations in the region, and
3. information for the different departments of transportation (DOTs) policymakers, and others, allowing them to examine economic costs of restrictions and regulations on motor carriers and their customers.

FINDINGS

State and provincial truck size and weight regulations and permitting processes are complex, difficult to define, and provide for a less than amicable business environment.
Projections of increased freight volumes highlight the need for the development of a regional truck freight transportation system that harmonizes truck size and weight regulations with a uniform permitting system which will enhance the region's economic competitiveness.

Cooperation among states, provinces, and private and public sector leaders is needed to bring about a plan for uniform regulations and a seamless truck freight transportation system that enhances commerce within the region.

Source: Berwick, Mark, Mark Lofgren, and Junwook Chi, "N.D. Strategic Freight Study on Motor Carrier Issues." Departmental Publication 185, Upper Great Plains Transportation Institute, North Dakota State University, Fargo, North Dakota, September 2005.

Feasibility of a Logistics Center Including Container/Trailer Intermodal Transportation in the Fargo/Moorhead Area

BACKGROUND—MOTIVATION

The Fargo/Moorhead Council of Governments (F/M COG), Fargo Cass County Economic Development Corporation, City of Moorhead, Minnesota Department of Transportation, North Dakota Department of Transportation, along with a committee of interested parties from western Minnesota and eastern North Dakota, initiated a feasibility study regarding the possible enhancement of intermodal transportation options. The committee determined that the Upper Great Plains Transportation Institute should conduct a survey to determine the current and potential future volume of intermodal freight trailers and containers in the area. This study provides the groundwork for decisions to be made by shippers, government officials, and others regarding the next steps in pursuing enhanced transportation services for businesses in the study region. The vision of the project is for a logistics center that would house facilities for intermodal loading, transloading, warehousing and packaging, and an industrial park for light manufacturing or assembly.

OBJECTIVES

The primary objective was to provide information for decision makers as to the feasibility of establishing a logistics center including an intermodal terminal in eastern North Dakota.

FINDINGS

Of the factors needed for a successful intermodal facility, the study area has marginal volume, an imbalance of traffic, some concentration, and at this time, only marginal cooperation of the steamship lines.

Commitment of businesses needing intermodal transportation is high, other businesses are apathetic, and beyond the 100-mile radius of Fargo, interest deteriorates while communities are taking a wait-and-see approach.

Source: Berwick, Mark and Mark Lofgren. "Feasibility of a Logistics Center Including Container/Trailer Intermodal Transportation in the Fargo/Moorhead Area." Departmental Publication 193, Upper Great Plains Transportation Institute, North Dakota State University, Fargo, North Dakota, January 2005.

Truck Costing Model for Transportation Managers, 2002-03

BACKGROUND—MOTIVATION

Truckers face different input prices, product characteristics, truck configurations, geographical characteristics, firm size, and driving practices. Thus it is difficult to obtain current estimates of costs for particular independent owner/operators. The software that was developed determines costs for a variety of truck configurations, product characteristics, and input prices. A firm's costs are determined by its equipment, characteristics of products hauled, and input prices associated with a typical movement for that firm.

The truck costing software may provide information to many in the trucking and or shipping industry. Anyone estimating transportation costs needs reliable estimates of owner/operator costs. Also some shippers need accurate truck cost information to negotiate desirable rates and determine the appropriate mode of transportation.

OBJECTIVES

The objective was to develop a stand-alone Truck Costing Model using Microsoft Visual Basic for Windows. The model in this study has many useful features. Costs can be obtained for many different configurations and trip characteristics. Important conclusions can be drawn from running simulations including the sensitivity of costs and equipment use, wait time and trip distance, labor, and fuel price. The relationships of these variables and the cost of operations are important for trucking interests.

FINDINGS

The simulations and sensitivity analysis determined the truck cost model's flexibility and inadequacies. Factors influencing costs of owner/operators include annual miles, trip distance, and truck speed for fuel efficiency. Decreasing annual miles may be critical for the trucker debating on waiting for a better revenue load. The opportunity cost of waiting may more than make up for the additional revenue received. Another interesting factor in the model is the wait time. Initial assumptions exclude wait time, but loading and unloading time for short movements are the cause of increased costs. The shorter the trip, the greater the impact of loading and unloading time on cost.

Source: Berwick, Mark and Mohammad Farooq. "Truck Costing Model for Transportation Managers, 2002-03." Mountain-Plains Consortium Report-03-152, Upper Great Plains Transportation Institute, Fargo, North Dakota, August 2003.

North Dakota Strategic Freight Analysis: The Role of Intermodal Container Transportation in North Dakota, 2001-02

BACKGROUND—MOTIVATION

The interest in intermodal container transportation expressed by different parties across the state prompted the North Dakota Department of Transportation and the Upper Great Plains Transportation Institute to evaluate the possibility of locating intermodal facilities in North Dakota. Improved intermodal container transportation in the state may facilitate future growth of the value-added agriculture and manufacturing industries.

OBJECTIVES

The objectives of this study were to: (1) examine the current transportation system for value-added processors, manufacturers, and specialty agriculture producers, (2) provide information and analysis necessary for decision makers to evaluate the viability of an intermodal container facility serving North Dakota, and (3) provide information related to the transportation needs of manufacturers and value-added agricultural producers to allow informed decision making by public policymakers.

FINDINGS

This report examined the potential role of a relatively newer form of transportation, intermodal truck-rail container transportation, in the state's expanding manufacturing and value-added agricultural base. Specifically, the report explored the general advantages of intermodal container transportation, examined the factors that make intermodal container transportation successful, estimated the costs of building and operating intermodal facilities, evaluated the characteristics of various locations that are desirable for an intermodal facility, estimated potential traffic volumes and other characteristics of various North Dakota locations where such a facility might be located, and explored various funding options for an intermodal facility. This was done using several secondary data sources along with surveying firms in North Dakota and the surrounding region. The surrounding region included border counties in Minnesota, South Dakota and Montana.

Source: Berwick, Mark, John Bitzan, Junwook Chi, and Mark Lofgren. "North Dakota Strategic Freight Analysis: The Role of Container Transportation in North Dakota." Departmental Publication 150, Upper Great Plains Transportation Institute, North Dakota State University, Fargo, North Dakota, November 2002.

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A Hedonic Cost Function Approach to Estimating Railroad Costs

BACKGROUND—MOTIVATION

There is a long history of examining the structure of railroad costs by academic economists. However, little attention has been given to the effects of different outputs emanating from different network structures with associated differences in commodity traffic.

OBJECTIVES

We estimate a hedonic cost function that considers the different types of services provided by railroads and differences in the nature of such services among railroads. We then provide an illustration of how such a cost function might be used to estimate individual movement costs.

FINDINGS

We find large differences in the elasticity of costs with respect to different outputs, and large changes in estimated marginal costs of different outputs as the characteristics of such outputs change. Moreover, the findings suggest that the hedonic approach to estimating individual railroad movement costs holds promise for overcoming the problems inherent in measuring individual movement costs with economic cost functions.

Source: Bitzan, John D. and Wesley W. Wilson. "A Hedonic Cost Function Approach to Estimating Railroad Costs." W.K. Talley and S.M. Dennis eds. Railroad Economics. London: Elsevier (2007): 69-95.

Industry Costs and Consolidation: Efficiency Gains and Mergers in the U.S. Railroad Industry

BACKGROUND—MOTIVATION

U.S. railroads were partially deregulated by the Staggers Rail Act of 1980, following years of decline laden with bankruptcies, a deterioration of productivity and financial viability, and misallocated traffic as a result of artificial constraints imposed by regulation Since partial deregulation, these trends have been largely reversed with tremendous increases in productivity and decreases in rates and costs. As reported by the American Association of Railroads, the revenue per unit of output (ton-miles) has fallen 57% in real terms, and ton miles (output) per constant dollar of operating expense have increased by 167% since 1980. A number of studies find that a large portion of the reductions in cost are due to partial deregulation. The reductions in cost, however, are also due to a massive consolidation movement in the industry that was facilitated by partial deregulation. Against the cost savings, however, is a growing concern over the consolidation of railroad output and network among progressively fewer firms. The concern is that horizontal mergers in concentrated industries may result in higher rates and associated deadweight losses. The welfare effects of mergers depend on the relative magnitudes of these deadweight losses and efficiency gains.

OBJECTIVES

The focus of this paper is on the efficiency gains of 14 mergers that took place between 1983 and 2003. We estimate a model of firm costs, using all Class I firms in the market over the time period, and then use the results to estimate the cost effects of mergers. The effects of mergers on costs to the entire industry are also estimated.

FINDINGS

The results suggest that the effects of individual mergers are idiosyncratic, but that overall industry cost savings are significant – particularly in later years. The central results are that consolidation in the railroad industry accounts for about an 11.4% reduction in industry costs (more than $4 billion in 1992 prices), and that while there are tremendous differences across mergers with respect to the direction, level, timing, and source of cost impacts, most mergers result in cost savings.

Source: Bitzan, John and Wesley W. Wilson. "Industry Costs and Consolidation: Efficiency Gains and Mergers in the Railroad Industry." Review of Industrial Organization 30(2), (2007): 81-105.

Economies of Density and Regulatory Change in the U.S. Railroad Freight Industry

BACKGROUND—MOTIVATION

Two reform acts, the Staggers Railroad Act of 1980 and the Railroad Revitalization and Regulatory Reform Act of 1976, represented big changes in U.S. policy toward railroads. An important welfare gain from these changes predicted by researchers was the efficiency gain from increased densities in rail freight traffic. However, few retrospective studies have analyzed the accuracy of these predictions.

OBJECTIVES

The present paper fills this gap by analyzing the effects of regulatory changes on freight traffic density, simulating the cost savings from gains in density using a newly estimated rail cost function, and comparing these results with earlier predictions.

FINDINGS

The results indicate net benefits of $7 billion to $10 billion per year (as of 2001) stemming from cost savings from increased traffic densities relative to what would have occurred under regulation. These benefits are substantially higher than researchers in the 1970s and early 1980s predicted, for reasons explained in the paper.

Source: Bitzan, John D. and Theodore E. Keeler. "Economies of Density and Regulatory Change in the U.S. Railroad Freight Industry." Journal of Law and Economics 50, (2007).

U.S. Railroad Productivity and Deregulation – A Brief Summary of Findings

BACKGROUND—MOTIVATION

U.S. railroads were partially deregulated more than two decades ago. By most measures, this change in regulation has been deemed a success. Since deregulation of the railroad industry in 1976 and 1980, (1) shippers have realized lower rates, (2) railroads have realized lower costs as a result of higher traffic densities, the shedding of unprofitable lines, and enhanced rail technology (productivity gains), and (3) the railroad industry has been restored to financial viability.

OBJECTIVES

The paper reviews findings on railroad productivity gains in the U.S. and their relationship to deregulation. It provides background on U.S. railroad regulation and deregulation, describes railroad productivity gains and

how they are measured, reviews U.S. studies examining productivity gains and deregulation, and discusses implications for European regulatory change.

Source: Bitzan, John D. "U.S. Railroad Productivity and Deregulation—A Brief Summary of Findings." Published in Institutions and Sustainable Transport: Regulatory Reform in Advanced Economies, 2007.

Higher Airfares to Small- and Medium-Sized Communities – Costly Service or Market Power?

BACKGROUND—MOTIVATION

By most accounts, U.S. airline deregulation has been successful in delivering lower prices and improved service to customers. Despite the recent increase in government involvement in the airline industry aimed at ensuring financial viability and improving safety, there has not been a return to the types of government intervention that existed before 1978. While real airfares have declined since deregulation, there continues to be a concern over higher fares paid by travelers from rural and small communities, in comparison to those paid by travelers from large metropolitan areas.

OBJECTIVES

This study examines airfares for flights serving small and large communities, and attempts to explain their differences using a 10% sample of all tickets sold nationwide in the year prior to the terrorist attacks of Sept. 11, 2001.

FINDINGS

The study finds airfares that are 11% higher for those serving communities of 300,000 or less in comparison to those serving communities of more than 300,000, on average. In examining reasons for fare differences, the study finds that average fares are higher for small communities due to a higher cost of serving such communities and due to market power differences. Moreover, these cost and market power differences in fares are roughly equal to each other. While it may be tempting to think of market power differences in fares as fixable through some competitive policy prescription, it is unlikely that any such policy would be successful. The market power differences accounting for fare differences between small and large communities are the result of the low passenger density nature of small communities. Remedies aimed at increasing competition in small communities are likely to contribute to increasing costs, and service that is not viable for private airlines.

Source: Bitzan, John D. and Junwook Chi. "Higher Airlines to Small- and Medium-Sized Communities—Costly Service or Market Power?" Journal of Transport Economics and Policy 40(3), (2006).

Airfares to Small- and Medium-Sized Communities

BACKGROUND—MOTIVATION

By most accounts, U.S. airline deregulation has been successful in delivering lower prices and improved service to customers. Despite the recent increase in government involvement in the airline industry aimed at ensuring financial viability and improving safety, there has not been a return to the types of government intervention that existed before 1978.

While real airfares have declined since deregulation, there continue to be concerns over higher fares paid by travelers from rural and small communities compared to those paid by travelers from large metropolitan areas. For example, a 1998 report by the U.S. Department of Transportation found evidence that travelers going to and from small communities paid higher airfares than those traveling between large hub airports. Moreover, a study by the U.S. General Accounting Office found evidence of barriers to entry and higher

fares at some airports, with particular concerns at airports in small communities. The study found passengers flying to or from small-and medium-sized communities paid 12% more than the national average airfare in 1998 and that 13 of the 42 airports serving small communities that they examined had real airfare increases between 1994 and 1998.

OBJECTIVES

This study examines one component of the air service provided to rural and small communities – the fares paid for airline travel. Specifically, this report examines differences in airfares paid by travelers to and from rural and small communities in comparison to those paid by travelers to and from large metropolitan areas.

FINDINGS

This study examines airfares for flights serving small and large communities, and attempts to explain their differences using a 10% sample of all tickets sold nationwide in the year prior to the terrorist attacks of Sept. 11, 2001. The study finds airfares are 11% higher for communities of 300,000 or less in comparison to communities of more than 300,000, on average. However, the study finds that there are wide differences in fares among different communities within various size categories.

Source: Bitzan, John and Junwook Chi. "Airfares to Small- and Medium-Sized Communities." Departmental Publication 156, Upper Great Plains Transportation Institute, North Dakota State University, Fargo, North Dakota, March 2004.

Costing Individual Railroad Movements

BACKGROUND—MOTIVATION

Railroads have been federally regulated for more than 100 years. Regulation places constraints on the rates railroads can charge, on the lines over which they operate, on merger activity and on a wide array of other activities. A mandate of regulation is that railroads are not allowed to charge "unreasonable" rates. Implementation of this mandate, however, is complicated due to the nature of railroad markets, technology, and information requirements. Specifically, railroads produce outputs over a network. A railroad market is a flow of a commodity from one location to another. Since railroads haul large numbers of commodities between many locations and generally provide the services under conditions of joint production and economies of density, estimating the cost of a specific movement is no simple undertaking.

OBJECTIVES

This report examines the history of railroad cost analysis, examines some of the criticism of current railroad costing methodologies, and presents some alternative methods for analyzing the costs of individual railroad movements.

FINDINGS

Many of the theoretical advances introduced by economists are not encompassed in the regulatory approach to costing. Aggregate "econometric" cost functions are obtained directly from economic principles. But, the results of this report suggest such an approach does not appear to effectively estimate cost differences across individual movements. That is, system averages in such a context do not appear to capture the specificity needed to estimate movement-specific costs.

Because of limitations with the Uniform Rail Costing System (URCS) approach and with the econometric aggregate cost function approach, this study examines a third approach titled "the New Industrial Organization Approach." The NEIO approach uses disaggregate data on railroad rates to infer marginal costs of specific shipments. The NEIO marginal cost estimates simulated in this study show a strong correlation with URCS costs. While several refinements to the NEIO model may improve on results obtained, the result

may provide another approach to rail costing, which relaxes a number of prior assumptions made in the regulatory approach to the costing of specific railroad movements.

Source: Bitzan, John and Wesley W. Wilson. "Costing Individual Railroad Movements." Departmental Publication 153, Upper Great Plains Transportation Institute, North Dakota State University, Fargo, North Dakota, September 2003.

The Differential Effects of Deregulation on Rail Rates

BACKGROUND—MOTIVATION

This research focuses on the long-standing relationship between the rail industry and production agriculture. The grain industry is heavily dependent on an effective and efficient rail system to move its large, bulk-packaged shipments. A substantial portion of the delivered cost of grain is often attributed to transportation, in terms of the actual cost, reliability, and market access. The grain industry, unlike other bulk commodity markets such as coal and fertilizer, covers a multitude of origins and commodities. Understanding the incidence of gain associated with deregulation for shippers within the grain industry is complex but critical as rail industry oversight is considered in future policy and investment discussions.

OBJECTIVES

Specific objectives of the study are to formulate and estimate statistical rail rate models to examine the effects of deregulation on rates, focusing on differences among shippers with varying elasticities of demand for rail service, and make an assessment of rail deregulation's impacts on rates and how the impacts have varied among major grains and across producing regions.

FINDINGS

The overall benefit of rail deregulation, measured in terms of rail productivity and decreasing rail rates for shippers, is well established in previous research and consistent with the findings in this research. Important findings in research go beyond the broad discussion to show that these benefits are not distributed uniformly across or within commodities. Furthermore, as market-based pricing has become more prevalent, the variance in distribution of benefits is shown to increasingly favor those grain producers located in regions with higher levels of intermodal competition. In a competitive market environment, trends in relative, as well as overall, rates should be considered in assessing the impacts of policy and investment initiatives. This research will help us to better understand the ultimate consequences of future policy and investment decisions, in terms of overall and relative competitiveness of grain commodities and U.S. grain producers.

Source: Bitzan, John, Kim Vachal, Tamara VanWechel, and Dan Vinje. "The Differential Effects of Deregulation on Rail Rates." Mountain-Plains Consortium Report-03-144. Upper Great Plains Transportation Institute, Fargo, North Dakota, June 2003.

Industry Costs and Consolidation: Efficiency Gains and Mergers in the Railroad Industry

BACKGROUND—MOTIVATION

Over the past few decades, a massive consolidation of firms in the railroad industry has occurred. While industry average revenues and costs have been falling, growing concerns over the consequences of railroad mergers exist. Indeed, this concern, along with recent experiences on service disruptions, resulted in a moratorium on further railroad mergers by the Surface Transportation Board, which was removed in June 2001. Yet, the issues surrounding railroad mergers remain.

OBJECTIVES

This paper focused entirely on the efficiency gains of mergers. The authors estimated a model of firm costs, using all Class I firms in the market over the time period. They also estimated the effects of each of the 12 mergers taking place from 1983 through 1996. In addition, an estimate of industry costs and an assessment of the efficiency gains accruing to the industry from the consolidation of firms were made.

FINDINGS

Previous research suggested cost savings are associated with railroad mergers, but these cost savings explain only a small component of the cost savings of deregulation (about 10%). This research suggests mergers are becoming more frequent between firms with large market shares, and corresponding efficiency gains are larger. The results point to very large effects of industry consolidation on costs. These estimates have grown over time and are largest at the end of the sample, reflecting two of the largest-ever mergers (BN-SF and UP-SP).

The results from a cost-savings perspective point strongly to the merits of further consolidation in the industry. However, further research addressing the demand and pricing effects is necessary to fully address the desirability of further industry consolidation.

Source: Bitzan, John and Wesley W. Wilson. "Costs and Consolidation: Efficiency Gains and Mergers in the Railroad Industry." Mountain-Plains Consortium-03-145, Upper Great Plains Transportation Institute, Fargo, North Dakota, June 2003.

Small Railroads—Investment Needs, Financial Options, and Public Benefits

BACKGROUND—MOTIVATION

Railroads play an important role in the U.S. transportation system. Annually, railroads haul more than 1.5 billion tons of freight for an average distance of more than 750 miles, with a value of more than $319 billion. These numbers account for more than 14% of the tonnage, 38% of the ton-miles, and 4.5% of the value of products hauled by all modes in the United States.

OBJECTIVES

This study examines: (1) capital investment needs facing the short-line industry, (2) terms available for meeting these needs, (3) public interest benefits of short-line railroads, and (4) the relationship of short-line railroad services to the statutory responsibilities of the Secretary of Transportation.

FINDINGS

The study finds substantial capital investment needs for the industry, some difficulty in obtaining financing to meet these needs, large public interest benefits of short-line railroad operations, and a positive contribution of short-line operations to safety and fuel efficiency.

In examining the ability of short-lines to obtain financing to meet these capital investment needs, the authors found several potential problems. These include: (1) few major banks that have a specialization in small railroad financing, (2) a need for better public information regarding small railroads (specifically, audited financial statement data), (3) short financing terms offered to small railroads for financing track and bridge improvements (five to eight years), and (4) some unwillingness by banks to make loans for track and bridge improvements because of an inability to liquidate these assets. However, on the positive side, they also found that (1) banks are interested in taking on more small- railroad loans, and (2) four of the six banks surveyed do not require large minimums for loans to short-line railroads.

Source: Bitzan, John, Denver Tolliver, and Doug Benson. "Small Railroads—Investment Needs, Financial Options, and Public Benefits." Departmental Publication 145, Upper Great Plains Transportation Institute, North Dakota State University, Fargo, North Dakota, September 2002.

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Projections of Washington-British Columbia Trade and Traffic, by Commodity, Route, and Border Crossings

BACKGROUND-MOTIVATION

As the U.S. moves forward in the international trade market, continuing adaptation to the changing transportation needs is critical in maintaining efficiency and reducing costs of raw and manufactured goods to ensure economic stability and growth. As the North American Free Trade Agreement (NAFTA) moves into its 13th year of existence, there is need to continue adapting to the changing transportation environment. With bilateral trade in excess of $1.4 billion per day between the U.S. and Canada and over 200 million annual crossings (passenger vehicles and freight trucks), knowledge of the composition of commodities crossing the border and the growth of those commodities allows for easier trade adjustment (U.S. Embassy, Ottawa, 2006).

OBJECTIVES

The objective of this study is to measure border flows of goods by truck between Washington and British Columbia, by dissecting the northbound and southbound flows by industry and commodity and projecting the trade growth in those industries. By knowing the potential growth and increases in commodity flows and truck crossings across border port locations, policymakers can better adapt border ports to allow for continuing efficiency in truck movements.

FINDINGS

The goal of this project was to estimate future truck flows at Washington border ports by developing a profile of the commodities flowing through those ports. Profiles were developed to increase understanding of what and where commodities are crossing the Washington-British Columbia border. Many of the border ports show consistent steady growth, which is supported by both methods of projecting truck crossings.

Source: Galloway, Hamilton, Kenneth L. Casavant, and Eric L. Jessup. "Projections of Washington-British Columbia Trade and Traffic, by Commodity, Route and Border Crossings." Strategic Freight Transportation Analysis Report #22, May 2007: pp. 1-112.

Qualitative Research for a Quality of Life: Benefits of Rural Airports

BACKGROUND-MOTIVATION

Most of Washington State's 129 public access airports are small and are based in rural locations. While much of the state has had robust economic growth in the 1990s and 2000s, many rural counties have had lower income levels and increased unemployment, particularly those counties dependent upon resource-extractive industries such as forestry, mining, agriculture, and fishing. Diminished prosperity in rural Washington, shrinking local budgets, and an insufficient understanding about community benefits threaten the viability of many rural airports.

OBJECTIVES

In this article, we report on the benefits rural airports bring to their communities and the value of qualitative methodology for uncovering many of these benefits. We then offer a framework for planners and policymakers to consider the non-traditional advantages of rural airports.

FINDINGS

Flights touch almost every aspect of life in these communities. The qualitative research, inductive approach worked well to uncover a plethora of potential benefits, supporting the importance of rural airport maintenance and upkeep. Qualitative research is able to identify the non-traditional benefits that rural airports bring to the communities more easily and completely than traditional economic analysis. Rural airports enhance the quality of life in rural communities and residents have an improved sense of well-being. Airports also influence how each community views itself and how residents hope outsiders will view their community. One Omak resident said, "Our airport is a sign that we are a progressive community; we are up-to-date." An airport can also represent the direction in which the community is moving. A Forks City Council member said, "The airport is a symbol of hope for our future, a star to which we are hitching our wagon."

Source: Newkirk, Jon, Eric L. Jessup, Kenneth L. Casavant, and Marcia Gossard. "Qualitative Research for a Quality of Life: Benefits of Rural Airports." Accepted for Publication, Western Planner, January 2007.

River Transport

BACKGROUND-MOTIVATION

An efficient multi-modal freight transportation network is essential to sustaining a thriving economy, especially for the Inland Empire and the trade-dependent regions (Washington, Oregon and Idaho) throughout the Pacific Northwest. This particular region has benefited in the past from access to all modes of freight transportation, including rail, truck, river, air, and ocean. Many economic benefits are derived from this abundance of transportation alternatives, including the competitive/complementary forces between and within modes that lead to an increase in service while decreasing transportation rates. Improvement in freight mobility strengthens an economy, often leading to accelerated economic development and expansion over time.

OBJECTIVES

A very brief history of this region is discussed. The functions of the modal transport of the Pacific Northwest are examined by looking at the truck, rail, and river movements of the area. The river transport is further analyzed by assessing the upriver and downriver movements along the Columbia-Snake River system. Finally, some evolving issues are addressed from river movements in this region.

FINDINGS

There is no doubt that future economic growth and prosperity for the region will largely depend on how successfully the products produced in the region find their way into domestic and export markets. A multi-modal transportation network is imperative to the health of the economy. Investments in the transportation network will be necessary to improve freight mobility and operational efficiency to enhance economic vitality and regional competitiveness for global trade.

Lastly, the importance of education and information exchange to area business owners, local residents, and policymakers regarding the important connection between local business and regional economic performance, trade, state revenues, and these transportation infrastructure investments cannot be understated. These investments today reap rewards and positive multiplier effects throughout the economy for years to come and also foster, facilitate, and accommodate future freight transportation and economic growth throughout the region. This additionally requires an understanding of the private/public benefits from these investments and suggests the need for future partnerships between private entities and public agencies.

Source: Jessup, Eric L. "River Transport." Feature Article in Idaho Issues Online, http://www.boisestate.edu/history/issuesonline/fall2006_issues/5f_numbers_06fall.html, November 2006.

Transportation Optimization Modeling for Washington State Hay Shipments: Mode and Cost Implications Due to Loss of Container Services at the Port of Portland

BACKGROUND-MOTIVATION

A recent issue impacting hay shipments in Washington State involves the reduction of container services at the Port of Portland, Oregon. Prior to this change, containers filled with hay were shipped almost exclusively via barge on the Columbia River to the Port of Portland. After reaching Portland, the containers were then loaded onto one of three steamship lines: Hyundai, KLine, or Hanjin and destined to markets in Japan and China. As of September 2004, Hanjin is the only carrier that calls on the Port of Portland.

OBJECTIVES

This research effort collected firm level data on the production, transportation, and marketing of hay in Washington and utilizes this information to develop an optimization model of regional hay movements. One alternative evaluated in this study is determining industry shifts in transportation usage and modal choice in reaction to the transportation changes after September 2004.

FINDINGS

The results indicate that after all barge and hay shipments were eliminated into Portland, total transportation costs decrease initially overall, while some producers experience shipping cost increase. Both rail and truck volumes increase substantially in the absence of container shipments on barge. The total industry impact is a $6.3 million increase in transportation costs from the Base Scenario to Scenario 3. Also, once trucks rates are allowed to increase due to the shortage of trucks and the increased demand for truck services, the total transportation cost increased by $8.7 million.

Source: Jessup, Eric L., Stephanie Meenach, and Kenneth L. Casavant. "Transportation Optimization Modeling for Washington State Hay Shipments: Mode and Cost Implications Due to Loss of Container Services at the Port of Portland." Paper presented at the International Association of Agricultural Economist Annual Meeting, Brisbane, Australia, August 2006.

A Feasibility Study Evaluating Transportation Security Systems and Associated Multi-Modal Efficiency Impacts

BACKGROUND-MOTIVATION

The focus of maritime security in the post 9/11 era has been changed to focus on prevention and managing risks of terrorist attacks on the nation's supply chains, specifically the ports. Ports remain a vulnerable terrorist target because of high traffic volumes passing through large concentrated ports. Government and industry participants have played a major role in tightening maritime security by implementing legislation, programs, and technologies that focus on developing more secure and transparent supply chains.

OBJECTIVES

The objective of this research effort was to evaluate the effects that various port security measures have on an electronic firm's supply chain for the movement of televisions through the six major West Coast ports. A constrained transportation optimization model was developed to represent the firm's distribution system. Using the firm's distribution network, the study expanded the model to represent all the television imports into the West Coast and further expanded it to represent all of the West Coast import volume. Three scenarios were evaluated for the firm, industry, and West Coast volumes. The first scenario estimated the effect of

increasing the rate charged for services at the port by 5, 10, and 15%. Scenarios two and three investigated the impacts of shutting down operations at the ports of Seattle and Long Beach.

FINDINGS

Results in all scenarios indicated that the impacts at the ports caused an increase in per-unit costs, while the total transportation cost decreased because of loss of quantity demanded. The results for the firm and industry level volumes were similar, but the West Coast model produced larger impacts. The port rate scenarios caused the most changes among distribution centers and retail store locations in response to increased costs. The port shutdown scenarios created the largest impacts because of the shifting of volumes that occurred between the ports, thus creating a chain reaction to optimize cost for shipments to distribution centers and retail store locations. Overall, the key insights of this study are the adjustments a firm makes to their distribution systems to counteract negative impacts imposed at ports, while meeting demands and maintaining supply chain efficiency.

Source: Jessup, Eric L., Grant Monson, and Kenneth L. Casavant. "A Feasibility Study Evaluating Transportation Security Systems and Associated Multi-Modal Efficiency Impacts." TransNow Final Report, August 2006.

Palouse River and Coulee City Railroad: Full Market Assessment

BACKGROUND-MOTIVATION

The Palouse River and Coulee City Railroad (PCC) has played a substantial role in the transportation system of the State of Washington. Railroad transportation overall serves an integral role in the movement of Washington products to distant markets. In fact, without the development of the railroads, especially in eastern Washington, the level of development in agriculture, forestry, and mining seen today would simply not have occurred. Access to markets, domestic and international, has made it profitable and productive to live and to farm, harvest, and mine in the areas far from those consumer markets.

The Staggers Rail Act of 1980, which gave increased flexibility to railroads to abandon or sell off unprofitable lines, caused massive abandonment of rail lines in the 1980s and 1990s. In Washington State over one-third of the rail mileage was abandoned during that period. Because of the low revenue being earned on these lines, most of these lines had not been regularly maintained at the desired level and, as a result, were not in very good physical condition at the time of abandonment or sale.

OBJECTIVES

The Washington State Department of Transportation desires information on the historical, current, and potential future of the market surrounding the Palouse and Coulee City Rail Lines. Changing market conditions, including but certainly not limited to a 110-car rail loading facility at Ritzville, are affecting traffic on these lines and the operating railroad has suggested abandonment might be necessary. This study is to provide desired information in a timely manner, based on interviews and surveys of potentially involved or affected firms and entities.

FINDINGS

This market assessment has revealed a dynamic and uncertain market with a multitude of competing forces and decision makers/stakeholders in the market having different options. Among other issues that are certainly not known for sure, but may be critical, are the level of maintenance chosen for the lines, the timing and magnitude of the track rehabilitation, the level of grain traffic committed and achieved on the lines, the amount of new "economic development" traffic reached, the continued progressive marketing by the Ritzville facility management, and energy impacts on operating costs of all modes. These forces make this marketing assessment and accompanying viability evaluation and any investment recommendations also uncertain and susceptible to the business decisions by firms and institutions in the market. The lack of certainty makes

consultant evaluations and state policy recommendations necessary but vulnerable.

Source: Casavant, Kenneth L. and Eric L. Jessup. "Palouse River and Coulee City Railroad: Full Market Assessment." Final Report to the WSDOT, Office of Freight Strategy and Policy, July 2006.

Regional Transportation Impacts as a Result of Reduced Container Services at the Port of Portland: Survey of Snake/ Columbia River Ports

BACKGROUND-MOTIVATION

During the summer of 2004, two ocean-going container cargo liners, "K" Line America and Hyundai Merchant Marine, made public their decisions to discontinue container service to the Port of Portland. Both "K" Line and Hyundai exported primarily agricultural products from the United States to Asian markets. While many agricultural producers and exporters anticipate sending containers by rail or truck to the Port of Tacoma where "K" Line and Hyundai will continue to provide service, these two alternatives are expected to cost nearly twice as much as carrying the same container by barge to Portland for outbound shipment on a container cargo liner. Given the increased expenditures of alternative shipping methods, clearly this container service loss will have a sizeable economic impact on the ports along the Snake and Columbia rivers as well as on agricultural producers, brokerages, and shippers who depend upon this transportation mode to access foreign markets.

OBJECTIVES

The study explores the circumstances that influenced the withdrawal of K-Line's and Hyundai's services and provides insight into the ways that the absence of these services have affected the ports that send their products through Portland (Morrow, Umatilla, Pasco, and Lewiston), the Port of Portland itself, and finally the ports that have received the export traffic from Portland's reduced cargo lines (Seattle and Tacoma). As the one-year anniversary of the withdrawn services approaches, discussion of the influence of their absence both locally and in terms of national shipping trends, remains necessary, especially as each of the ports must continue to alter its transportation modes and facilities to sustain profitable business and to maintain clientele.

FINDINGS

After examining the responses of all interviewees, several common effects appear to have resulted from the suspension of services by K-Line and Hyundai at the Port of Portland. First, Pacific Northwest agricultural producers, brokerages, and shippers have been forced to utilize different forms of transportation to move their products to Asian markets. Second, producers, brokers, and shippers of hay and frozen potato products have experienced the greatest inconvenience. Third, all container handling ports and their respective container terminal operators along the Columbia and Snake rivers have been negatively impacted by the reduced container service. Lastly, Columbia River and Snake River port manager and operator optimism regarding acquisition of previously lost services at the Port of Portland in the future is high.

Source: Reimer, Aaron, Marie Drews, Eric L. Jessup, and Kenneth L. Casavant. "Regional Transportation Impacts as a Result of Reduced Container Services at the Port of Portland: Survey of Snake/Columbia River Ports." Strategic Freight Transportation Working Paper #2, July 2006: 1-20.

2003 Washington Statewide Transportation Input-Output Study

BACKGROUND-MOTIVATION

Over the last few decades, change is one of the constants in characterizing the Washington State economy. To be sure, the state economy is dynamic; always evolving in response to changes in the economic environment. The magnitude of these changes and the challenges that they represented were particularly large, including oil shocks, major recessions, substantial changes in the global economy, and increasing importance of technological change in the economy. In response to these changes, the industrial structure in Washington State has altered significantly, reflecting a structural shift in the composition of output, employment, income, and trade. (See Strategic Freight Transportation Analysis Report #18).

OBJECTIVES

This report presents the latest input-output table of Washington State for 2003. Input-output tables provide a storehouse of economic information that can provide economists, planners, and policymakers with a better understanding of the current economic situation and enable future economic developments of the state economy to be anticipated. Contained in this table are estimates of the value of outputs, inputs, and markets served by industries in Washington State. Furthermore, this table includes a disaggregated view of transportation services industries in Washington State.

FINDINGS

The input-output table supplies a portrait of regional economic activity. The input-output table provides a basis for measuring the income and product accounts for Washington State. The natural resource (includes agricultural goods) and manufacturing sectors account for about 19% of total gross state product. Clearly, the commodity-producing industries are making a relatively smaller contribution to the Washington State economy. The value added (measured in terms of labor compensation) in general government accounts for a greater proportion of GSP (Gross State Product) in Washington State.

Source: Chase, Robert, Eric L. Jessup, and Kenneth L. Casavant. "2003 Washington Statewide Transportation Input-Output Study." Strategic Freight Transportation Analysis Report #19, July 2006: pp. 1-93.

2003 Eastern Washington Transportation Input-Output Study

BACKGROUND-MOTIVATION

Input-output tables provide a storehouse of economic information that can be used by economists, planners, and policymakers to analyze various issues related to economic developments within the region. The tables constitute a comprehensive and detailed set of accounts on all conventionally defined economic activities within the state. The input-output tables provide the foundation for estimating output, employment, and income multipliers, utilized in conducting economic impact analyses. The input-output model is a suitable framework for conducting long-term regional economic and demographic forecasting. Unveiled in 1995, the Eastern Washington Input-Output study is an economic model of the eastern region of Washington State.

OBJECTIVES

This regionalized input-output table of Eastern Washington for 2003 extends the rich tradition of the statewide tables. This technical report, which is divided into four parts, is intended for analysts and policymakers who want to understand and apply the Eastern Washington input-output table. The first part describes the input-output model, specifically its sectors and transactions table. The second part of this report discusses the various methods utilized in updating the input-output table to 2003. The third part includes a detailed examination (by mode of transport) of the economic importance of the transportation services

industry to Eastern Washington. Finally, the fourth part describes the principal application of input-output tables, namely economic impact analysis.

FINDINGS

During the ensuing years from the previous Eastern Washington input-output table (1992), significant structural change has occurred within the regional economy. As one moves further away from the model year, a growth in labor productivity would reduce the validity of using such fixed ratios in estimating employment impacts. The model assumes that local supply is perfectly elastic, which is a characteristic problem in conducting impact assessments of large-scale energy projects sited in rural areas during the 1980s and 1990s. Finally, input-output impact analysis estimates the total impact from an external change in final demand.

Source: Chase, Robert, Eric L. Jessup, and Kenneth L. Casavant. "2003 Eastern Washington Transportation Input-Output Study." Strategic Freight Transportation Analysis Report #18, July 2006: pp. 1-75.

Geo-Coding Survey Truck Route Data: GIS Analytical Applications

BACKGROUND-MOTIVATION

The application of Geographic Information Systems (GIS) has been widely accepted in a number of areas, i.e. transportation, utility network, land-use, city planning, and policy planning. Transportation policy planners and transportation network analysts, for instance, use the GIS software to analyze highway traffic and congestion problems in urban areas as well as planning for new highway infrastructure and maintenance.

OBJECTIVES

This paper is the first attempt in the freight transportation area to develop an automatic algorithm which allows identifying specific segments of highways used by each observed truck using the application of the GIS software. With known origins, destinations, and the list of highways used, Arc-Info may be utilized to specifically identify unique route segments used by each truck and assign geographic attributes to the route data.

FINDINGS

Many different analytical capabilities related to freight highway flows are then possible and applicable once specific routes have geographic properties, several of which are provided in this presentation. These include specific highway segment properties and traffic profile, including upstream/downstream contribution of freight flows by different highways and commodities throughout the highway network.

Source: Puenpatom, Tosmai, Eric L. Jessup, and Kenneth L. Casavant. "Geo-Coding Survey Truck Route Data: GIS Analytical Applications." Proceedings, Annual Transportation Research Forum Meetings, Washington D.C., March 2006.

Intercept Surveys: Productivity in Collecting Truck Trip Data, A Case Study of Portland, Oregon

BACKGROUND-MOTIVATION

Research is needed to develop and test truck trip data collection methods, which can produce data capable of better characterizing freight flows at the metropolitan level for transportation models and freight planning processes. Recent changes in supply chain distribution methodology, such as Just-In-Time or Off-The-Shelf, and the advent of significant trip chaining in intra-urban movements, create an intensified need for data that reflect actual modal movements, rather than portraying the trips as simple origin-destination pairs. Such new levels of data specificity will allow real time and real location analysis to be undertaken. A productive truck trip data collection methodology, focused on movements at generators, entry points/gateways, and activity centers, would provide a significant advancement toward achieving the overall goal of improved freight modeling and planning.

OBJECTIVES

The objective of this study was to examine and contrast the use of intercept surveys at different locations (a highway roadside, a port, and a warehouse) to generate details useful to states' modeling and freight planning needs for truck movements, particularly at the sub-county level. Data collected at roadside locations provides complete trip detail for all inter-regional movements (highway locations) and also trip detail for almost all intra-regional freight movements (warehouse/distribution center locations).

FINDINGS

Interviews at the warehouse/distribution center and interstate highway weigh station provide the highest commodity type response rates, while the preponderance of container traffic at the port facility yields limited responses on payload information. Different locations yielded differing question response rates.

Source: Jessup, Eric L., Kenneth L. Casavant, Catherine Lawson, and Alan Kirk. "Intercept Surveys: Productivity in Collecting Truck Trip Data, A Case Study of Portland, Oregon." Journal of the Transportation Research Forum 45(2), (2006): 69-85.

Estimating the Impact of Seasonal Truck Shortages on the Movement of Time-Sensitive, Perishable Products

BACKGROUND-MOTIVATION

Washington State is the number one apple-producing state in the United States, accounting for more than 2.7 million tons of apples per year valued in excess of $1 billion. However, without timely and accessible transportation to move the product from production site to the consumer's table, the value to apple producers and the state's economy diminishes rapidly.

OBJECTIVES

This research aims to identify and quantify the change in total transportation cost that occurs as a result of seasonal truck shortages and associated rate increases and to provide a framework for evaluating changes in specific destination markets, modal changes, and market competitiveness. A cost-minimizing optimization model is used to represent apple shipments from 29 producing supply points to 16 domestic markets and three international export markets over four seasons for two modes (truck and rail).

FINDINGS

Total transportation costs increase nearly $12 million as a result of truck shortages, from $245.6 million without shortages to $257.5 million under the current seasonal situation. Overall (across all seasons), the export markets of Nogales, Arizona, McAllen, Texas, and the Port of Seattle, Washington, are most affected by the truck shortages, followed by domestic markets near Seattle and San Francisco, California. The large markets of New York City, New York, and Los Angeles, California, also experience relatively large increases in transportation cost per ton mile.

Source: Jessup, Eric L. and Ryan Herrington. "Estimating the Impact of Seasonal Truck Shortages on the Movement of Time-Sensitive, Perishable Products." Transportation Research Record #1906, (2005): 81-88.

Grain Receipts at Columbia River Grain Terminals, 1980-1981 to 2004-2005

BACKGROUND-MOTIVATION

In many years, the international markets have accounted for up to 90% of Washington's grain sales. Washington State benefits from a transportation system that has all three major modes available to it (truck, barge, and rail). Such efficiencies arise due to the competitive and complementary roles played by the modes in the Washington system. Competition serves to make rates more closely reflect costs of operation, while encouraging innovation. Complementary roles allow each mode to perform that function for which it is economically suited, while the overall efficiency of the system serving producers and foreign consumers is enhanced. Irrespective of which mode is used, this efficient system is dependent on the terminals and export facilities available to move the grain from barge, rail, or truck onto the ocean segment of transportation. These Northwest ports, and the physical facilities within them, serve both Washington and national grain movements. If overall system efficiencies are to be maintained and increased, investment in and upgrading of these facilities should reflect the distribution of land-side barge, train, or rail arrivals.

OBJECTIVES

The objectives of this working paper are to evaluate volume of wheat and barley moving through the tidewater elevators, to determine the modal split in the arrivals of these movements, to determine any discernable changes over time, and to draw implications on the relationship between volume and modal splits.

FINDINGS

A better understanding of receipts by mode can be generated by considering source and volume of grain receipts, providing further insight into the overall shipping pattern. Truck is obviously used mainly for local gathering near the export elevators and the relative amount of this volume is decreasing. Most of the barge movements come from the Pacific Northwest states of Idaho, Washington, and Oregon. Substantial truck-barge shipments in the early 1980s originated from Montana and the Dakotas.

Rail volume is usually more stable than truck-barge. In periods of rail shortage, the ability of rail to provide service is evident, possibly reflecting the railroads' willingness to provide cars on those long haul, higher revenue moves from the Midwest. It is possible that, if railroads or shippers increase rail car numbers or relieve congestion, then the barge share of total receipts may decrease relative to rail. In times of high grain volumes, however, the critical role played by barge transportation is evident.

Source: Casavant, Kenneth L., Marcia Gossard, and Eric L. Jessup. "Grain Receipts at Columbia River Grain Terminals 1980-1981 to 2004-2005." Strategic Freight Transportation Working Paper #1, November 2005: 1-12.

Profile of Washington Rail Shipments: Commodity Origin-Destination Analysis 1985-2002

BACKGROUND-MOTIVATION

Rail lines and rail shipments are vital components of the state of Washington's intermodal transportation system. Rail transportation has several unique characteristics useful to the intermodal system, two of which are that rail is three times more energy efficient than truck and that rail has the distinctive ability over other modes to transport any of a large variety of materials, ranging from farm products to industrial products, without major physical or geographical restrictions. Barging goods is limited to regions with a navigable waterway, which the Columbia-Snake River System provides for the Pacific Northwest (PNW). Trucking is probably the most readily available and flexible mode of transportation, but it is somewhat limited in capacity and cost-effectiveness. Both the PNW and Washington in particular are fortunate to have a complete transportation system (all modes) at their disposal. Rail, used exclusively or as a segment of an intermodal movement, is an integral part of this system.

OBJECTIVES

Specific objectives of the study are to:

1. Identify the commodities which contribute at least 2% of the total commodity tonnage moving into and out of the state over the 18-year study period, and to identify trends in movement of these commodities;
2. Identify the commodities which tend to terminate in and originate from Washington, Eastern Washington and Western Washington;
3. Identify any seasonal patterns in commodity movements;
4. Identify intrastate rail traffic patterns between Western and Eastern Washington in terms of commodity groups and tonnage;
5. Present selected conclusions based on findings in regards to inferences made on the role of rail transportation in the state and in the PNW.

FINDINGS

With respect to agricultural commodities, more products arrive in Washington than are shipped out of the state. Washington is an importer of farm products and food products. Nine times more farm products entered Washington by rail than left by the same mode. Similarly, 1.69 times more food products entered rather than exited by rail. Note that fertilizers used by agricultural producers fall into the chemical commodity group. Eastern Washington depends on rail transportation for the movement of its agricultural and forest products. Eastern Washington is an exporter of farm products, lumber and food products. Seasonality of rail terminations into Washington is driven by the agricultural cycles of planting and harvesting.

Source: Stenger, Jessica, Marie Drews, Eric L. Jessup, and Kenneth L. Casavant. "Profile of Washington Rail Shipments: Commodity Origin-Destination Analysis 1985 - 2002." Strategic Freight Transportation Analysis Report #15, September 2005: 1-357.

Washington State Grain Cooperatives: History, Functions, and Regulations

BACKGROUND-MOTIVATION

The United States Department of Agriculture (USDA) defines a farmer cooperative as an organizational business structure where membership is limited to people producing agricultural commodities and the majority of business is done with those who are members. Due to the success of this cooperative business structure, from their early beginnings, cooperatives have survived through low crop yields, producer

bankruptcies, changing U.S. farm policy, dwindling farm numbers, declining patron loyalty, increasing operating costs, fluctuating crop prices and a rapidly evolving agricultural industry.

Local cooperatives, managed with additional global perspective and commitment to patrons locally, appear useful to the economic viability of farmers, the grain industry and American agriculture. In Washington during the year 2002, there were 22 state and federally licensed grain marketing cooperatives. The structural alterations of grain cooperatives are affected by changes in technology, timing of grain movements, types of transportation available, farm populations, customer demands and markets. These kinds of changes in the industry have influenced the decreasing numbers of grain cooperatives in different ways.

OBJECTIVES

The following report provides an overview of the history of cooperatives in terms of their general organizational structure and legislative influences. As grain farmers prospered, developments in transportation and storage of grain products shaped the ways that they were able to market their commodities and conduct business. Cooperatives, then, rose out of situational and legislative decisions surrounding grain transport, even as differing factors continue to shape the way that these cooperatives function in the present. The grain industry in Washington, in particular, has witnessed the organization of its cooperatives shift substantially since the early half of the 20th century. Tracing the ways that these 22 Washington cooperatives through consolidation, acquisition, and mergers have matured since their founding provides a helpful glance at the state of the industry.

FINDINGS

The coordination of country elevators contributed to the subsequent structure of Washington's grain cooperatives. Most grain firms are multiplant firms where they operate several grain receiving stations or houses within the firm. A cooperative is user-owned and user controlled business that distributes benefits on the basis of use. Cooperatives enjoy the special privilege to act and bargain collectively. The Capper-Volstead Act of 1922 recognized them legislatively as a unique form of business in stating that farmers can organize marketing associations without violating antitrust laws.

Source: Monson, Jason Warren, Eric L. Jessup, and Kenneth L. Casavant. "Washington State Grain Cooperatives: History, Functions, and Regulations." Strategic Freight Transportation Analysis Report #16, September 2005: 1-38.

Waterborne Commerce on the Columbia/Snake Waterway: Commodity Movements Up/Down River, 1995-2003

BACKGROUND-MOTIVATION

Waterborne movements are one of the more economical and cost-efficient methods of transport among all modes of transportation, and they certainly comprise a key component of the Pacific Northwest multimodal transportation system. More than 40 various types of commodities travel up and down the Columbia-Snake River daily. These commodity shipments move through eight separate locks and dams, including the Snake River dams: Lower Granite, Little Goose, Lower Monumental, and Ice Harbor; followed downriver by the Columbia River dams: McNary, John Day, The Dalles, and Bonneville.

OBJECTIVES

This report aims to capture the general characteristics of commodity transportation movements up and down the Columbia-Snake River for the nine-year period between 1995 and 2003. The report's main objective is to describe the volume and variety of commodities shipped during this time period, to identify the trends in their movements, and to draw inferences regarding future trends.

The primary objectives of this report are as follows:

- To describe in detail the commodity movements along the Columbia-Snake River for the period from 1995-2003

- To identify the general trends and seasonality of commodity movements, both overall and for individual dams
- To draw inferences and evaluate likely future trends

Information provided in this report is based on data available from the U.S. Army Corps of Engineers Waterborne Commerce Statistics Center.

FINDINGS

About four times more total tonnage travels downriver than upriver. Wheat; forest products, lumber, logs, woodchips; sand, gravel, stone, limestone flux and calcareous stone, phosphate rock; rye, barley, rice, sorghum, oats; paper and allied products; animal feed, grain mill products, flour and other processed grains; and vegetable products are the commodity groupings that travel most often and in the most amounts downriver.

Bonneville and McNary are usually the busiest dams where most of the commodities are unloaded or uploaded for further travel to any direction. However, Bonneville receives the most tonnage of commodities that travel both upriver and downriver.

Source: Makaryan, Shushanik, Eric L. Jessup, and Kenneth L. Casavant. "Waterborne Commerce on the Columbia/Snake Waterway: Commodity Movements Up/Down River 1995 - 2003." Strategic Freight Transportation Analysis Report #14, September 2005: 1-68.

How Can Intermodal Truck-Rail Facilities Provide Continuing Service in the Supply Chain: An Application in Washington State

BACKGROUND-MOTIVATION

- WSDOT allocated funds to support Inter-Modal Infrastructure Development.
- Multitude of sites throughout the state became "candidate" projects.
- A need developed for some process of evaluating likelihood of "economic viability" from all these potential intermodal facility projects.

OBJECTIVES

- Inventory current activities being produced by existing centers and facilities
- Investigate the economic and physical characteristics associated with these centers
- Identify attributes that determine or contribute to the economic feasibility and long-term economic viability
- Enumerate the public benefits associated with the inter-modal center activities
- Identify the combination of private and public interests that support inter-modal center feasibility.

FINDINGS

The most important element for assessing the viability of any inter-modal facility or location is the market and demand for inter-modal freight services moving through the area. The three models developed from the reviews reflect several of the current concerns for the state of Washington so they do serve as a useful analytical framework. The viability of the inter-modal centers increases when the traffic flow of the agricultural gathering model is combined with the port clearing model, generating backhauls to each respective movement. The list of attributes developed from the conceptual framework, the review of literature and the analytical review of inter-modal centers/facilities/ports seem to be basic determinants of economic feasibility. The attributes vary by model and situation as to importance and even applicability. Many of the attributes developed in the study are directly and critically affected by the competitive ratio of rail rates relative to door-to-door truck rates. Each inter-modal center or project is independent in that the

relevant attributes are site specific and the methodology developed in this report should be used carefully and with discretion. The availability and magnitude of public participation should be evaluated on the basis of public benefits produced by each individual project. The overall methodology of evaluating the appropriate attributes of each proposed facility or project to determine economic viability can inform both private decision makers and policy makers of the state of Washington.

Source: Casavant, Kenneth L. and Eric L. Jessup. "How Can Inter-Modal Truck-Rail Facilities Provide Continuing Service in the Supply Chain: An Application in Washington State." Paper presented at the V International PENSA Conference on Agri-food Chains / Networks Economics and Management. Ribeirao Preto, Brazil, August 2005.

Impact of Identity Preserved Grain on Rail Car Allocation

BACKGROUND-MOTIVATION

The growth of the Identity Preserved (IP) grain market in the last decade has changed the grain logistic system significantly. Traditionally, elevators move various types of grains in bulky shipments, but with IP grain, multi-location elevator companies store only one type of grain in an elevator and ship different types of grains in different containers.

The IP system supports the idea of differentiating grain for each specific end-use. Each IP grain shipment is loaded inside a container and treated as a different commodity in an attempt to prevent the risks of co-mingling different types of grains by mistake.

Even though the segregation system is crucial to the growth of the IP market, the segregation system is extremely limited in Washington State because the system is expensive and no one wants to pay for it. Information on the cost structure is required in order to assist the industry in deciding whether the new technology is economically feasible.

OBJECTIVES

The objective of the study was to evaluate the minimum impact of the IP system by quantifying the impact on the cost of wheat transportation in Washington. This paper is the first attempt of measuring impacts of the IP system on the costs of the grain distribution system from elevators to the export market.

FINDINGS

There are two significant changes in the Washington wheat distribution system as a result of the IP system. First, we found that grain transportation costs are much higher because of the new grain logistics. Second, wheat elevators are more likely to use a truck-barge mode instead of railroads. Third, the Port of Windust is affected the most among the six river ports. Although the total transportation costs increase under the IP system, an adoption of the IP system in the Washington wheat market is still possible if the premium of the IP wheat over the bulk wheat is in the range of $2.5-$2.7 per bushel.

Source: Puenpatom, Tosmai and Eric L. Jessup. "Impact of Identity Preserved Grain on Rail Car Allocation." Paper presented at the Western Agricultural Economics Association Annual Meeting. San Francisco, CA, July, 2005.

Transportation Usage and Characteristics of the Washington Warehouse/Distribution Center Industry

BACKGROUND-MOTIVATION

It is estimated that there are 21.6 million truck trips made each year on Washington state highways. Of that 21.6 million, it is estimated that 45% of freight transported originated from or is destined for a warehouse or distribution center within the state. The growing amount of road congestion within the state of Washington

has prompted concern regarding the state's ability to appropriately anticipate and provide for current and future freight transportation infrastructure needs.

OBJECTIVES

The overall objective of this study was to determine freight mobility issues for the Warehouse/Distribution Center industry in Washington State. The project scope of this study was primarily two-fold: first, to assess the operations of warehouse/distribution centers and second, to evaluate infrastructure adequacy, and identify transportation deficiencies and investment needs related to this industry.

FINDINGS

This sample used for this study was compiled from various agencies at the local, county, state, and federal levels. The information collected includes the following:

- Warehouse/distribution center characteristics (hours of operation, square footage of facility, and type of products handled)
- Daily time distribution of inbound and outbound shipments
- Seasonal time distribution of inbound and outbound shipments
- Inter-modal capabilities at each facility
- Mode distribution among inbound and outbound shipments
- Key routes utilized for inbound and outbound shipments
- Country of origin and destination of products
- Mode distribution among imports and exports
- Ranking of transportation issues
- Indicators of freight chokepoints

The paper provides analysis and findings of the operations and needs of the warehouse/distribution center industry, with some policy implications drawn by the authors.

Source: Pike, Quinton, Kenneth L. Casavant, and Eric L. Jessup. "Transportation Usage and Characteristics of the Washington Warehouse/Distribution Center Industry." Poster presentation at the Washington State University Showcase Event, Pullman, WA, April, 2005.

Understanding Grain Movements for Demand Estimation: The Columbia/Snake River System in Washington State

BACKGROUND-MOTIVATION

Grain producers and handlers in Washington State have benefited from a multimodal transportation network of roads, railroads, and the Columbia-Snake River barge system to move large amounts of grain effectively in a timely and economic manner. The competitive environment of the grain industry brings many changes, including the number of firms and shipping locations, mergers, and modal competitiveness. Additionally, marketing strategies are affected because choices of available transportation modes reflect the decision processes of warehouses or firm managers.

OBJECTIVES

This aggregate study of grain marketing and transportation in the Pacific Northwest helps lay the groundwork for subsequent estimates of empirical demand. Such subsequent modeling attempts may include revealed and stated preference analysis in discrete choice demand models. A thorough understanding of the industry and market characteristics should improve empirical estimation efforts and produce more defensible policy analysis.

FINDINGS

Based on a 90% shipment volume survey response rate, results show that in the Columbia-Snake River grain situation, one destination absorbs more than 90% of shipments. Modal competition is active; barge has a market share of more than 50%, down 12-16% from 10 years ago. Multiple-car rail shipments have increased, but not drastically. Rates are consistently competitive over the analysis period. Finally, grain demand is seasonal but generally has been stable over time. The revealed preferences from this aggregate analysis suggest that price elasticity may vary across shippers, times of movement, and modal availability.

Source: Jessup, Eric L., and Kenneth L. Casavant. "Understanding Grain Movements for Demand Estimation: The Columbia-Snake River System in Washington State." Transportation Research Record #1909, (2005): 17-21.

Transportation Logistics and Supply Chain Characteristics of Washington Hay and Livestock Movements

BACKGROUND-MOTIVATION

The local and regional hay and livestock industries have experienced considerable growth over the past few years generating multiple economic benefits and multiplier effects throughout Washington's economy. The total value of production for livestock products ($1.35 billion) and hay ($414 million) collectively totals over $1.76 billion. Growth in these agricultural and natural resource industries and continued success depends upon access to markets and an efficient multimodal transportation system to bridge production supply sources with destination demand markets. The value of hay and livestock products to regional producers and the state's economy is substantially diminished without an efficient transportation system.

OBJECTIVES

This study graphically describes those transportation characteristics and requirements necessary for efficient movement of hay and livestock products to domestic and international markets. This is accomplished through the evaluation and analysis of data collected and compiled from a variety of sources, including industry level surveys of hay and livestock producers, processors and brokers.

FINDINGS

Detailed analysis regarding statewide geographic concentration and intensity of hay and livestock production is provided. In addition, the unique seasonality of shipments from production supply locations to intermediate processing locations is provided, by product type and transportation mode choice. Specific hay and livestock processing facilities are geographically identified in addition to the degree of product transformation that occurs between production and consumption. Destination demand markets are identified by product type and by season, revealing inherent transportation efficiencies associated with different product forms and the demand opportunities in international markets. This is especially noticeable for dense cubed-hay products utilizing container transport to Asia. Finally, key freight corridors and highways supporting hay and livestock shipments are geographically identified by level of intensity and type of movement.

Source: Jessup, Eric L., Stephanie Meenach and Kenneth L. Casavant. "Transportation Logistics and Supply Chain Characteristics of Washington Hay and Livestock Movements." Poster presentation at the Washington State University Showcase Event, Pullman, WA, April, 2005.

Pacific Northwest Waterborne Commerce: A Detailed Analysis of Upriver and Downriver Movements on the Columbia/Snake River System

BACKGROUND-MOTIVATION

Water transportation is an integral part of the complete and efficient transportation system in Washington and the Pacific Northwest. Barging is the second most cost effective mode (energy and total cost per ton mile) in the system behind pipeline transport, and is more economical than rail and truck transportation. Eight locks and dams along the Columbia-Snake River system, stretching 465 river miles inland to Lewiston, Idaho, provide water navigation to the region.

OBJECTIVES

This paper identifies the volume, composition, and characteristics of waterborne commerce on the Columbia-Snake River system for the time period 1995 to 2003. Specifically, data and analysis is provided regarding barge transportation along the Columbia and Snake rivers, detailed description of commodity movements by individual water pool, identification of trends and patterns related to these movements and inferences drawn related to regional implications. The data utilized in this paper is obtained from the monthly Lock Tonnage Reports collected by the U.S. Army Corps of Engineers.

FINDINGS

The most notable trend for waterborne movements on the Columbia/Snake River is that about four times more tonnage travels downriver than upriver. This trend has been consistent for at least 25 years as suggested by previous analyses of Columbia-Snake river transportation. The annual total tonnage traveling upriver has remained quite stable between 1995-2003, whereas the total tonnage of downriver shipments has ranged from a high of 8.4 million tons in 1998 to a low of around 6 million tons in 2002 and 2003.

The primary commodities for downriver shipments include wheat, forest products, sand, gravel, limestone, rye, barley, animal feed, and vegetable products. The primary commodities for upriver movements include gasoline, jet fuel, kerosene, fertilizers, waste materials, garbage and distillates.

Source: Jessup, Eric L., Shushanik Makaryan, and Kenneth L. Casavant. "Pacific Northwest Waterborne Commerce: A Detailed Analysis of Up-River and Down-River Movements on the Columbia/Snake River System." Proceedings, Annual Meeting of the Transportation Research Forum, Washington D.C., March 2005.

Freight Origin and Destination Study for Washington State Trucking: Characteristics and Trends

BACKGROUND-MOTIVATION

An extensive study of the origin, destination and other characteristics of trucks in the state of Washington was conducted in 2003-2004, presenting findings and comparison to a similar study done in the state in 1994-1995. Over 24,000 interviews at 28 locations, over four seasons, were conducted in the survey, providing a comprehensive overview of freight movements in the state. This allowed in-depth comparisons to the movements revealed in the earlier study when 28,000 truckers at the same 28 locations were interviewed.

Information types produced in the surveys include the carrier, truck type, unloaded truck weight, payload weight, commodity type, and the facility types at the origin and destinations. Detailed information on the highways and routes used by the drivers was also collected as an aid in identifying the major and minor freight corridors in and through Washington.

OBJECTIVES

The paper presented the methodology of these surveys, surveys that to the authors' knowledge are the first and only ones done in the nation that provided this detailed information on a statewide basis. Particular attention is paid to the data management techniques utilized in this massive data base, since much of it is incorporated into a GIS framework and modeling framework.

FINDINGS

Examples of sub analyses that have been done were presented, along with determination of policy issues of congestion, mobility and investment needs that can be examined with this data set. Comparison of intrastate movement to out of state destination and origins provides interesting policy implications to funding at the state or federal level. A short list of examples of recent data usage requests by the WSDOT, cities, ports, railroads and consulting firms indicates how this data adds value to the planning and investment decisions by private and public decision makers.

Source: Peterson, Steve, Eric L. Jessup, and Kenneth L. Casavant. "Freight Origin and Destination Study for Washington State Trucking: Characteristics and Trends." Proceedings, Annual Meeting of the Transportation Research Forum, Washington D.C., March 2005.

Airport Transportation: The Search for Benefits of Rural Airports

BACKGROUND-MOTIVATION

Washington's urban and rural communities are served by an airport system that provides mobility to Washington's citizens, visitors, and other traveling public. The economic benefits of major airports are well-known and acknowledged; less well-known are the benefits to the state and rural communities provided by rural airports. It is difficult to quantify the value of these benefits, yet they are real, even if not always noticed, to the people who live and work in rural communities.

OBJECTIVES

This report identifies the wide range of benefits that rural communities receive because they have an airport. Study objectives included:

- Describe the economic environment within which rural communities operate.
- Understand why flights are made in order to understand how the community is served by aviation-related and other activities that use the rural airport.
- Identify the benefits communities receive and how rural airports are integrated into the fabric of these communities.

The case study rural communities were the Forks area, located in the northwest corner of Washington, the Omak area in Okanogan County in Nnorth central Washington, and the Goldendale/Dalles port area in Klickitat County bordered by the Columbia River and Oregon in south central Washington.

FINDINGS

The study found the benefits to rural communities include the following: (1) enhanced quality of life; (2) access to needed professional services; (3) improved quality of healthcare; (4) effective and timely response to disasters, emergencies, and fires; (5) support for local businesses, including agriculture and timber businesses; (6) improved ability to petition government; (7) community life enriched; (8) critical asset for economic development; and (9) an improved sense of well-being.

Source: Casavant, Kenneth L., Eric L. Jessup, and Jon Newkirk. "Airport Transportation: The Search for Benefits of Rural Airports." Presented at the Annual Meeting of the Transportation Research Forum, Washington D.C., March 2005.

What Makes Them Viable? Determining the Attributes That Offer Potential Viability to Intermodal Truck-Rail Facilities in Washington State

BACKGROUND-MOTIVATION

Efficient freight mobility is the result of successfully balancing the demand for transportation capacity and service with the quantity supplied of those services and capacities. A growing number of communities and economic interests in the state of Washington recognize that efficient freight movement is directly associated with the health of their local and regional economies. A great deal of information and analysis is needed to identify the necessary attributes and operating characteristics that "would or could" produce private economic viability and, if necessary, a required rate of return on public investment.

OBJECTIVES

The general purpose of this research was to investigate and develop an applied methodology for determining the potential economic viability of inter-modal truck-rail facilities in Washington State. The focus was on discerning the attributes, characteristics or market situations that are associated with successful projects, thereby suggesting a framework for economic feasibility analysis of an inter-modal truck-rail facility.

FINDINGS

The most important element for assessing the viability of any inter-modal facility or location is the market and demand for inter-modal freight services moving through the area. The viability of the inter-modal centers increases when the traffic flow of the agricultural gathering model is combined with the port clearing model, generating backhauls to each respective movement. The attributes vary by model and situation as to importance and even applicability. Many of the attributes developed in the study are directly and critically affected by the competitive ratio of rail rates relative to door-to-door truck rates. Each inter-modal center or project is independent in that the relevant attributes are site specific and the methodology developed in this report should be used carefully and with discretion. The availability and magnitude of public participation should be evaluated on the basis of public benefits produced by each individual project. The overall methodology of evaluating the appropriate attributes of each proposed facility or project to determine economic viability can inform both private decision makers and policy makers of the state of Washington.

Source: Casavant, Kenneth L. and Eric L. Jessup. "What Makes Them Viable? Determining the Attributes That Offer Potential Viability to Inter-Modal Truck-Rail Facilities in Washington State." Abstract presented to the Annual Meeting of the Transportation Research Forum, Washington D.C., March 2005.

Estimating the Impact of Seasonal Truck Shortages on the Pacific Northwest Apple Industry: Transportation Cost Minimization Approach

BACKGROUND-MOTIVATION

Washington State is the number one apple producing state in the U.S., producing over 2.7 million tons of apples per year valued at over $1 billion. However, without timely and accessible transportation to move the product from production to the table of the consumer, the value to apple producers and the state's economy diminishes rapidly.

OBJECTIVES

The objective of this research is to identify and quantify the changes in total transportation cost which occur as a result of seasonal truck shortages and associated rate increases and to provide an avenue for evaluating

changes at specific destination markets, modal changes and market competitiveness. This is accomplished by utilizing a cost-minimizing optimization model representing apple shipments from 29 producing supply points to 16 domestic markets and three international export markets over four seasons and two mode options (truck and rail).

FINDINGS

Total transportation costs increase nearly $12 million as a result of truck shortages, going from $245.6 million without shortages to $257.5 million under the current seasonal situation. Overall (across all seasons), the export markets of the Nogales, McAllen and the Port of Seattle experience the greatest negative impact as a result of truck shortages, followed by domestic markets within close proximity of Washington at Seattle and San Francisco. The large markets of New York and Los Angeles also experience relatively large increases in transportation cost per ton-mile.

Source: Jessup, Eric L. and Ryan Herrington. "Estimating the Impact of Seasonal Truck Shortages on the Pacific Northwest Apple Industry: Transportation Cost Minimization Approach." Paper presented at the Transportation Research Board Meetings, Washington D.C., January 2005. Abstract presented at the Annual Transportation Research Forum, Washington D.C., March 2005.

Transportation and Market Accessibility: Dynamic Grain Industry Changes, Transportation Challenges and Positive Initiatives

BACKGROUND-MOTIVATION

The "Grain Movement and Road Needs Survey" was administered twice in the state of Washington. The first one was conducted in 1994 under the Eastern Washington Intermodal Transportation Study (EWITS) in cooperation with the Washington Wheat Commission and Washington State Department of Transportation (WSDOT). The second was a follow-up study that was conducted in 2003, by the Strategic Freight Transportation Analysis (SFTA). The study provided valuable information regarding grain shipment characteristics.

OBJECTIVES

Using the results of the survey, this presentation looks at the following points and how they changed over time.

- The elevator characteristics
- The concentration of firms with number of elevators and percent of industry volume accounted for
- Shipments to elevator by distance
- Annual wheat and barley receipts by time period
- Annual wheat and barley shipments by time period
- Wheat and barley shipments by destination
- Modes used to ship wheat and barley

FINDINGS

From the survey the following conclusions were discovered

- There is major consolidation in the Washington grain distribution system
- The larger size elevator operations have more of an increase in volume per firm
- There is an increased distance for elevator drawing power

- Incoming grain shipments are more concentrated in the July-October time period
- Barge shipments still account for about 60% of all grain movements, 5% from rail-barge

Source: Jessup, Eric L. and Kenneth L. Casavant. "Transportation and Market Accessibility: Dynamic Grain Industry Changes, Transportation Challenges and Positive Initiatives." Invited presentation to the Pullman Chamber of Commerce, Pullman, WA, February, 2005.

Transportation Characteristics and Needs of the Washington Hay Industry: Producers and Processors

BACKGROUND-MOTIVATION

The local and regional hay industry has experienced considerable growth over the past few years generating multiple economic benefits and multiplier effects throughout Washington's economy. Growth in this industry and continued success depend upon access to markets and an efficient multimodal transportation system to bridge production supply sources with destination demand markets. The value of hay to regional producers and the state's economy is substantially diminished without an efficient transportation system.

OBJECTIVES

This study investigates those transportation characteristics and requirements necessary for efficient movement of hay to domestic and international markets. This is accomplished through the evaluation and analysis of data collected and compiled from a variety of sources, including industry level surveys of hay producers, processors and brokers.

The information contained in this report details specific attributes regarding when, where, and how hay is moved from production points, through processing facilities in Washington State, to domestic and international destination markets. Additional information for this report was compiled using data provided by the United States Department of Agriculture, National Agricultural Statistics Service and personal interviews with industry experts.

FINDINGS

The hay industry in Washington relies heavily on truck movements, significantly in the central southern part of the state. Truck transportation is the dominant mode of transportation utilized by processors to receive raw product from fields as well as to ship products to final markets. Hay movements in Washington consist of three destination points; processing facilities, livestock farms and ocean ports. Eighty percent of Washington hay is distributed domestically. The largest amount of transported hay within the state is shipped via truck to livestock farms. The remaining 20% of hay is exported to foreign markets, specifically the Pacific Rim. The seasonality of hay shipments into processing facilities is more varied and less differentiated than shipments from processing facilities. Highways supporting hay movements from the producer tend to be more local and county highways whereas shipments from hay processors are primarily on state and interstate highways.

Source: Meenach, Stephanie, Eric L. Jessup, and Kenneth L. Casavant. "Transportation Characteristics and Needs of the Washington Hay Industry: Producers and Processors." Strategic Freight Transportation Analysis Research Report #11, November 2004: pp. 1-26.

Transportation and Marketing Needs for the Washington State Livestock Industry

BACKGROUND-MOTIVATION

The transportation of livestock is an important component of Washington's livestock industry and an integral requirement for future growth and prosperity. The cattle industry comprises a significant proportion of the

livestock being produced, processed and transported throughout Washington. Cattle production currently ranks fifth among the top 40 agricultural commodities of Washington in 2002. Cattle and calf operations total 13.6% of the market value for agricultural sales in Washington.

OBJECTIVES

Growth in the livestock industry depends on access to markets and an efficient multimodal transportation system. Therefore, this study investigates those transportation characteristics and requirements necessary for the efficient movement of livestock to domestic markets. This is accomplished through the evaluation and analysis of data collected and compiled from a variety of sources, including industry level surveys of licensed livestock producers, processors and brokers. The information provided in this report details when, where and how livestock are moved from production to destination markets and the transportation infrastructure supporting these shipments.

FINDINGS

Today, slaughter plants are located near the supply of animals. Due to this advancement, livestock can now be processed and boxed to be shipped countrywide via truck. Movements associated with the livestock industry can be broken down into three distinct categories; livestock to processing facilities, livestock to feedlots and livestock to farms. Each category presents distinctive traffic flows; heavy overlap of routes does exist. I-5, I-82 and I-90 support the majority of livestock shipments for all three categories. Many livestock farms and processing facilities lie on these routes, creating traffic on these major interstates. A large majority of livestock and processed meats are shipped within the Pacific Northwest. A significant amount of livestock are transported from areas located more than 50 miles from its final destination. Continued production and business within the livestock industry will continue to cause traffic over existing routes.

Source: Meenach, Stephanie, Eric L. Jessup, and Kenneth L. Casavant. "Transportation and Marketing Needs for the Washington State Livestock Industry." Strategic Freight Transportation Analysis Report #12, November 2004: pp. 1-16.

The Changing Dynamics of Grain Cooperatives in Eastern Washington

BACKGROUND-MOTIVATION

In the Pacific Northwest, grain cooperatives were established in the 1930s and 1940s to take advantage of economies of size in shipping commodities. There are many forces impacting cooperative country elevators such as globalization, industrialization, government policies, changes in technology, types of transportation available, farm populations, customer demands, reduced patron loyalty, and evolving markets.

Consolidation of grain firms are likely to continue as long as gains in efficiency can be made to achieve a higher net price for producers and an increase in profitability for grain merchants. Cooperatives are often burdened with high cost facilities, declining grain volumes, low profit margins and excess storage capacity.

OBJECTIVES

The goal of the study was to explain the historical development of grain cooperatives, evaluate consolidation in the grain industry, and construct financial benchmarks on which to evaluate economic performance. The population of the study is defined as all grain cooperatives presently operating in eastern Washington.

FINDINGS

The number of grain cooperatives in eastern Washington has decreased by 59% in the past 55 years, but the total cooperative storage capacity has increased 312%. Financial ratios and cost analysis for the grain industry were constructed from 1997-2002 financial statements of grain cooperatives. Medium-sized

cooperatives maintained the highest average current ratio. Solvency improved for small and medium cooperatives. Large cooperatives became less solvent. The average total cost curve shows the existence of economies and diseconomies of size in the eastern Washington grain industry. Finally, the U.S. government influences the economic and financial performance of cooperatives through warehousing laws, the Conservation Reserve Program, and 43 actions by the Commodity Credit Corporation.

Source: Monson, Jason, Kenneth Duft, Kenneth L. Casavant, and Eric L. Jessup. "The Changing Dynamics of Grain Cooperatives in Eastern Washington." EB 1985E, School of Economic Sciences, Washington State University, Pullman, WA, September 2004.

Freight Movements on Washington State Highways: Results of the 2000-2003 Origin and Destination Study

BACKGROUND-MOTIVATION

The Eastern Washington Intermodal Transportation Study (EWITS) conducted an extensive two-year assessment of freight truck movements occurring on major Washington State highways from 1993 to 1994. This assessment involved 300 persons conducting personal interviews at 28 separate locations which led to 28,000 truckers being interviewed. The truck driver survey collected information on time of day movements, vehicle configuration, trucking company location, origin and intended destination, cargo type, vehicle and cargo weight, use of intermodal facilities and the specific route traveled.

OBJECTIVES

This study follows up on the EWITS assessment of freight truck movements in the state of Washington. Between 2002 and 2003, the same assessment was performed with 100 individuals interviewing at 28 separate locations which led to 24,000 truckers being interviewed. The purpose of this report shows the results of this current assessment and compares it with the assessment that was performed nine years earlier. Forecasts were made with the 1993-1994 assessment and this report shows whether those forecasts were consistent with the 2002-2003 assessment.

FINDINGS

Many charts and graphs are used throughout the report to show the results of the 2002-2003 assessment. The amount and type of agricultural products being shipped across the state of Washington is analyzed as well as where they come from, where they are going, and what path is used to get to their destination. The 1993-1994 assessment forecasted that expected annual rates of growth in freight truck traffic would be at just over 2%. The 2002-2003 assessment showed that the annual rate of growth in freight truck traffic was actually closer to 5%.

Source: Peterson, Steven K., Eric L. Jessup, and Kenneth L. Casavant. "Freight Movements on Washington State Highways: Results of the 2002-2003 Origin and Destination Study." Strategic Freight Transportation Analysis Report #10, October 2004: pp. 1-89. Presented to the Strategic Freight Transportation Analysis Steering Committee. Spokane, WA, September 2004.

Business Decisions in a Cooperative Environment

BACKGROUND-MOTIVATION

The trend for cooperative consolidations continues to be omnipresent throughout the U.S. In the state of Washington, for example, the total number of agribusiness cooperatives has decreased by nearly 40% over the past three decades. Grain cooperatives in eastern Washington have diminished by 30% over this same period, and by 60% over the past 55 years. The bulk of this reduction in number can be attributed to mergers and consolidations, but a few liquidations are also evident. While many factors have contributed to this

long-standing trend, most would argue that a persistence of "economies of size" appears as a dominant force encouraging industry restructuring at almost every level.

OBJECTIVES

Throughout the past three decades, it has been presumed that cooperative consolidation in eastern Washington's grain industry afforded the surviving entity a lower per unit cost and enhanced its performance and survival ability. Yet the very existence of this concept has never been tested. The concept also presumes that "economies of size" are continuous throughout, where increasing size, alone, never becomes a detriment to firm performance. Neither has this been tested. It is also easy to document that handling and storage capacity within the grain cooperative sector is well in excess of annual production volume. The impact of unused capacity on a cooperative's access to economies of size also remains untested. The objectives of this research report are to address these three questions.

FINDINGS

In search of further economies of size, cooperatives are consolidating at a notable rate. While their numbers continue to diminish, these organizations continue to add value to farmer output, provide high-quality service to their member-patrons, and most importantly, guarantee healthy competition in an industry which might otherwise be subject to olygopolistic exploitation.

The singular functions of receiving, storing and merchandising grain do not afford cooperative management many competitive options. Neither are they confronted with a broad array of means for altering their internal operational cost structure. Yet the industry continues to change and innovate. Industry structure continues its three-decade evolution through consolidation. Cooperative performance remains financially strong, but increasingly reliant on volume throughput, quality service, government farm programs, and attempts to capture efficiencies linked to economies of size. Industry segmentation by function (diversified vs. specialized) suggests that each is impacted by volume considerations, but to differing degrees.

Source: Casavant, Kenneth L., Jason Monson, Eric L. Jessup and Ken Duft. "Business Decisions in a Cooperative Environment." Journal of Business and Economics Research, Vol. 2, No. 6, The CIBER Institute, June 2004, pp. 71-75.

Rail Line Abandonment and Highway Preservation: A Case Study of Washington in the U.S.

BACKGROUND-MOTIVATION

Highway and railroad investments are directly interconnected. The Palouse River and Coulee City Railroad (PCC) currently operates 372 miles of light-density lines in eastern Washington. The PCC has raised the possibility that these lines may be targeted for abandonment in the next five years.

OBJECTIVES

The purpose of this paper is to describe the potential highway impacts that would result if the existing volume is moved in trucks to river ports or inland terminals. Two alternative techniques are described in the report: an incremental pavement thickness method and an environmental analysis procedure that isolates load-related and non-load (environmental) effects.

FINDINGS

Two new analytical techniques are described in this paper. A new environmental analysis procedure has been developed that improves the average cost approach used in earlier studies. An incremental thickness method has been developed that simulates the overlay thickness approach used in pavement rehabilitation. The

revised average cost and incremental thickness methods yield similar forecasts of future highway impacts in eastern Washington. Either of these procedures would be useful in future studies.

Source: Tolliver, Denver, Eric L. Jessup and Kenneth L. Casavant. "Rail Line Abandonment and Highway Preservation: A Case Study of Washington in the U.S." Proceedings, World Conference on Transportation Research, 2004. Istanbul, Turkey.

Idaho Transportation Department Weight Distance Conversion Study

BACKGROUND-MOTIVATION

The weight distance tax was enacted in 1951 and revised periodically until 1981. Since that time, there were only minor changes until February 22, 2000, when Judge McLaughlin issued his decision based on the American Trucking Association lawsuit. The court found that Section 49-434-9, Idaho Code, (the weight distance tax) was unfair to out-of-state trucking firms. Weight distance is a tax on commercial or large trucks based on the loaded maximum registered scale weight of the combination of vehicles. The settlement negotiations from the decision resulted in a registration system change. As a byproduct of that change, the Legislature requested annual reports concerning the revenue stream to the Highway Distribution Account from the new truck registration system from 2001 through 2004. To manage that reporting, the University of Idaho, through the National Institute of Advanced Transportation Technologies (NIATT), was hired as an independent consultant whose charge was to complete a study comparing the old weight distance/use fee system with the new registration-based system and report their final findings to the 2004 Legislature.

OBJECTIVES

This report does (1) analyze and compare Idaho's former and current truck tax system, (2) examine the impacts on intra- and inter-state truck operations, (3) evaluate economic and administrative impacts on affected taxpayers, and (4) provide recommendations.

FINDINGS

The results are that: (1) High-mileage firms gain as a result of the new system because they experience decreases in costs, on both a ton-mile and total cost of operation basis. (2) When considering the gas tax, increases are significantly less for low-mileage firms, and decreases are smaller for high-mileage firms. (3) Firms above 75,000 annual miles gain under the new system and those under that mileage experience increased cost per mile. (4) A University of Idaho pilot study on grains showed that little or no modal shifts would occur as a result of being shifted between rail/truck or truck/barge as a result of cost increases. Relative to the rest of the world, the Idaho grain industry did not lose competitiveness, so there was no shifting of competitiveness between modes.

Source: Jessup, Eric L. and Kenneth L. Casavant. "Idaho Transportation Department Weight Distance Conversion Study." Presentation to the Idaho Transportation Commission, Boise, ID. February 2004.

Truck Trip Data Collection Methods: Final Report SPR343.

BACKGROUND-MOTIVATION

Research is needed to develop and test truck trip data collection methods, which can produce data capable of better characterizing freight flows at the metropolitan level for transportation models and freight planning processes. Recent changes in supply chain distribution methodology, such as Just-In-Time or Off-The-Shelf, and the advent of significant trip chaining in intra-urban movements, create an intensified need for data that

reflect actual modal movements, rather than portraying the trips as simple origin-destination pairs. Such new levels of data specificity will allow real time and real location analysis to be undertaken. A productive truck trip data collection methodology, focused on movements at generators, entry points/gateways and activity centers, would provide a significant advancement toward achieving the overall goal of improved freight modeling and planning.

OBJECTIVES

The overall goal of this study was to identify a reliable data collection method capable of generating the information at a level of detail useful to ODOT's modeling and freight planning needs for data on truck movements at the metropolitan level. Such a method would then be available to other planning agencies in other states and the nation.

FINDINGS

Roadside interviews at a warehouse/distribution center and port facilities offered the most complete detail related to street address and ZIP code of shipment origins and destinations. Roadside interviews at interstate highway locations provided excellent trip origin-destination data for city and state detail, but less complete information for street address and ZIP code. Both mail and fax questionnaires offered less complete data related to trip origin and destination, especially for street address and ZIP code data detail. Identification of trip routes used by inter- and intra-regional shipments was best obtained through the roadside surveys. Information and data characteristics related to the facility or land use at specific freight stops was generally more complete via mail and fax surveys for the firms that participated in the survey. Roadside interviews provided the greatest detail and data for description of commodity, payload, weight, and vehicle configuration. The location of stops and trip generator data were not easily obtained from any of the tested data collection methods. The information related to volume of shipments into and out of warehouses and distribution centers was best obtained by either mail/fax surveys or via roadside surveys at the warehouse/ distribution center location.

Source: Jessup, Eric L., Kenneth L. Casavant, and Catherine Lawson. "Truck Trip Data Collection Methods: Final Report SPR343." Oregon Department of Transportation and the Federal Highway Administration. Salem, Oregon. February 2004.

Environmental Impacts from an Environmental Policy: Evaluating Drawdowns of a River to Aid Salmon Using GIS and GAMS

BACKGROUND-MOTIVATION

The U.S. Pacific Northwest has benefited from the multi-modal transportation infrastructure and competitive relationship that are present from truck, rail, and river transport of commodities. The Columbia and Snake River transportation system is an integral component of this multi-modal transportation system. This has caused the salmon habitat to decline dramatically throughout the Columbia-Snake ecosystem, causing several salmon species extinctions and listings as endangered species. One policy option to improve salmon recovery efforts is to lower the Snake River, thereby increasing water flow and simultaneously rendering the river un-navigable. Eliminating river transport will result in a modal shift away from barge transport and toward rail and truck.

OBJECTIVES

The overall purpose of this study was to determine the impact on energy consumption and emissions production for transporting wheat and barley from a drawdown of the Snake River, using regionally specific energy and emission coefficients. Specific objectives were to:

- Develop regional energy intensity and emissions production coefficients.
- Apply the regional coefficients to the model used in the Lee and Casavant study.[1]
- Determine the impact of the drawdown on energy and emissions related to transportation.
- Evaluate the implications of using regionally specific versus national energy coefficients in analyzing impacts of drawdowns.

FINDINGS

Three conclusions were drawn from this paper.

- Snake River drawdown decreases energy consumption.
- Emissions produced decrease from a Snake River drawdown.
- Regional coefficients for BTUs and emissions are negative and larger than national coefficients.

Source: Ball, Trent, Eric L. Jessup and Kenneth L. Casavant. "Environmental Impacts From an Environmental Policy: Evaluating Drawdowns of a River to Aid Salmon Using GIS and GAMS." Proceedings, World Conference on Transportation Research, 2004. Istanbul, Turkey.

[1] Lee, Nancy and Kenneth L. Casavant. "Transportation Energy, Emissions, and Endangered Species: An Environmental Paradox." Journal of the Transportation Research Forum published in Transportation Quarterly 56(2), (2002): 77-78.

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Cotton Transportation and Logistics: A Dynamic System

BACKGROUND—MOTIVATION

Modest information is known about cotton transportation and logistics in the United States. An effort is made to review the evolution of U.S. cotton transportation and logistics patterns over the past three decades. Many forces were found to have changed over this time period with the most important being a shift from primarily domestic market destinations to the international market.

OBJECTIVES

The objective of the paper is to document recent changes in U.S. cotton transportation and logistics, with a focus on Texas, a producer of one-third of U.S. cotton. The historic system that reflects flows when domestic cotton consumption was dominant (1970s - 1990s) is contrasted with the present export-based system, documenting and discussing important forces that changed the system such as the exiting of domestic textile mills and growing international demands which is a result of globalization. The documentation is based on secondary data on U.S. cotton exports and a recently completed cotton warehouse survey.

FINDINGS

The U.S. cotton market has undergone major shifts from having considerable domestic demand to primarily supplying foreign demands. These foreign demands are diverse but largely concentrated in Asia. This has impacted the cotton distribution patterns within the U.S. and Texas that supply cotton to port for export. Primary Texas cotton distribution patterns involve truck shipment to transshipment locations (containers) for rail shipment to West Coast ports, truck shipment to western Gulf of Mexico ports for export, and truck shipment to the Mexican border.

Source: John Robinson, J. Park, and S. Fuller. "Cotton Transportation and Logistics: A Dynamic System." Transportation Research Forum Annual Meeting, Boston, Massachusetts. (2007).

Briefing Paper on the Upper Mississippi and Illinois Rivers Transportation Corridors: Grain Transportation Rates and Associated Market Area

BACKGROUND—MOTIVATION

Inland waterways are important transport arteries for the transport of coal, grain, petroleum, construction materials, chemicals and low-valued, bulky commerce. Of particular importance to U.S. agriculture are the upper Mississippi and Illinois rivers which link the north central U.S. region with export grain facilities in the lower Mississippi River port area.

OBJECTIVES

The paper examines grain barge, truck, and rail rates to (1) evaluate relative transport rates for these modes and to compare railroad and barge rates from important grain export regions in Iowa and Minnesota to the U.S. Gulf export market and (2) offer insight on the geographic dimensions of the upper Mississippi River's grain market gathering area.

FINDINGS

As expected, rates per ton-mile are generally lowest for barge while truck rates per ton-mile are highest but all modes play an important role in the assembly and distribution of north central U.S. grain to domestic and export markets. Secondary grain flow studies suggested the river grain gathering areas extends from 90 up to 180 miles.

Source: Fuller, Stephen and Tun-Hsiang Yu. "Briefing Paper on the Upper Mississippi and Illinois Rivers Transportation Corridors: Grain Transportation Rates and Associated Market Area." FAPRI-UMC Briefing Paper #05-04, Food and Agricultural Policy Research Institute, University of Missouri, July 2004. http://www.fapri.missouri.edu/outreach/publications/umc.asp?current_page=outreach

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Process for County Road Planning

BACKGROUND—MOTIVATION

Transportation is a major industrial sector in its own right. As socioeconomic systems become more complex and as the global economy continues to expand, our dependence on a sophisticated and technically advanced transportation system will continue to intensify at an increasing rate. County road systems link much of rural America to the state highway systems and thus to cities. The county road systems also provide a means for residents of urban areas to access recreational, sport, scenic, and business opportunities in rural areas. The county road system is as important as the state and city road systems, and each of these systems is only as strong the other–they are highly interdependent. Counties must thus develop both long-term and short-term plans for improving and operating their transportation systems in order to maximize mobility while minimizing any deleterious effects on the environment or communities.

OBJECTIVES

The objective of the study was to develop a county road planning process. The aim of transportation planning is to satisfy the mobility goals and objectives of a community, subject to feasibility, resource, and impact constraints. Transportation planning is the mechanism for maximizing, within the constraints of limited resources, opportunities for mobility of goods, services, and people. The transportation plan must meet the needs of groups that have a great deal at stake in the county road transportation system, but that may also have different viewpoints.

FINDINGS

A county road planning process was developed that would facilitate the best use of scarce resources and that could be easily adapted to a county's unique situation. The planning process was used to create a county road plan for Cass County, North Dakota, and the process was modified during the project to reflect what was learned as the county's road plan was being developed.

The planning process recommended in this report consists of five basic steps with 15 associated activities. The process is intended to be used not only by county transportation administrators, but also by consultants and state Local Technical Assistance Program (LTAP) personnel. Consultants and LTAP personnel can provide counties with valuable assistance in using the recommended planning process and in developing county road plans.

Source: Griffin, Gene, Jill Hough, and Kathryn Harrington-Hughes. "Process for County Road Planning." Mountain-Plains Consortium Report-06-183. Upper Great Plains Transportation Institute, Fargo, North Dakota, April 2006.

Hearing on Rail Freight Transportation in North Dakota

BACKGROUND—MOTIVATION

Recent research suggests that it is the distribution system which makes the U.S. grain producing industry competitive in the global economy. It is also important to recognize that some of those efficiencies must be passed on through the supply chain to have an impact on the delivered price of grain and processed commodities. Regardless of exactly how the distribution of efficiency gains eventually takes place, it should be emphasized that an efficient, reliable, and equitable transportation system is critical to the viability of agriculture in the United States, one of the major industrial sectors of the U.S. economy.

OBJECTIVES

This hearing's objective was to present findings regarding the analysis of railroad revenues and costs. The revenue-cost study was restricted to wheat movement originating in North Dakota by the BNSF railroad.

FINDINGS

There appears to be three fundamental issues that are causing a great deal of consternation among grain producers and shippers, as well as those public sector entities responsible for transportation. They are: (1) the 110-car shuttle train program being developed by the BNSF; (2) the manner in which this program is being implemented; and (3) the so-called inverse rate structure. There is a great deal of anecdotal evidence regarding all three of these issues as well as much second-hand information.

Source: Griffin, Gene. "Hearing on Rail Freight Transportation in North Dakota." Upper Great Plains Transportation Insitute Staff Paper 147, North Dakota State University, Fargo, North Dakota, March 2002.

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Enhancing Passenger Mobility Services in North Dakota through Increased Coordination

BACKGROUND—MOTIVATION

In North Dakota, as in other states, individual human service agencies funded and/or operated transportation programs to support their basic missions. In addition, in recent years federal and state funding has led to the inception or expansion of public transit services in many areas of the state. Until recently, little attention has been paid to reducing duplication of services and coordination of transportation programs. However, in the past two years a new emphasis on coordination by the North Dakota Department of Transportation has led to an examination of the policy, funding, and operational options available to maximize the benefit of public transportation funds it manages and those of human service programs. This need to increase the effectiveness of transportation resources is crucial because of increasing needs for service and increasing difficulty in providing services especially in the rural western portion of the state where the overall population is declining and the remaining population is aging.

OBJECTIVES

The objective of this study was to identify and evaluate the current coordination efforts including an inventory of transportation options in North Dakota and recommendations on how the state could improve its coordination efforts.

FINDINGS

The best approach to encouraging coordination is to take steps at both the state and local levels. State approaches to promote coordination often are mandates (legislative or administrative) that require coordination at the local level and/or combine state funding from a number of sources into a single funding stream available only to coordinated systems. At the local level, coordination can be increased in response to the state mandates or incentives or it can be locally generated by programs to increase communication at the local level and by providing training and technical assistance to local providers. This study calls for the establishment of a state-level coordinating council and eight regional coordinating councils that include representation of providers and users of all publicly funded transportation programs. All state-managed transportation funds will flow through the regional coordinating councils. The state-level coordinating council will advise state agencies on funding allocations, ease barriers to increased coordination, and will oversee the activities of the regional councils.

Source: Hegland, Gary, Jim Miller, Jon Mielke, and Jill Hough. "Enhancing Passenger Mobility Services in North Dakota through Increased Coordination." Departmental Publication 160, Upper Great Plains Transportation Institute, North Dakota State University, Fargo, North Dakota, November 2004.

An Evaluation of Transportation Needs of the Disadvantaged in North Dakota, 2002-03

BACKGROUND—MOTIVATION

There are 25 different transit system operations covering the state of North Dakota and the four tribal nations located in the state. The clients served by the four centers for independent living are using these transit systems for their mobility.

OBJECTIVES

This report will show in detail results of the transportation survey of North Dakota's disadvantaged. It reveals that not all disadvantaged have adequate transportation services.

FINDINGS

The disadvantaged make up a significant portion of the North Dakota population. The demographics of the survey group were compared to the demographics of the disadvantaged at large and found that females and the elderly were represented by a higher percent in the survey responses than in the general population.

It was discovered that requiring a lift to access a vehicle did not seem to hinder the ability to drive a vehicle. The ability to drive a vehicle did have significant influence on earned income potential. Education also plays a role here, as the average educational attainment for the disadvantaged is lower than the average educational attainment of the general population. Mobility or the ability to go to school, to work, to medical appointments, go shopping and/or visit friends plays an important role in feeling and being included in society for the individuals that are at a disadvantage compared to the rest of the population.

Some of the disadvantaged do not want to use public transportation. Others would like to use it if it were available to them. North Dakota is striving to make public transportation available to all disadvantaged with the help of federal dollars. However, a higher percentage of North Dakota disadvantaged (36%) reported problems with transportation than the national average (30%). There still may be some negative stigma associated with riding public transit, or the other choices may be more convenient, as is evidenced by the fact that public transportation is the third ranked mode of choice.

Source: Hegland, Gary and Jill Hough. "An Evaluation of Transportation Needs of the Disadvantaged in North Dakota." Departmental Publication 151, Upper Great Plains Transportation Institute, North Dakota State University, Fargo, North Dakota, September 2003.

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An Assessment of Regional Road User Needs in Three Rural States

BACKGROUND—MOTIVATION

The states of Montana, North Dakota, and South Dakota are among the many states plagued by declining revenues for road budgets, increasing road user demands, and a deteriorating infrastructure. Decision makers are faced with difficult choices regarding the rural road infrastructure and allocation of limited resources. These choices are not likely to get easier in the future. Road users pay taxes and expect a safe and reliable infrastructure to move from one point to another.

OBJECTIVES

A survey instrument was designed and sent to individual road users in North Dakota, South Dakota, and Montana to measure the difference in perceptions between decision makers and users on paved and unpaved roads. The specific objectives of the study were to: (1) identify the rural road decision makers, (2) identify the rural road users, (3) gather information about the perceptions of decision makers regarding rural road decisions, (4) gather information about the perceptions of rural road users needs regarding the rural road system, and (5) use the information gathered to compare the perceptions between the rural road decision makers and rural road users.

FINDINGS

This study found significant differences in the perceptions of rural road users and decision makers regarding the rural road system. The perceived needs of the rural road users may always outweigh the available funding to improve or even maintain rural roads. The large geographic areas coupled with sparse populations will likely continue to plague rural areas and further challenge the decision makers who already make difficult choices in regard to the rural road system. The results of this study provide decision makers with a perspective of how users perceive the quality of rural roads. The findings validate the importance of good communication between decision makers and rural road users.

Source: Hough, Jill, Gary Hegland, and Crystal Bale. "An Assessment of Regional Road User Needs in Three Rural States." Mountain Plains Consortium Report-03-140. Upper Great Plains Transportation Institute, Fargo, North Dakota, April 2003.

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The Effects of Technologies on Commercial Vehicle Company Safety and Service: A Supply Chain Perspective

BACKGROUND—MOTIVATION

Because of the importance of safety, and the potential benefits for both the general public and the commercial vehicle industry of improving safety, the main goal of this project is to identify those commercial vehicle-related technologies that, through successful adoption, have had a positive impact on the safety of motor carrier companies. This is examined through two perspectives—one simply examining the effect of a technology implementation on safety and the second identifying the effect of a successful adoption of a technology on safety. It is hypothesized that technologies with factors that lead to successful adoption will have a greater safety impact.

OBJECTIVES

The main implication of this study for both commercial vehicle companies and government agencies is that simply implementing a technology, or advocating implementing a technology, may not give a desired result, and in some cases may even result in a negative impact on safety. The company needs to take the time to learn the technology and integrate it correctly for it to have a positive impact. Similarly, government agencies should examine companies that have successfully implemented certain technologies and that have a good safety record to determine the steps they took during the implementation. Providing this information to other companies examining implementation of a technology could prove very useful and assist toward a positive safety impact from the technology.

FINDINGS

The overall results are mixed. Considering the simple implementation of the technology, because of the high ratings of the freight mobility technologies in many adoption factors, the anticipation was that the use of these technologies would have a greater effect on safety than other technologies, such as the on-board safety monitoring technologies that do not rate high on average in any adoption factor. The models illustrate that the on-board safety monitoring technology of on-board computers for vehicle diagnostics have no significant effect on safety, in terms of either out-of-service inspections or crashes. Unfortunately, the models illustrate that technologies in both the freight mobility area and the electronic clearance area have a negative effect on safety. Across all these technologies in both areas, those with significant parameter estimates indicated that the use of these technologies had a negative safety impact.

Source: Lantz, Brenda. "The Effects of Technologies on Commercial Vehicle Company Safety and Service: A Supply Chain Perspective." Mountain-Plains Consortium Report-06-186. Upper Great Plains Transportation Institute, Fargo, North Dakota, December 2006.

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Evaluation of Strategic Logistics of Rural Firms

BACKGROUND—MOTIVATION

Logistics strategies and practices are essential elements for improving a company's competitiveness in domestic or global markets. Firms expanding into domestic and global markets from the Midwestern and Plains states need to employ efficient strategic logistics practices to compete. Geiger and Dooley (1998) identified problems with North Dakota firms adopting strategic logistics practices. The study identified leading-edge firms using a supply chain management philosophy and North Dakota firms that have adopted some or none of a supply chain management strategy. One conclusion was that leading-edge firms focus on strategic initiatives while the North Dakota firms focus more on day-to-day operations. The Geiger and Dooley study recommended that rural firms adopt a strategic logistics philosophy to position themselves as supply chain participants.

OBJECTIVES

This study focused on identifying current logistics practices in North Dakota and Minnesota firms and determining their participation in strategic logistics concepts. The project goals were to: 1) Analyze the supply chain management strategies of firms within North Dakota and Minnesota to determine if they employ a strategic logistics philosophy, and, 2) establish a case study(s) to determine the cost/benefits of employing the logistics strategies and determine a method of measuring the efficiency gains achieved by participating firms. The case study(s) may serve as a guide for other firms desiring to adapt a strategic logistics philosophy.

FINDINGS

Understanding logistics strategies and practices is essential to improving competitiveness in domestic and global markets. Firms expanding into domestic and global markets from the Midwestern and Plains states need to further employ strategic logistics practices to compete. Extensive literature review was conducted and used as a guide for developing survey questions relevant to the study objectives. This study indicated that North Dakota companies presently trail Minnesota companies with respect to information technology compatibility, EDI, and bar coding with respect to both capital expenditure and level of implementation. However, it may also be concluded that Minnesota firms initially have larger operating budgets for information technologies and, therefore, have advanced their capabilities based on capital expenditure.

Source: Lofgren, Mark and Mark Berwick. "Evaluation of Strategic Logistics of Rural Firms." Mountain-Plains Consortium Report-05-177, Upper Great Plains Transportation Institute, Fargo, North Dakota, October 2005.

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Survey of Implementation Strategies by Rural Paratransit Agencies Using Low-Cost Software

BACKGROUND—MOTIVATION

Every day, employees of coordinated transportation systems report to work to plan and deliver high-quality, safe, productive, personalized transportation service for members of the community who would otherwise be homebound.

The process of assembling productive routes is difficult and time consuming, complicated by the unique characteristics of both the supply—the tools and human resources—and the demand—the passengers and their trip requests. The following section will discuss some of those unique characteristics.

OBJECTIVES

The objective and daily task for a coordinated transportation system is to assemble the wide variety of individual requests for rides for the following day and create efficient, effective routes. The passenger takes some responsibility in this process as well; systems usually require flexibility from riders, including a time "window" in which their pick-up is considered acceptable.

FINDINGS

The size of agencies surveyed ranged from about 700 to 17,000 trips per month, and may be classified as small to medium. All of the agencies in this range benefited from low-cost computer software for the purposes of making trip reservations, scheduling trips, dispatching trips, record keeping, and reporting. Low-cost software included in this survey ranges from about $5,000 to $15,000 depending on the number of work stations, complexity of customizing the database to the community, and amount of training.

The principal data items that were considered necessary for each trip were client name and physical/ cognitive condition, age group, funder, provider, and trip purpose. For volunteers driving their own vehicles, revenue and non-revenue mileages were necessary.

The principal features that were considered important for the computer interface included: fast access to client and trip information, ease of creating trip tickets and subscriptions, color-coded visual display of trip tickets, drag-and-drop and point-point-and-click functionality, and convenient features for generating end-of-month report statistics.

Source: McGrane, Judy, William Grenney, and Cindy Johnson. "Survey of Implementation Strategies by Rural Paratransit Agencies Using Low-Cost Software." Mountain-Plains Consortium Report-04-161, Upper Great Plains Transportation Institute, Fargo, North Dakota, May 2004.

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Analyses of the Upper Mississippi and Illinois Rivers as Grain Transport Arteries: A Spatial Equilibrium Analyses

BACKGROUND-MOTIVATION

Grain is the primary commodity transported on the upper Mississippi and Illinois rivers, comprising about half of the tonnage on the upper Mississippi and 40% of the Illinois River traffic. It is estimated these rivers annually originate over 26 million metric tons (mmt) of corn and about 10 mmt of soybeans that are primarily destined for export at lower Mississippi River ports, a port area responsible for about two-thirds of U.S corn and soybean exports, which are important to the U.S. grain economy. All grain originating on the upper Mississippi, Illinois and Missouri rivers that moves to export at lower Mississippi River ports must traverse Lock and Dam 27, therefore a critical link in the system and focus of the catastrophic analyses.

OBJECTIVES

The objectives of this study are to (1) estimate the contribution of the upper Mississippi and Illinois rivers to grain producers' revenues in Midwest regions and (2) evaluate alternative grain transport routing that may be necessitated by a catastrophic event at Lock and Dam 27 near St. Louis. To carry out the objectives of the study, spatial equilibrium models representing the international corn and soybean economies in the 2003-2004 crop year are developed.

FINDINGS

The analyses shows the upper Mississippi and Illinois rivers to be important transportation arteries whose annual value to the Midwest grain economy could range up to $806 million. The scenario including greatest constraints on handling facilities ability to reroute commodities indicated annual producer revenue losses of $645 million and when railroads increased export rates 15%, losses grew to $806 million. Whereas, the scenario including least constraints showed annual revenue losses of $229 million but when railroads increased export rates 15%, producer revenue losses grew to $484 million. Therefore, the analysis suggests the annual value of the upper Mississippi and Illinois rivers for grain transport ranges from $233 to $806 million but based on the most likely scenario to range from $296 to $599 million.

Source: Fellin, Luis, Stephen Fuller, John Kruse and Seth Meyer. "Analyses of the Upper Mississippi and Illinois Rivers as Grain Transport Arteries: A Spatial Equilibrium Analyses." FAPRI-UMC Report #05-07, Food and Agricultural Policy Research Institute, University of Missouri, Columbia, Missouri, May 2007.

Analyzing Factors Impacting Locking Times on the Upper Mississippi River Comparing 600-foot and 1,200-foot Locks with a Look at Excessive Lockage Time Charges

BACKGROUND-MOTIVATION

Over the last two decades, there has been considerable debate regarding proposals to upgrade the lock and dam system on the Mississippi River. The lock and dam system on the upper Mississippi River consists primarily of locks which have a 600-foot long primary locking chamber. However, three locks on the lower system, which are of newer construction, have a primary locking chamber 1,200 feet in length and experience high levels of commercial traffic. Congestion on the river, defined as delay or time spent waiting in queue to lock at periods of high traffic volume, has been substantial during certain periods of the year.

Recent legislative initiatives have proposed constructing 1,200-foot locks beside several of the older 600-foot locks (18 and 20 through 25) on the Upper Mississippi that experience high traffic volumes and delays after grain harvest, reducing locking times and increasing the capacity of the system. However, the capital expense for such a large project has drawn considerable criticism and assertions that congestion could be reduced by less costly non-structural methods, such as fining or otherwise economically incentivizing slower operators.

OBJECTIVES

In order to evaluate the proposal to fine river operators for excessive locking time, it was necessary to determine factors influencing locking time as well as the source of variation in the locking time on the Upper Mississippi River. In the first step, the analysis corrects for factors such as the number and type of barges, lock, direction of travel, time of day and year, putting the operators on an equal footing. The remaining variation then more closely reflects the operational efficiencies of the individual vessels, and the variation that the fee would target to improve system efficiency.

FINDINGS

Imposition of congestion fees based solely on raw lockage time would be arbitrary as flotilla characteristics and environmental impacts beyond the control of the operator explained 78% of the variation in lockage time. Further, the remaining variation is quite narrow and little is explained by vessel identification number, indicting that lockage fees based purely on relative locking times would not provide the intended result. Importantly, the analysis also suggests lock capacity has declined over the 1992 to 2004 period for all locks through an increase in locking times all else held constant.

Source: Meyer, Seth and John Kruse. "Analyzing Factors Impacting Locking Times on the Upper Mississippi River Comparing 600' and 1200' Locks with a Look at Excessive Lockage Time Charges." FAPRI-UMC Report #21-06, Food and Agricultural Policy Research Institute, University of Missouri, Columbia, Missouri, October 2006.

Briefing Paper on the Demand for U.S. Commodity Exports and the Mississippi River: Past and Future

BACKGROUND-MOTIVATION

As part of the decision in evaluating the lock and dam upgrade on the Mississippi River, the U.S. Army Corps of Engineers has contracted with various agricultural forecasting companies to produce long-range projections of agricultural exports and the implied demand for Mississippi River transportation services. The future demand for barge transportation services is a key component in evaluating the value of lock and dam upgrades. Therefore, it is important to understand the volume of U.S. exports that utilize the river versus other modes of transportation. According to the Corps' 2002 data on agricultural commodity exports, 50 to 60% of corn, 30 to 45% of soybeans, and 2 to 8% of wheat was exported via the Mississippi River. Since corn and soybean exports account for the majority of agricultural commodities moved on the Mississippi River, evaluating the future export demand for these commodities is critical.

OBJECTIVES

The outlook for U.S. agricultural commodity export growth over the next 10 years varies by commodity based on the supply and demands in the United States and the rest of the world as well as transportation costs. The study uses FAPRI's January 2004 baseline outlook to evaluate the factors which determine demand for U.S. grain exports including exchange rates, income, Chinese demand, grain stocks, income distribution, domestic biofuel production, and to evaluate a likely range of exports over the next decade.

FINDINGS

U.S. corn exports, which account for 60% of agricultural volume, are projected to grow by 25% by 2013 to a level of 2.5 billion bushels based on world supply and demand growth. Stochastic analysis of U.S. corn exports puts a range of 1.8 to 3.2 billion bushels at the 10^{th} percentile and 90^{th} percentiles, respectively, with variability in world supply demand causing U.S. corn exports to move within this range. Variability in U.S. agricultural commodity exports will continue, especially with low world stock levels. U.S. soybean and wheat exports are expected to remain relatively flat with occasional export opportunities when shortfalls in production occur in other countries.

Source: Kruse, John, Seth Meyer, Abner Womack, and William Meyers. "Briefing Paper on the Demand for U.S. Commodity Exports and the Mississippi River: Past and Future." FAPRI-UMC Report #02-04, Food and Agricultural Policy Research Institute, University of Missouri, Columbia, Missouri, June 2004.

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Turtle Mountain and Rolette County Transit Development Plan

BACKGROUND—MOTIVATION

The Turtle Mountain Reservation is located in Rolette County in extreme north central North Dakota. The reservation and surrounding tribal lands are densely populated and have more residents per square mile than Cass County, North Dakota's, most populated county. Unemployment in the area is extremely high and income levels are expectedly low; 27% of North Dakota's Temporary Assistance for Needy Families (TANF) caseload is in Rolette County. Many area residents are transportation-disadvantaged.

This study is being undertaken to develop a transit management plan that will result in the provision of transit services that will better satisfy the personal mobility needs of residents of the Turtle Mountain Reservation and Rolette County, North Dakota.

OBJECTIVES

An advisory committee was formed to provide input and direction to this study. The committee included tribal and local government officials, human service and employment agency personnel, hospital representatives, administrators of local transit operations, representatives of local schools and the community college, and the North Dakota Department of Transportation.

The advisory committee was asked to identify and prioritize areas of need regarding local transportation services. The committee identified medical, compliance, and education-related transportation as priorities. These areas of need were confirmed via personal interviews and an employer survey. Interviews were conducted with approximately 25 local entities, including transit operators, county and tribal officials, human service and employment agency representatives, and school personnel. A transportation needs questionnaire was sent out to the county's 25 largest employers. The survey achieved an 80% response rate.

FINDINGS

This study's recommendations for service enhancements involves expanded service hours of existing operations, new service routes, expanded marketing efforts, and the addition of new administrative personnel and practices which will facilitate coordination and management of the expanded transit system. The authors outlined a Phase I, Phase II, and Phase III implementation strategy related to the recommendations presented in this paper.

Source: Mielke, Jon, Gary Hegland, James H. Miller, David Ripplinger, and Carol Wright. "Turtle Mountain and Rolette County Transit Development Plan." Departmental Publication 176, Upper Great Plains Transportation Institute, North Dakota State University, Fargo, North Dakota, April 2007.

Vanpooling in North Dakota: Feasibility and Operating Scenarios

BACKGROUND—MOTIVATION

North Dakota once had an active, state-sponsored vanpool program. The North Dakota State Highway Department (now the Department of Transportation) used federal highway monies to provide interest-free loans to help individuals purchase vans for use in vanpooling. At its peak, the department had over 30 vanpools in operation. Participation in North Dakota's vanpool program declined as fuel prices and interest rates dropped in the 1990s. These factors and the completion of several major power plant construction projects contributed to the program's discontinuance.

The situation facing many North Dakota commuters has changed again. Fuel prices have again risen to historic levels and the cost of commuting is consuming a greater portion of their personal income. Vanpooling at the national level is again increasing, up from 8,500 pools in 1999 to 10,000 pool in 2005.

OBJECTIVES

The objective of the study is to identify changes that have taken place relative to vanpooling since North Dakota's program was discontinued. This identification process includes a review of operating characteristics of several state and local vanpool programs that are in operation around the country and discusses federal incentives that have been created to encourage vanpooling.

The ultimate goal of this study is to determine whether North Dakota should renew its vanpool program and, if so, in what form.

FINDINGS

This study reviewed the operations of eight state-run vanpool programs and another seven programs that are run by local units of government. This review focused on the size of each program, funding sources, passenger fares, and overall operations. Some of these services are run with in-house personnel while others contract with commercial vanpool companies to administer and promote their programs. The experiences of these programs may be beneficial if North Dakota decides to re-establish a vanpool program for the benefit of its business community and state residents.

Source: Mielke, Jon. "Vanpooling in North Dakota: Feasibility and Operating Scenarios." Departmental Publication 174, Upper Great Plains Transportation Institute, North Dakota State University, Fargo, North Dakota, January 2006.

Personal Mobility in North Dakota: Trends, Gaps, and Recommended Enhancements

BACKGROUND—MOTIVATION

Personal mobility is vitally important to everyone. It facilitates personal livelihood and well-being and contributes to quality of life. North Dakota, given its rural nature, faces personal mobility challenges that are different than those of many other states. While heavily populated states wrestle with traffic congestion, air pollution, high parking costs, and frequency of transit services, major issues confronting North Dakota and other rural states are related to matters such as availability of service, sparse population densities, and aging populations. This study is part of a statewide strategic transportation plan adopted in 2002 by the NDDOT to provide a shared vision for North Dakota's transportation system.

OBJECTIVES

The plan's goals call for a transportation system that allows optimum personal mobility. One of the initiatives is the development of a statewide personal mobility plan. It takes a comprehensive look at transportation methods, demographics and geography in North Dakota to find ways to improve mobility for the state's residents. The purpose of this paper is to: (1) identity desired levels of personal mobility for various segments of North Dakota's population and various geographic areas, (2) identify gaps that currently exist regarding personal mobility in North Dakota, and (3) provide state policymakers with options concerning the enhancement of personal mobility for state residents.

FINDINGS

North Dakota is fortunate because the vast majority of its residents have a high degree of personal mobility. Further, the state has physical and service infrastructure in place that is capable of satisfying many of the mobility needs of residents who do not have direct access to a personal automobile. System refinements are needed, however, to make this infrastructure more responsive to residents' unmet needs. This study presents a wide range of recommendations regarding basic and supplemental levels of service, all of which would enhance the personal mobility of North Dakotans. Some of these recommendations, both base service and supplemental, involve administrative and operational issues which may be implemented without additional research. Others, however, may require further research to achieve maximum benefits, efficiencies, and effectiveness.

Source: Mielke, Jon, Jim Miller, David Ripplinger, Del Peterson, and Jill Hough. "Personal Mobility in North Dakota: Trends, Gaps, and Recommended Enhancements." Departmental Publication 165, Upper Great Plains Transportation Institute, North Dakota State University, Fargo, North Dakota, September 2005.

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Analyzing the Effects of Spring Highway Load Restrictions on North Dakota's Agricultural Freight Flows

BACKGROUND—MOTIVATION

A national summit sponsored by USDA and the St. Louis Regional Chamber and Growth Association on "Agricultural Transportation Challenges of the 21st Century" described the U.S. agricultural sector as the largest user of freight transportation services in the country. Agriculture is the backbone of North Dakota's economy. The agricultural freight generated in the state moves to both domestic and international destinations. This paper presents an agricultural freight demand model for assigning freight flows from farms to destinations. The model is customized to focus on the specific research objective, which is to analyze the effects of spring load restrictions on freight flows.

OBJECTIVES

The main objective of this research is to develop a statewide agricultural freight travel demand model for North Dakota and to use the model to analyze the effects of spring load restrictions on freight flows. Agricultural products comprise a sizable portion of freight flows in North Dakota. These freight flows from fields reach their final destinations through a series of transportation modes and intermediate transfer facilities. The spring load restrictions on state highways are transient and vary from month to month. To capture this transient effect the traffic assignment is done in four stages: i.e., in March, April, May, and the remainder of the year.

FINDINGS

The estimated cost of removing spring load restrictions from all state highways in North Dakota is over $300 million. The cost savings of these improvements for agricultural freight are small in comparison to the total highway improvement cost. However, it may be cost-effective to improve key access highways to large elevators and plants. In the future, individual link analyses must be undertaken to estimate the economic viability of segment-specific improvements that will remove the most onerous load restrictions.
Some of the contributions of this research are:

- An improved trip generation model based on satellite imagery which models the supplies of crops within sub-county zones
- Explicit consideration of various truck types and variations in trip delivery lengths in modeling internal-to-internal grain flows
- An incremental truck costing and highway assignment procedure which predicts the incremental truck VMT and VHT due to spring load restrictions
- Calibrated friction factors which are applicable to grain truck movements in North Dakota

Source: Mitra, S., D. Tolliver, A. Varma, and A. Dybing. "Analyzing the Effects of Spring Highway Load Restrictions on North Dakota's Agricultural Freight Flows." Accepted for presentation at the 86th TRB Annual Conference and Publication in Transportation Research Record, 2007.

Analyzing Satellite Imagery to Develop Freight Generation Data

BACKGROUND—MOTIVATION

Modeling agricultural freight flow necessitates the development of a crop production data base true to its spatial location and extent. The extent of agricultural production varies from a few acres to hundreds of acres with a heterogeneous mixture of different crops scattered throughout the state. This paper illustrates the use of satellite imagery and GIS tools to model agricultural production and its spatial distribution into a dynamic system to measure the freight flow from the field to the elevators and from the elevators to the final destinations.

There were prior studies on crop movement in different states, where primarily secondary data available for crop movements was used for freight modeling. In this study, the landsat imagery is analyzed to estimate crop production in 71,529 one-square-mile sections of the state. This disaggregated data was further aggregated to the TAZ (Transportation Analysis Zone) level to generate the production data for the statewide freight model. The trip attraction data is developed from the grain elevator survey report. The elevator locations are geocoded and added as a separate layer to develop a spatial analysis overlay model. This project also included the development of a highway and railroad network by including available GIS data from different sources.

This paper provides an overview of the broad areas in which remote sensing data applications were done in transportation projects. Specifically this paper delves into transportation planning applications.

OBJECTIVES

The objective of this project is to develop a comprehensive database of crop production regarding its spatial location and extent for the state of North Dakota and to model the crop flow from the field to the grain elevators. The commodity flow survey does not prove this data and the published annual report of NASS provides county level crop production data. A sizable portion of the agriculture freight flow takes place on the county roads. Therefore, it is required to develop sub-county level data.

FINDINGS

An important finding of this research is the methodology to analyze freely available satellite imagery produced by NASS to develop sub-county level trip generation data. This finding can be used by other states, as this imagery is available for 19 other states. The yield data used here was not very specific as there can be variation of production within a county and there can be changes in crop production from year to year. In the future, remote sensing data such as Normalized Difference Vegetation Index (NDVI), soil moisture, surface temperature and rainfall can be used to predict yield and give more accurate trip generation data. In the unavailability of satellite data in the future, the USDA Agricultural Baseline Projections to 2015 along with a relation of U.S. versus North Dakota crop production in the past can be used to forecast freight transportation demand in the state.

Source: Mitra, Subhro. "Analyzing Satellite Imagery to Develop Freight Generation Data." 20th AASHTO GIS-T Symposium 2007, http://www.gis-t.org.

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Transportation in Saskatchewan: History, Policy, and the Future

BACKGROUND—MOTIVATION

Due to its large area and scattered population, transportation links have always played a crucial role in the geography of Saskatchewan. They became especially critical as the economy of the region focused on external trade. Throughout the 20th century, agriculture and the grain industry were the driving force in transportation planning and related infrastructure investment. In recent decades, agriculture has declined in relative importance, but transportation remains crucial to the expansion and diversification of the provincial economy.

OBJECTIVE

The objective is to explore the development of transportation in Saskatchewan, focusing on three major networks - rail, road and air transport. A related objective is to examine some of the policies and initiatives that have contributed to today's transportation system.

FINDINGS

The continued evolution of transportation in Saskatchewan reflects ongoing changes in the provincial economy. Policies that helped create the dense rail and road networks of the early 20th century could not be sustained under the economic and technological changes of the post-World War II era. In the future, economic development and urbanization within the province are likely to increase demands on the provincial road network and will necessitate continued investment in local infrastructure.

Source: Nolan, J. "Transportation in Saskatchewan: History, Policy and the Future." to appear as Ch. 19 in Geography of Saskatchewan, Canadian Plains Research Centre Press, Regina, SK, 2007.

Pricing Access to Rail Infrastructure in Canada

BACKGROUND—MOTIVATION

Since the inception of the railway industry in Canada, fears about market power and rate discrimination resulted in a long-standing policy of oversight and regulation. The most recent process of regulatory review for the rail industry in Canada culminated with the Canada Transportation Act Review of 2001. This document discussed the possibility of implementing a track access regime in the Canadian rail industry, without offering specific details on how this might be accomplished.

OBJECTIVES

To show how such a policy could affect market structure in the rail industry, we develop representative regulated rail access rates applicable to Canada, using publicly available financial data from the Class I railways. We implement a pricing method sometimes used by the Surface Transportation Board (STB) for access cases in the United States. The SSW method is related to the well-known efficient component pricing rule (ECPR) for pricing access in other network industries. Interestingly, the access fee we compute using the SSW method is very similar in magnitude to access fees computed for the rail industry in Australia.

FINDINGS

Rail market power for the movement of certain goods is still a concern in Canada, with perhaps the greatest concern for the agricultural (grains) sector in Western Canada. In this light, we find that for a typical haul of grain on a unit train, the difference between actual rates and hypothetical rates are on the order of C$4-6 per ton. With a typical volume of over 20 million tons of grain moved each year, we conclude that potential entry in the rail industry under regulated or open access would help transfer some of the considerable economic rent now garnered by the major Canadian railways on this type of movement.

Source: Carlson, L. and J. Nolan. "Pricing Access to Rail Infrastructure in Canada." Canadian Journal of Administrative Sciences. 22, (2005): 45-57.

Commuting on the Canadian Prairies and the Rural/Urban Divide

BACKGROUND—OBJECTIVES

There is a growing division between urban/rural areas and policies in Canada. In particular, commuting patterns within rural areas are poorly understood. Using the 2001 census, commuting data from the western provinces (Manitoba, Saskatchewan, and Alberta) were analyzed. This paper is distinct from previous related research because it focuses on a very large region using updated micro-level data. In addition, we used geographic information systems analysis to help create a number of locational variables that were incorporated into the econometric analysis.

FINDINGS

We find that there is indeed a considerable and measurable urban/rural divide in commuting patterns in the study region. For example, in urban areas we find that the closer a census subdivision is to the urban core or CBD, the more likely its residents will commute shorter distances. Conversely, rural residents seem to be more concerned with access to jobs than reducing commuting distance. In rural regions, access to two-lane provincial highways increases the likelihood of residents commuting a greater distance. Overall, the results indicate that a very distinct set of policies will be needed to address commuting issues across rural and urban communities in Canada.

Source: Partridge, J. and J. Nolan. "Commuting on the Canadian Prairies and the Rural/Urban Divide." Canadian Journal of Administrative Sciences 22, (2005): 58-72.

Damn Lies Revisited: Revenue per Ton-Mile as a Rate Surrogate

BACKGROUND—OBJECTIVES

The continued productivity gains that have been garnered by railroads since the beginning of the American rail industry are well documented. Many studies have concluded that U.S. rail rates fell following deregulation. However, we question whether or not actual freight rates faced by shippers in the U.S. have fallen consistently as a consequence of rail deregulation in the 1980s. To begin, a discussion about the American experience with transportation de-regulation and its relevance to Canadian policy is described. The principal objective is to determine if revenue per ton-mile (RTM) accurately represents U.S. rail rates in the post-deregulation era.

FINDINGS

To this end, we examine the use of the commonly used revenue per ton-mile (RTM) measure as a proxy for rail rates. Considering related empirical work as well as a simple re-interpretation of the RTM equation, we conclude that RTM may not represent actual shipping rates very well, especially in the post-deregulation era. Objective assessments of the merits of the U.S. rail deregulation experience for shippers should not be made solely through examination of the widely available RTM measure.

Until the industry or appropriate regulatory bodies begin reporting and tracking time series of freight rates per ton for particular goods movements, the broader societal effects of U.S. rail deregulation cannot be clearly evaluated. Considering other modal studies (including U.S. public transit) conducted when appropriate data was available, it is our contention that it is highly unlikely the U.S. experience with rail de-regulation is the definitive success for shippers as claimed by some transportation researchers.

Source: Nolan, J. "Damn Lies Revisited: Revenue per Ton-Mile as a Rate Surrogate." Journal of Transportation Law, Logistics and Policy 71, (2004): 313-319.

Rail Infrastructure Management Policy: Applying a Real Options Methodology

BACKGROUND—MOTIVATION

Since the economic liberalization of the rail industry in North America, the rail industry has continually sought to increase operating efficiency. The selective abandonment of track in a rail network is one of the methods commonly used to reduce rail costs. The issue of rail line abandonment has proven to be more controversial in Canada than in the United States. Currently, the Canadian rail regulator uses cost benefit analysis (CBA) as a decision criterion to assess rail line abandonment proposals.

OBJECTIVES

By considering more modern methods of financial analysis, this article constructs a counterfactual re-examination of an interesting 1993 track abandonment case near Toronto, Canada. The objective is to reassess the case through the lens of a real options analytic framework.

FINDINGS

While this approach to abandonment decision-making appears to be best suited to lines with potential passenger rail uses, much of the controversy in Canada surrounding rail abandonment relates to grain dependent branch lines. It remains to be seen whether or not the suggested methodology will eventually be considered as a regulatory instrument to help support abandonment decisions for predominantly freight rail lines. However, real options analysis does show that if the variability of freight movement and associated revenues is high enough, the approach would be valuable to a regulator making a decision about further infrastructure abandonment. We find that a real-options approach generates a unique perspective and decision assessment that would be of interest to both sides of the rail abandonment debate in Canada and other jurisdictions.

Source: Law, S., A. MacKay and J. Nolan. "Rail Infrastructure Management Policy: Applying a Real Options Methodology." Public Works, Management and Policy 9, (2004): 145-153.

Agro-terrorism and the Grain Handling Systems in Canada and the United States

BACKGROUND—MOTIVATION

The grain handling sector in Canada and the United States is vital to agriculture and trade. Trade volume in the sector gives rise to some concern about the risks of terrorism. The grain and oilseed supply chain is noteworthy because much of it is characterized by relatively long-term, insecure bulky storage (particularly on farms) along with numerous modal and inter-modal product transfers. These factors suggest that there are many places where chemical or biological contaminants could be introduced into this supply chain.

OBJECTIVES

The objective is to use a real options approach to risk management to identify and prioritize hazards among seven critical sections along the grain supply chain system and to determine cost-effective strategies for mitigation of agro-terrorism threats to the U.S.- Canadian grain handling system. Two numerical simulations are developed with respect to agro-terrorism surveillance for U.S. wheat and corn production and associated handling and transportation systems.

FINDINGS

The analysis indicates that due to its high volatility and high net present value/cost ratio, only one link in the grain supply chain (the rail sector) needs to be considered for immediate investment in strategies to mitigate agro-terrorism. We conclude that the rail transportation and grain handling sector should rapidly undertake investments in tamper-proof seals for shipping containers. We note that this policy was also suggested by the World Health Organization in 2002.

Source: Nganje, W., W. Wilson and J. Nolan. "Agro-terrorism and the Grain Handling Systems in Canada and the United States." Current Agriculture, Food and Resource Issues (CAFRI: www.cafri.org) 5, (2004): 148-159.

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Small Transit Vehicle Industry Study

BACKGROUND—MOTIVATION

The supply chain for small transit vehicles has not received the same attention as that of the larger vehicles though it shares some of the same issues. A number of manufacturers have entered and left the market over the years, and a number of mergers and changes in ownership have characterized the industry. However, unlike the large bus industry, where federally supported purchases represent the majority of demand for each firm's products, manufacturers of small vehicles also serve other customer segments including private shuttle services and privately funded human service transportation. In addition to the issues faced by the large bus manufacturers, small bus and van suppliers face unique challenges because of the relatively small size of individual orders and the large number of competitors. From a transit agency perspective, there is uncertainty related to the quality of small transit vehicles produced as many are manufactured with a low-bid procurement process in mind. Although the Federal Transit Agency (FTA) and others have frowned upon procuring transit vehicles based solely on price, this practice still exists within the small transit vehicle market. When transit vehicles are unreliable, passengers view the agency as unreliable and an agency's reputation is degraded.

OBJECTIVES

The objective for this study is to provide FTA with information regarding the current state of the small transit vehicle industry. Also, the recommendations of this research will serve as a general procurement aid for bus manufacturers and transit agencies. The ultimate goal of this research is to discover procedures to improve the efficiency of the entire small transit vehicle procurement process.

FINDINGS

The authors began by discussing the current and future evolution of the market. They followed this with an overview of issues that have arisen in recent years pertaining to small transit vehicle procurement. Next, data analysis was used, including regression analysis, to gain a better understanding of the current small transit vehicle market. Finally, a combination of questionnaires and committee meetings were used to understand transit agency and manufacturer perspectives regarding the overall market as well as its smaller intricacies. The demand for small transit vehicles should continue to grow in coming years. Research objectives should be designed to educate and update individuals responsible for the well-being of the entire industry.

Source: Peterson, Del. "Small Transit Vehicle Industry Study." Departmental Publication 181, Upper Great Plains Transportation Institute, North Dakota State University, Fargo, North Dakota, April 2007.

Express Bus Transit Study: A Case Study

BACKGROUND—MOTIVATION

Clay County Rural Transit (CCRT) is considering the implementation of an express bus system to serve commuters between the Wahpeton-Breckenridge and Fargo-Moorhead metro areas, a 55-mile trip. CCRT runs a similar service between Detroit Lakes, Barnesville, and Fargo-Moorhead. The bus would stop at designated areas using a park and ride system. A questionnaire was created to determine travel needs of potential users and gauge potential interest in such a service.

OBJECTIVES

This project had five main objectives. (1) Determine the number of regular commuters between the Wahpeton-Breckenridge and Fargo-Moorhead metro areas, (2) make commuters aware of the cost of driving their personal automobile and compare that cost to that of using commuter bus service, (3) discover the willingness of commuters to utilize commuter bus service, (4) determine what commuter bus service features were of utmost importance to travelers, and (5) gauge the awareness of local commuters of commuter bus service and its features.

The report begins with a description of common commuter service features, followed by a discussion of the proposed commuter bus service. Survey design methodology is then discussed highlighting companies whose employees completed the survey. This was followed by survey results and findings.

FINDINGS

The questionnaire data provided some positive feedback for an express bus service. Of those who responded, only 13% said that they would not use the service. Also, if a guaranteed ride is available, such as a taxi, the 25% who indicated they would use the service rose to nearly 50%. The majority of respondents commute between the Fargo-Moorhead and Wahpeton-Breckenridge areas frequently, as most travel more than three days per week. As expected, most individuals do not want to wait long for bus transfers. However, providing more information should make users more conducive to the idea. The actual implementation of the service between Fargo-Moorhead and Wahpeton-Breckenridge has seen low ridership. Marketing techniques are being used to increase awareness of the route, but inefficient transfers between the commuter service and the Fargo-Moorhead local bus service is the primary obstacle to increased ridership.

Source: Peterson, Del, Jill Hough, and Dustin Ulmer. "Express Bus Transit Study: A Case Study." Mountain-Plains Consortium Report-06-178, Upper Great Plains Transportation Institute, Fargo, North Dakota, February 2006.

Advanced Small-Transit Vehicle Development Study

BACKGROUND—MOTIVATION

Most transit systems are designed and operated to serve urban areas with high population densities. However, a significant number of rural and suburban customers do not have access to regular transit operations. Several issues have impeded the growth of rural transit systems. Ridership tends to fluctuate and destinations are dispersed widely, making it difficult to select practical routes. Additionally, product and technology availability, as well as very limited transit budgets in rural areas, makes the acceptance and maintenance of industry advancements more difficult. Because of low demand, the cost-to-benefit ratio often makes any improvements less likely to obtain agency approval. Another indication of the need for improvements to rural transit is the current state of the fleets and infrastructure. In 2000, it was estimated that 59% of rural vans and 41% of rural small buses were past their expected lifetimes.

Increased rural transit funding through SAFTEA-LU will help small transit agencies update their bus fleets. Currently, many agencies are in a holding pattern as they anticipate funding increases for 2006. Procurement patterns could change dramatically within the next year or two as small agencies update their aging fleets.

OBJECTIVES

The primary objective was to determine the need for a bus designed to serve a specific rural market.

FINDINGS

The main goal of this research is to ensure that the small transit vehicle market is efficient at serving riders and transit agencies. One method to accomplish this is to develop either transit vehicle specifications or a specific transit vehicle to meet the specific needs of rural transit systems. Either of these approaches will lead to efficiencies by transit providers as a result of increased reliability and greater fuel economy while offering riders greater comfort with improved ride quality and greater vehicle maneuverability. The need for industry involvement throughout the study was paramount to a successful research outcome. Both transit agency and manufacturer opinions were given high priority in the effort.

Source: Peterson, Del. "Advanced Small Transit Vehicle Development Study." Staff Paper 164, Upper Great Plains Transportation Institute, Fargo, North Dakota, August 2006.

Meeting Small Urban Transit Needs in North Dakota: A Case Study Perspective

BACKGROUND—MOTIVATION

James River Transit is a paratransit system serving the Jamestown, North Dakota, community. It provided 50,180 one-way rides in 2000 and 45,100 one-way rides in 2001 while traveling 130,476 miles and 129,118 miles for those years, respectively. The system operates seven days per week and its ridership may warrant some form of fixed-route system.

Jamestown also has a large population of individuals with special needs. This large demographic group, along with FTA requirements, will not allow for the complete elimination of James River Transit's current paratransit system. However, implementing a fixed-route system and reducing the number of miles traveled and the number of individual trips provided by the paratransit service may allow James River Transit to reduce costs and charge lower fares for fixed-route service.

OBJECTIVES

This study evaluates the operational feasibility of altering the James River Transit paratransit system to include fixed-route service, and measures the improvement in service to residents as well as cost savings to the transit system riders.

FINDINGS

The survey results indicate that James River Transit is doing an excellent job providing its current paratransit service. Like most small towns, Jamestown is home to a large aging population that continues to age as the younger generation relocates to larger cities in search of greater opportunity. The concerns of the James River Transit riders are echoed throughout the country. Riders desire better and cheaper service -- desires which are virtually impossible to meet. A fixed-route system, or something similar, will make riding the bus in Jamestown more affordable for current riders and potential riders who currently use other means of transportation. Also, there seems to be a stigma connected to paratransit service in that only the elderly and handicapped use such a service, making a fixed-route option all the more desirable to increase James River's ridership as a whole.

Source: Peterson, Del, Dustin Ulmer, and Jill Hough. "Meeting Small Urban Transit Needs in North Dakota: A Case Study Perspective." Departmental Publication 159, Upper Great Plains Transportation Institute, North Dakota State University, Fargo, North Dakota, October 2004.

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U.S. Containerized Grain & Oilseed Exporters- Industry Profile and Survey- Phase II, 2002-03

BACKGROUND—MOTIVATION

Containerization has evolved from an industry serving niche markets to an industry creating niche market opportunities. The grain and oilseed industry is dominated by bulky, homogenized product marketing that is heavily reliant on economies of scale in delivering competitively priced commodities. At the same time, technological advances, foreign market privatization, and declining global market transaction costs have supported diversification of this industry in niche markets such as small-volume containerized products. This research suggests an established and growing U.S. shipper population is active in marketing containerized grains and oilseed products.

OBJECTIVES

The objective of this research was to create a profile of the U.S. grain and oilseed industry. The profile is based on survey responses from 47 shippers located across 19 states. The profile considers shipper characteristics, market practices, container export activity, and market growth factors.

FINDINGS

The survey suggested premiums for containerized grain and oilseed products are $5 per hundredweight, compared to the local bulk counterpart market. The net return to shippers is opaque as business practices and market fundamentals influence the costs associated with delivering the product to a customer overseas versus a local grain terminal or processor. Assuming market activity is positively correlated to profitability, the grain and oilseed container shippers would seem to be achieving acceptable levels of profit. Shippers reported container exports increased annually between 2000 and 2002, and are projecting it will increase another 20% by 2005. Although many factors affect industry ability to realize this growth, shippers deem ocean freight rates as most crucial. Ocean liner routes/services, distance to container terminal, and foreign buyer information are also rated as above average importance.

Source: Reichert, Heidi, Kimberly Vachal, and Tamara VanWechel. "U.S. Containerized Grain and Oilseed Exporters—Industry Profile and Survey—Phase II." Mountain-Plains Consortium Report-03-151, Upper Great Plains Transportation Institute, Fargo, North Dakota, July 2003.

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Designing a School Transportation Management System with Public Transportation Capabilities

BACKGROUND—MOTIVATION

In North Dakota, there has been widespread and growing concern about inefficient operation of school fleets and provision of transportation to students. In recent years, many of the state's rural communities have seen significant demographic changes including dramatic decreases in student age populations, enrollment, and school bus ridership. These trends are, in general, expected to continue. The presence of buses filled to less than capacity on rural highways and roads is a cause for criticism, appropriate or not, in many North Dakota communities. In many districts, the decline in enrollment and ridership has been paired with a steady or decreasing tax base and rising costs of education and related programs, including student transport.

OBJECTIVES

Given similar challenges facing rural pupil and non-pupil transportation providers and the success of the application of routing algorithm and coordination in other, primarily urban, locations, a pilot study to investigate the value of their introduction in a rural North Dakota school district was initiated. This report includes the findings from a pilot project in Enderlin, North Dakota.

FINDINGS

A profile of the Enderlin community and its reason for selection is presented. Current and projected demographic data is provided, as is information on the local economy, available services, and mobility issues. Possible high-demand locations for users of public transportation, both local and regional, are identified. This is followed by an overview of the process and results of the application of modern routing and school transportation techniques to the Enderlin School District. The report concludes with an outline of possible next steps and opportunities for further research on the issue.

Source: Ripplinger, David and Yan Wang. "Designing a School Transportation Management System with Public Transportation Capabilities." Staff Report 165, Upper Great Plains Transportation Institute, Fargo, North Dakota, March 2007.

Projecting Changes in Mobility-Challenged Populations in North Dakota

BACKGROUND—MOTIVATION

The efficient delivery of public transportation requires knowledge of the physical location of individuals who may benefit from service. Furthermore, given the dynamic nature of modern society, the design and operation of public transportation systems, as well as their oversight, must take into account changes in their communities to properly accommodate changing needs in the presence of limited resources.

OBJECTIVES

The populations of interest in the study, seniors, the disabled, students age 5 to 19, and households without vehicles, traditionally face greater mobility challenges than other members of their community. The objective of the study is to generate data that will aid in future public transportation research and policymaking in the state.

FINDINGS

In this study, the cohort-component method of population projection is used to project changes in the size of various age groups at five-year intervals from 2005 to 2025 for each of North Dakota's 53 counties.

This paper is divided into three parts. The first presents a current demographic profile of North Dakota which is valuable as a starting point for those unfamiliar with the size and distribution of subpopulations that traditionally face mobility challenges. This information is also needed to project future population sizes using the cohort-component method. The second section reviews the cohort-component method of population projection, the most common method used for calculating future populations. The third part of the paper presents the projected size of subpopulations of interest to public transportation researchers. Included as appendices are population projections by age and gender from 2005 to 2025 as well as for special population groups facing greater mobility challenges than the general population.

The paper includes a summary of relevant, existing data to assist in the understanding of the current size and distribution of populations of interest in North Dakota. Next, the conceptual framework behind the cohort-component method of population projection and its mechanics are reviewed. Finally, projections of age-gender groups and mobility-challenged populations by county calculated at five-year intervals from 2005 to 2025 are presented.

Source: Ripplinger, David. "Projecting Changes in Mobility-Challenged Populations in North Dakota." Staff Paper 163, Upper Great Plains Transportation Institute, Fargo, North Dakota, January 2006.

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Impacts of Transportation Infrastructure on the Economy of North Dakota

BACKGROUND—MOTIVATION

The focus of this study is on the potential role of transportation infrastructure in expanding sales of goods outside the state. Much of the freight exported from North Dakota moves by rail. Therefore, both highway and railroad system are analyzed. To the extent possible, the benefits and costs associated with infrastructure improvements are quantified.

OBJECTIVES

The primary objective of this study is to describe how improvements to the state's transportation infrastructure might "enhance the business climate and the state's competitive position in economic development, with a focus on the potential to expand the sale of goods to markets outside the state by strengthening the state's transportation infrastructure." Specifically, the study calls for an analysis of the benefits and costs of potential enhancements to the state's highways to allow load limits to be raised to more efficiently move goods to market. An integration of three key software models was used to perform this analysis. HERS-ST, REMI, and Cube were used separately and in conjunction to provide a broad picture of the impacts of North Dakota's transportation system. Various components of the study were coordinated with the North Dakota Department of Transportation and the North Dakota Aeronautics Commission to ensure that the results were realistic and applicable to the transportation planning process.

FINDINGS

It is not cost-effective to remove spring load limits from all state highways. The total estimated cost is $292 million. To justify this expenditure, the present value of all future cost savings must be equal to $292 million. If freight benefits are projected over a 20-year period, approximately $20 million in annual cost savings are needed to achieve a minimum B/C ratio of 1.0. The estimated cost savings to grain and manufactured goods are roughly $2.6 million per year. Other cost savings may be quantified for potatoes, sugar beets, oil, and other goods. However, the cumulative effects of these impacts are unlikely to equal $20 million per year. Nevertheless, the B/C ratios of projects that would eliminate spring load restrictions on certain key highways (such as highways providing access to shuttle-train elevators, processing plants, and industrial parks) may be quite good.

Source: Tolliver, Denver and Alan Dybing. "Impacts of Transportation Infrastructure on the Economy of North Dakota." Departmental Publication 187, Upper Great Plains Transportation Institute, North Dakota State University, Fargo, North Dakota, April 2007.

Trip Generation Rates for Large Elevators: A North Dakota Case Study

BACKGROUND—MOTIVATION

Trip generation rates are widely used for site impact analysis, travel demand forecasting, and highway planning. Trip rates for warehouses are published by the Institute of Transportation Engineers and the Transportation Research Board. In these studies, daily vehicle trips are based on number of employees, square feet of floor space, or land area. Although grain elevators are classified as warehouses, these facilities are much different from manufacturing warehouses and distribution centers. Typically, employees and floor space are not good indicators of the daily trips generated by grain elevators.

OBJECTIVES

Highway traffic studies, elevator surveys, and elevator market studies estimate trips to new or expanded elevators. Highway traffic counts are useful. However, a new facility may not reach its traffic potential for some time. Moreover, farm-to-elevator movements exhibit seasonal fluctuations that limit the usefulness of short-term traffic counts. Although elevator surveys are advantageous, they can be time consuming and difficult. Throughput volumes and traffic data are often viewed as confidential. Elevator market studies provide the most detailed forecasts of potential throughput; however, these studies require the demarcation of a market region based on the locations, sizes, and bid prices of competing elevators. Market territory studies are meticulous and specific to the facility and its competitive landscape. Clearly, a quick forecasting method is needed. This paper presents a generalized approach for highway planning, facility impact analysis, and traffic modeling. The objectives of the study are to estimate trip-rate equations for elevator facilities, provide estimating procedures that are generally transferable, and provide estimating techniques that can be readily and quickly applied using publicly available data.

FINDINGS

Elevator trip generation equations are estimated from detailed facility, land-use, and highway traffic data in North Dakota. A trip attraction equation is used to explain the effects of elevator storage capacity and side track capacity on elevator throughput. Elevators are classified on the basis of track capacity as shuttle train, unit train, and multi-car. Shuttle-train elevators typically consign 110-car trains, while unit-train elevators consign 50- to 100-car trains. The analysis shows that large shuttle-train elevators may generate 35,000 to 40,000 loaded and empty truck trips per year. A large unit-train elevator may generate 20,000 annual trips.

Source: Tolliver, Denver, Alan Dybing, and Subhro Mitra. "Trip Generation Rates for Large Elevators: A North Dakota Case Study." Mountain Plains Consortium Report-06-185, Upper Great Plains Transportation Institute, Fargo, North Dakota, December 2006.

Farm-to-Market Transportation Patterns and Truck Use in the Northern Plains

BACKGROUND—MOTIVATION

Much of America's rural economy is based on agricultural production. According to the Census of Agriculture, there were more than 1.9 million farms in the United States in 1997. These farms produced and sold products valued at $196,865 million. More than 300 million acres of cropland were harvested in 1997.

Most agricultural products are delivered from farms to processors, elevators, storage facilities, or final markets. The distribution chain for many agricultural commodities is long and complicated, involving several transportation modes and transfers of cargo. However, regardless of the destination, the first essential link in this chain is the farm-to-market movement. Many transportation statistics are published annually or in periodic censuses. The Commodity Flow Survey (CFS) provides information on shipments from elevators and processing plants to export locations or final markets. However, farm-to-elevator and farm-to-

processing plant movements are not covered in the CFS and are not described in detail in other sources. Most information on farm-to-market movements is derived from special studies.

OBJECTIVES

The objectives of the survey are to provide information on: the proportions of wheat and barley delivered to elevators, processing plants, and feed lots; the proportions of wheat and barley moved directly to off-farm locations during harvest; the proportions of wheat and barley stored on-farm after harvest; average farm-to-market trip distances and average trip distances on paved and unpaved roads; longest farm-to-market trip distances; the types and average numbers of trucks owned and leased by farmers in 2000; the projected types and numbers of trucks owned and leased by farmers in 2005; and average empty and loaded trucks weights.

FINDINGS

This study provides information about the types of trucks owned and leased by farmers and how these trucks are utilized. It complements other studies of farm-to-market transportation in the Great Plains region that provide detailed information about corn and soybean movements in the Western Corn Belt. This study provides detailed information about another important farm-to-market movement: wheat and barley flows in the Northern Plains.

Source: Tolliver, Denver, Mark Berwick, and Kimberly Vachal. "Farm-to-Market Transportation Patterns and Truck Use in the Northern Plains." Departmental Publication 167, Upper Great Plains Transportation Institute, North Dakota State University, Fargo, North Dakota, December 2005.

Grain Transportation in the Great Plains Region in a Post-Rationalization Environment

BACKGROUND—MOTIVATION

Much of America's rural economy is based on agricultural production. According to the Census of Agriculture, there were more than 1.9 million farms in the United States in 1997. These farms produced and sold products valued at $196,865 million. More than 300 million acres of crop land were harvested in 1997.

The distribution of farm products is a major source of transportation demand in rural areas. Grain and oilseed movements are especially critical in the Great Plains region. Most grains and other field crops are delivered from farms to elevators, processing plants, or intermediate storage facilities. Grain elevators are key links in the farm-to-market distribution chain. These facilities receive grains and oilseeds from farmers, which they merchandise and ship to final markets by rail, truck, and barge.

During the last 150 years, the technology of farm-to-market transportation has evolved from a horse-and-wagon system to a vast network of rural highways, commercial vehicles, and transfer and storage facilities. Many changes in transportation and marketing practices have occurred throughout the years. Many of these changes have been external to the farm. Nevertheless, they have affected farmers' delivery practices and altered farm-to-market trucking patterns.

OBJECTIVES

The main objectives of this project are to describe: (1) the general trends and effects of railroad rationalization on grain transportation, (2) farm-to-market transportation characteristics in the Great Plains region, and (3) grain elevator characteristics and transportation demand.

FINDINGS

The findings of this study are presented in three volumes. Volume 1 provides an overview of the project. In addition, it describes rationalization and its effects. Volume 2 continues this theme, focusing on farm-to-

market grain movements in the Great Plains region, where farmers deliver grain long distances to a limited number of large shuttle train elevators or mainline sub-terminals. Volume 3 of this study continues the theme by describing the transportation and marketing characteristics of Great Plains elevators. It provides important new information about elevator procurement practices and outbound elevator-to-market shipments.

Source: Tolliver, Denver and John Bitzan. "Grain Transportation in the Great Plains Region in a Post-Rationalization Environment." Departmental Publication 170, Upper Great Plains Transportation Institute, North Dakota State University, Fargo, North Dakota, December 2005.

Analysis of Revenues and Costs for Wheat Shipments Originated in North Dakota on the BNSF Railroad

BACKGROUND—MOTIVATION

The Uniform Railroad Costing System (URCS) is the general purpose costing system of the Surface Transportation Board. The focus in this study is on applications of URCS, not its design.

An analysis of railroad revenues and costs has been conducted for the hearing on Rail Freight Transportation in North Dakota held in Bismarck, N.D., March 27, 2002. The revenue-cost study is restricted to wheat movements originated in North Dakota by the BNSF railroad. The purpose of the study is to provide background information about the rates and costs of various railroad service levels.

OBJECTIVES

The primary objectives are to: (1) analyze the costs and revenue-cost ratios of wheat movements from North Dakota to major markets, (2) assess the relative efficiencies of BNSF service levels and shipment sizes, and (3) place BNSF revenue-cost ratios in the context of rate reasonableness.

FINDINGS

The waybill analysis of revenue-to-variable cost ratios and the analysis of current revenue-to-variable cost ratios for BNSF wheat movements to Portland and Minneapolis paint a similar picture. Both analyses suggest that North Dakota wheat shipments to Portland and Minneapolis are highly profitable for the BNSF. For all service levels in either analysis, the average revenue-to-variable cost ratio to either market is at or above 1.85. Moreover, for all service levels of 26 cars or more to either market, the average revenue-to-variable cost ratios exceed 2.43. For all service levels of 52 cars or more to either market, the average revenue-to variable cost ratios exceed 2.7.

Source: Tolliver, Denver and John Bitzan. "Analysis of Revenues and Costs for Wheat Shipments Originated in North Dakota on the BNSF Railroad." Departmental Publication 144, Upper Great Plains Transportation Institute, North Dakota State University, Fargo, North Dakota, March 2002.

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Annual North Dakota Elevator Marketing Research

BACKGROUND—MOTIVATION

The distribution and shipment data in this report was developed from the Public Service Commission reports that require elevators to report monthly movements of grains and oilseeds by truck and rail. The storage capacities reported to the ND PSC were used to calculate the turnover ratios. The 2005-06 numbers represent 95% of the required reports.

OBJECTIVES

The objective of this report is to provide a benchmark for elevator managers assessing performance, and supply a source for recognizing trends in the characteristics of North Dakota elevators.

FINDINGS

Five groups of data are presented in this report: (1) individual elevator performance (e.g. turnover) and distribution information (due to confidentiality agreements, each elevator receives individual data on only its own activities), (2) storage capacity, volume handled, and turnover ratios by elevator size and for each crop reporting district, (3) elevator distribution and modal choice for the state, (4) destination information for each of the state's nine crop reporting districts and each of the commodities, (5) modal selection for each of the crop reporting districts and for each commodity marketed. From this report, elevator managers are able to compare their performance to that of similar elevators (e.g. size and location).

Source: Vachal, Kimberly and Tamara VanWechel. "Annual North Dakota Elevator Marketing Research." Departmental Publication 180, Upper Great Plains Transportation Institute, North Dakota State University, Fargo, North Dakota, November 2006.

North Dakota Grain and Oilseed Transportation Statistics

BACKGROUND—MOTIVATION

This series began with the analysis of 1956-57 data and was published in Agricultural Economics Reports 15, 17, 44, 56, and 86 and Agricultural Experiment Station Bulletin 462. The compilation and analysis of data for the year 1967-68 in this series was assumed by the Upper Great Plains Transportation Institute. Also, the data representing the 1967-68 period were the first results of the requirements of the North Dakota Public Service Commission that all North Dakota elevators report monthly movements of grains and oilseeds by truck and rail. Prior to 1967-68, these data had been estimated from questionnaires completed by a sample of country elevators.

OBJECTIVES

This report represents a continuation of analysis concerned with the patterns and methods of distributing grain from North Dakota. The collection and compilation of this type of data began in 1956-57. The objectives of this report, like prior reports, are to provide the necessary database for identifying trends in the distribution of grain and oilseeds from North Dakota.

FINDINGS

The data used to analyze North Dakota grain distribution patterns for the period July 2005 through June 2006 were obtained from all country elevators in North Dakota. The data source is the North Dakota Public Service Commission's "Grain Movement Report." Every country elevator in North Dakota is required under state

statute to assemble and submit a "Grain Movement Report" to the Public Service Commission on a monthly basis.

Flow patterns for each type of grain are described in separate sections in the following order: (1) Total Grain and Oilseed Shipments, (2) Hard Red Spring Wheat, (3) Durum, (4) Barley, (5) Sunflower, (6) Oats, (7) Soybeans, (8) Corn, and (9) Canola.

Source: Vachal, Kimberly and Tamara VanWechel. "North Dakota Grain and Oilseed Transportation Statistics." Departmental Publication 179, Upper Great Plains Transportation Institute, North Dakota State University, Fargo, North Dakota, November 2006.

Annual North Dakota Grain and Oilseed Transportation Statistics, 2004-05

BACKGROUND—MOTIVATION

This report represents a continuation of analysis concerned with the patterns and methods of distributing grains and oilseeds from North Dakota. This series began with the analysis of 1956-57 data and was published in Agricultural Economics Reports 15, 17, 44, 56, and 86 and Agricultural Experiment Station Bulletin 462. The compilation and analysis of data for the year 1967-68 in this series was assumed by the Upper Great Plains Transportation Institute. Also, the data representing the 1967-68 period were the first results of the requirements of the North Dakota Public Service Commission that all North Dakota elevators report monthly movements of grains and oilseeds by truck and rail. Prior to 1967-68, these data had been estimated from questionnaires completed by a sample of country elevators.

OBJECTIVES

This report represents a continuation of analysis concerned with the patterns and methods of distributing grain from North Dakota. The collection and compilation of this type of data began in 1956-57. The objectives of this report, like prior reports, are to provide the necessary database for identifying trends in the distribution of grain and oilseeds from North Dakota.

FINDINGS

The same general commodity flow characteristics are considered in this report as in previous years' reports. Flow patterns for each type of grain are described in separate sections in the following order: (1) Total Grain and Oilseed Shipments, (2) Hard Red Spring Wheat, (3) Durum, (4) Barley, (5) Sunflower, (6) Oats, (7) Soybeans, (8) Corn, and (9) Canola.

Source: Vachal, Kimberly and Tamara VanWechel. "Annual North Dakota Grain and Oilseed Transportation Characteristics, 2004-05." Departmental Publication 172, Upper Great Plains Transportation Institute, North Dakota State University, Fargo, North Dakota, November 2005.

Annual North Dakota Elevator Marketing Research 2004-05

BACKGROUND—MOTIVATION

The distribution and shipment data in this report was developed from the Public Service Commission reports that require elevators to report monthly movements of grains and oilseeds by truck and rail. The storage capacities reported to the ND PSC were used to calculate the turnover ratios. 2004-05 numbers represent 95% of the required reports.

OBJECTIVES

The objective of this report is to provide a benchmark for elevator managers in assessing performance, and supply a source for recognizing trends in the characteristics of North Dakota elevators.

FINDINGS

Five groups of data are presented in this report: (1) individual elevator performance (e.g. turnover) and distribution information (due to confidentiality agreements, each elevator receives individual data on only its own activities), (2) storage capacity, volume handled, and turnover ratios by elevator size and for each crop reporting district, (3) elevator distribution and modal choice for the state, (4) destination information for each of the state's nine crop reporting districts and each of the commodities, (5) modal selection for each of the crop reporting districts and for each commodity marketed. Elevator managers will be able to compare their performance to that of similar elevators (e.g. size and location).

Source: Vachal, Kimberly and Tamara VanWechel. "Annual North Dakota Elevator Marketing Research 2004-05." Departmental Publication 173, Upper Great Plains Transportation Institute, North Dakota State University, Fargo, North Dakota, November 2005.

U.S. Grain Rail Market Indicators, 2004-05

BACKGROUND—MOTIVATION

Throughout much of the 2003-04 crop year, railroad service was characterized by shippers as unreliable and uneconomical. Market forces, including a good U.S. crop, a relatively small European crop, a weaker U.S. dollar, and most-favored nation status for China, were compounded by rail industry issues including overall rail traffic increases and rail labor shortages attributed to changes in railroad retirement policies. These factors created a fall and winter rail shipping season that was laden with service problems. Unreliability was associated both with delays in service, as well as a lack of communication between producers, shippers, and rail carriers regarding the current status of grain system service and plans for service level recovery. These service uncertainties led to many problems for shippers and producers, including elevators acting as storage terminals rather than transfer terminals, an inability for producers and elevators to deliver to financially attractive export markets, and premiums paid for guaranteed rail service that didn't materialize. Because of the concerns expressed by producers and shippers during the 2003-04 crop year, the STB is seeking to enhance the market indicator information it provides regarding rail grain service. A better understanding of current indicators and assessment of potential new indicators are both considered. The indicators are a means to communicate trends and shifts that have market implications for shippers, producers, and buyers, along with institutional inferences for policymakers.

OBJECTIVES

Secondary rail market prices for guaranteed grain service provide insight regarding U.S. rail service available to grain shippers. This analysis investigates alternative market information that may enhance indicators offered to gauge current and expected rail grain service levels.

FINDINGS

Findings add to the current knowledge base used for interpreting market parameters as indicators in current and expected rail grain service. Given the derived demand nature of transport, the relevance of demand variables such as manufacturing orders and outstanding grain sales is not surprising. In addition, more specific rail capacity measures such as average grain train speed and system dwell time also offer valuable rail grain service information. Although relationships are largely expected, the analysis offers new insight regarding the relative value of alternative secondary data sources as indicators of current and future rail grain service.

Source: Vachal, Kimberly and John Bitzan. "U.S. Rail Grain Market Indicators, 2004-2005." Departmental Publication 169, Upper Great Plains Transportation Institute, North Dakota State University, Fargo, North Dakota, November 2005.

Rail Grain Indicators Industry Survey, 2004-05

BACKGROUND—MOTIVATION

Railroads transport approximately one-third of U.S. grains and oilseeds from producing regions to domestic plants and export ports (U.S. Department of Agriculture 2003). Grain production is generally consolidated by trucks at inland grain facilities and loaded into larger barge and rail shipments because of the economies of scale in administration and operations for handling this bulky, natural-resource based commodity.

OBJECTIVES

The purpose of this survey is to ascertain information regarding management of rail service by grain shippers. A survey pool is queried regarding service levels, service prices, ordering practices, and the information used in managing rail grain service.

FINDINGS

Survey respondents handle an estimated 5.3 billion bushels based on the 174 businesses that reported average annual grain throughput. This volume represents about 23% of total U.S. grain usage in domestic and export markets. The average volume for all facilities was 8.1 million bushels. The 50-car shuttle facilities accounted for approximately 69% of all shipments and 80% of rail shipments in the survey response group.

Modal usage among the facilities averaged 57% for rail and 27% for truck, with the remaining 16% marketed via barge, based on a weighted average of annual shipments. Shuttle facilities, as expected, exhibited the greatest utilization of rail. These facilities shipped 65% of the grain they marketed via this mode. Rail share for shipments from multi-car and unit train facilities represented about 40% of the total traffic originated from these facilities. Single car grain facilities reportedly market about one in three bushels via rail.

Source: Vachal, Kimberly. "Rail Grain Indicators Industry Survey, 2004-05." Departmental Publication 168, Upper Great Plains Transportation Institute, North Dakota State University, Fargo, North Dakota, September 2005.

Annual North Dakota Elevator Marketing Research, 2003-04

BACKGROUND—MOTIVATION

The distribution and shipment data in this report was developed from the Public Service Commission reports that require elevators to report monthly movements of grains and oilseeds by truck and rail. The storage capacities reported to the ND PSC were used to calculate the turnover ratios. 2003-04 numbers represent 95% of the required reports.

OBJECTIVES

The objective of this report is to provide a benchmark for elevator managers in assessing performance, and supply a source for recognizing trends in the characteristics of North Dakota elevators. This report and the statistics mailed to individual elevators are presented as a source of information for elevator managers and those interested in the North Dakota grain industry. Continuation of the report as an annual project will be considered based on public response.

FINDINGS

Five groups of data will be presented in this report: (1) individual elevator performance (e.g. turnover) and distribution information (due to confidentiality agreements, each elevator receives individual data on only its own activities), (2) storage capacity, volume handled, and turnover ratios by elevator size and for each crop reporting district, (3) elevator distribution and modal choice for the state, (4) destination information for each of the state's nine crop reporting districts and each of the commodities, (5) modal selection for each of the crop reporting districts and for each commodity marketed. Elevator managers will be able to compare their performance to that of similar elevators (e.g. size and location).

Source: Vachal, Kimberly and Tamara VanWechel. "Annual North Dakota Elevator Marketing Research, 2003-2004." Departmental Publication 164, Upper Great Plains Transportation Institute, North Dakota State University, Fargo, North Dakota, December 2004.

North Dakota Grain and Oilseed Transportation Statistics, 2003-04

BACKGROUND—MOTIVATION

The data used to analyze North Dakota grain distribution patterns for the period July 2003 through June 2004 were obtained from all country elevators in North Dakota. The data source is the North Dakota Public Service Commission's "Grain Movement Report." Every country elevator in North Dakota is required under state statute to assemble and submit a "Grain Movement Report" to the Public Service Commission on a monthly basis.

OBJECTIVES

This report represents a continuation of analysis concerned with the patterns and methods of distributing grains and oilseeds from North Dakota. Data are tabulated according to major characteristics which typically describe commodity flows. The major shipment characteristics considered are destination, mode, origin, time and commodity.

FINDINGS

The same general commodity flow characteristics are considered in this report as in previous years' reports. Flow patterns for each type of grain are described in separate sections in the following order: (1) Total Grain and Oilseed Shipments, (2) Hard Red Spring Wheat, (3) Durum, (4) Barley, (5) Sunflower, (6) Oats, (7) Soybeans, (8) Corn, and (9) Canola.

Source: Vachal, Kimberly and Tamara VanWechel. "North Dakota Grain and Oilseed Transportation Characteristics, 2003-2004." Departmental Publication 163, Upper Great Plains Transportation Institute, North Dakota State University, Fargo, North Dakota, October 2004.

Transportation Quality Indices for Economic Analysis of Non-Metropolitan Cities

BACKGROUND—MOTIVATION

Non-metropolitan cities often play a pivotal role in economies of the surrounding region. Unlike larger metropolitan centers, commerce and trade generated by non-metropolitan regions may not be sufficient to create a competitive environment for freight or business travel. As the non-metropolitan cities and their surrounding regions make decisions regarding resource distribution, it is important to consider the transportation environment. A greater understanding of the competitive position of their transportation resources may allow them to more effectively enhance the regional economic development climate.

OBJECTIVES

This research offers estimates of the relative quality of freight and business transport service resources available to non-metropolitan cities across the United States. The U.S. economic geography is determined largely by its metropolitan population centers.

FINDINGS

The goal of this research is to estimate indicators of the relative service quality for freight and business travel among cities with 25,000 to 250,000 residents. The transport indicators provide information about the competitive position of cities, and their surrounding region. Findings suggest that transport services are largely a function of market competition for natural and manmade resources under the deregulated market scheme initiated with legislation passed more than two decades ago. These cities in the Midwest have the highest overall-quality freight services. A general weakness of overall freight-service quality indicators for this size city in eastern states, along with Florida, Tennessee, and Texas, is a concern because research suggests that there is a tendency for those lagging in transport quality to become more disadvantaged over time. Considering the quality of rail freight transport, non-metropolitan cities in the central and northern plains have an advantage in serving natural resource-based industries. The business travel indicator does not follow the same pattern for service quality, suggesting that freight and business travel resources are not allocated in similar ways. Although business travel service still is strongest for this size city located in eastern states, there is a distribution in the range of service qualities across states in the central, southern, and western regions.

Source: Vachal, Kimberly, John Bitzan, and Kenneth Button. "Transportation Quality Indices for Economic Analysis of Non-Metropolitan Cities." Departmental Publication 158, Upper Great Plains Transportation Institute, North Dakota State University, Fargo, North Dakota, July 2004.

Annual North Dakota Elevator Marketing Research, 2002-03

BACKGROUND—MOTIVATION

The distribution and shipment data in this report was developed from the Public Service Commission reports that require elevators to report monthly movements of grains and oilseeds by truck and rail. The storage capacities reported to the ND PSC were used to calculate the turnover ratios. 2002-03 numbers represent 95% of the required reports.

OBJECTIVES

The objective of this report is to provide a benchmark for elevator managers in assessing performance, and supply a source for recognizing trends in the characteristics of North Dakota elevators. This report and the statistics mailed to individual elevators are presented as a source of information for elevator managers and those interested in the North Dakota grain industry.

FINDINGS

Five groups of data are presented in this report: (1) individual elevator performance (eg. turnover) and distribution information (due to confidentiality agreements, each elevator receives individual data on only its own activities), (2) storage capacity, volume handled, and turnover ratios by elevator size and for each crop reporting district, (3) elevator distribution and modal choice for the state, (4) destination information for each of the state's nine crop reporting districts and each of the commodities, (5) modal selection for each of the crop reporting districts and for each commodity marketed. Through this report, elevator managers are able to compare their performance to that of similar elevators (eg. size and location).

Source: Vachal, Kimberly and Tamara VanWechel. "Annual North Dakota Elevator Marketing Research, 2002-03." Departmental Publication 155, Upper Great Plains Transportation Institute, North Dakota State University, Fargo, North Dakota, October 2003.

North Dakota Grain and Oilseed Transportation Statistics, 2002-03

BACKGROUND—MOTIVATION

This report represents a continuation of analysis concerned with the patterns and methods of distributing grains and oilseeds from North Dakota. This series began with the analysis of 1956-57 data and was published in Agricultural Economics Reports 15, 17, 44, 56, and 86 and Agricultural Experiment Station Bulletin 462. The compilation and analysis of data for the year 1967-68 in this series was assumed by the Upper Great Plains Transportation Institute. Also, the data representing the 1967-68 period were the first results of the requirements of the North Dakota Public Service Commission that all North Dakota elevators report monthly movements of grains and oilseeds by truck and rail. Prior to 1967-68, these data had been estimated from questionnaires completed by a sample of country elevators.

OBJECTIVES

The objectives of this report, like prior reports, are to provide the necessary database for identifying trends in the distribution of grain and oilseeds from North Dakota.

The data used to analyze North Dakota grain distribution patterns for the period July 2002 through June 2003 were obtained from all country elevators in North Dakota. The data source is the North Dakota Public Service Commission's "Grain Movement Report." Every country elevator in North Dakota is required under state statute to assemble and submit a "Grain Movement Report" to the Public Service Commission on a monthly basis.

FINDINGS

The same general commodity flow characteristics are considered in this report as in previous years' reports. Flow patterns for each type of grain are described in separate sections in the following order: (1) Total Grain and Oilseed Shipments, (2) Hard Red Spring Wheat, (3) Durum, (4) Barley, (5) Sunflower, (6) Oats, (7) Soybeans, (8) Corn, and (9) Canola.

Source: Vachal, Kimberly and Tamara VanWechel. "North Dakota Grain and Oilseed Transportation Statistics, 2002-03." Departmental Publication 154, Upper Great Plains Transportation Institute, North Dakota State University, Fargo, North Dakota, January 2003.

North Dakota Grain and Oilseed Transportation Statistics, 2001-02

BACKGROUND—MOTIVATION

This report represents a continuation of analysis concerned with the patterns and methods of distributing grain from North Dakota. The collection and compilation of this type of data began in 1956-57. 2001-02 totals are preliminary, representing 99% of the required reports.

The data used to analyze North Dakota grain distribution patterns for the period July 2001 through June 2002 were obtained from all country elevators in North Dakota. The data source is the North Dakota Public Service Commission's "Grain Movement Report." Every country elevator in North Dakota is required under state statute to assemble and submit a "Grain Movement Report" to the Public Service Commission on a monthly basis.

OBJECTIVES

The objectives of this report, like prior reports, are to provide the necessary database for identifying trends in the distribution of grain and oilseeds from North Dakota.

FINDINGS

The same general commodity flow characteristics are considered in this report as in previous years' reports. Flow patterns for each type of grain are described in separate sections in the following order: (1) Total Grain and Oilseed Shipments, (2) Hard Red Spring Wheat, (3) Durum, (4) Barley, (5) Sunflower, (6) Oats, (7) Soybeans, (8) Corn, and (9) Canola.

Source: Vachal, Kimberly. "North Dakota Grain and Oilseed Transportation Statistics, 2001-2002." Departmental Publication 147, Upper Great Plains Transportation Institute, North Dakota State University, Fargo, North Dakota, November 2002.

Annual North Dakota Elevator Marketing Report, 2001-02

BACKGROUND—MOTIVATION

The distribution and shipment data in this report was developed from the Public Service Commission reports that require elevators to report monthly movements of grains and oilseeds by truck and rail. The storage capacities reported to the ND PSC were used to calculate turnover ratios. 2001-02 numbers represent 95% of the required reports.

OBJECTIVES

The objective of this report is to provide a benchmark for elevator managers in assessing performance and supply a source for recognizing trends in the characteristics of North Dakota elevators. This report and the

statistics mailed to individual elevators are presented as a source of information for elevator managers and those interested in the North Dakota grain industry.

FINDINGS

Five groups of data were presented in this report: (1) individual elevator performance (eg. turnover) and distribution information (due to confidentiality agreements, each elevator receives individual data on only its own activities), (2) storage capacity, volume handled, and turnover ratios by elevator size and for each crop reporting district, (3) elevator distribution and modal choice for the state, (4) destination information for each of the state's nine crop reporting districts and each of the commodities, (5) modal selection for each of the crop reporting districts and for each commodity marketed. Elevator managers will be able to compare their performance to that of similar elevators (eg. size and location).

Source: Vachal, Kimberly. "Annual North Dakota Elevator Marketing Report, 2001-02." Departmental Publication 148, Upper Great Plains Transportation Institute, North Dakota State University, Fargo, North Dakota, November 2002.

U.S. Containerized Grain and Oilseed Exports – Industry Profile: Phase I

BACKGROUND—MOTIVATION

Competitive access to an array of agricultural markets is critical to agricultural shippers and rural economies. As producers and customers adapt to technologically advanced production and marketing systems, it is important to consider the potential the system offers for adding value to raw grain through alternative handling and transportation options. One sector that has garnered some attention recently is the sector delivering grain and oilseed products via container. Technological advancements in commodity shipping, grain production, crop handling, and communications, along with sophistication of buyer expectations and producer merchandising, and increasing container industry capacity may lend themselves to continued expansion of this sector.

OBJECTIVES

Limited and rather disjointed information exists for profiling the grain container industry and identifying trends for regional and national logistical planning. The goal of this project is to develop a profile of the U.S. containerized grain and oilseed export industry, including marketing activities, future expectations, information needs, and business practices. This profile will be completed for a planned two-phase project. The first phase, to be completed in this report, provides an environmental scan of the grain container industry. The information is based on secondary data sources. Important characteristics, such as location of grain container shippers, commodity spectrum, export volumes by port and destination, and rates, are considered in the scan. The second stage of the project will be a survey of the industry. The survey will be used to enhance and update the industry profile created in this project.

FINDINGS

The basic industry information included in this report provides a profile of the U.S. grain container industry. It is useful in identifying data voids that exist in addressing future needs and interests of this sector of the U.S. grain market. As U.S. producers seek to add value to their product through logistics and marketing, the container market provides many opportunities and challenges. Phase Two of this project will provide an opportunity to integrate the industry into data collection and distribution efforts with regard to the grain container industry. The communication between the industry, policy authors, and investment makers is critical in ensuring efficient and effective resource allocation for this sector of the grain industry.

Source: Vachal, Kimberly and Heidi Reichert. "U.S. Containerized Grain and Oilseed Exports—Industry Profile: Phase 1." Mountain Plains Consortium-02-132, Fargo, North Dakota, April 2002.

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Investment in Rural Roads: Willingness to Pay for Improved Gravel Road Service in Freight Transportation

BACKGROUND—MOTIVATION

States that rely heavily on agriculture depend on rural roads for agricultural-related transport. Agricultural states like North Dakota are often home to grain processors and terminals that are vital to nearby rural economies. Roads surrounding the processing facility are more susceptible to damage from frequent use by heavy equipment and therefore need to be optimally maintained. Many rural roads used to transport grain to processing facilities are gravel. Gravel roads offer less than ideal operating conditions for various reasons. Paved roads are convenient, not only for agricultural transportation purposes, but for general travel. However, more than 50% of the roads in the United States (1.6 million miles) are unpaved.

Given the current transportation funding climate, it would not be feasible to publicly fund the paving of even the more frequently used gravel roads. Because of this, innovative financing methods are becoming more important for rural road maintenance.

OBJECTIVES

This study focuses on ascertaining information on user willingness-to-pay and their perceptions of funding for improving gravel roads which support freight transportation service in rural areas. The objective was to assess and develop a profile of producers' opinions of rural road services in North Dakota. In cooperation with two agricultural entities located in the Enderlin, N.D., area, a survey was mailed out to 1,900 producers. The statewide survey drew a 10% response rate with 193 completed surveys.

FINDINGS

The most common category of improvement producers were willing to pay for is gravel road surfaces. Other popular answers for improvements include paved road surfaces as well as signs and safety. Survey respondents also say they are most willing to use cost participation, fines, or sales tax to finance rural road improvements when questioned about a variety of innovative financing methods. The results of this project are beneficial to rural states that are agriculture-based. It includes an assessment of the monetary amount the public is willing to pay for gravel roads and the amount they are willing to pay for paved roads. Determining the relative value of gravel roads and paved roads is included.

Source: VanWechel, Tamara and Kimberly Vachal. "Investment in Rural Roads: Willingness-to-Pay for Improved Gravel Surface in Freight Transportation." Mountain-Plains Consortium Report-04-168, Upper Great Plains Transportation Institute, Fargo, North Dakota, December 2004.

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Spatial Competition, Pricing, and Market Power in Transportation: A Dominant Firm Model

BACKGROUND—MOTIVATION

Much has been written about the spatial competition between firms. Generally, these models treat transportation as being competitive. Yet, transportation is replete with market power, and the railroad market, in particular, has become heavily concentrated in recent years. Yet, the level of market power varies over space. The nature of railroad pricing is very important to policymakers on questions of regulation and on the evaluation of the benefits to infrastructure and capacity investment. On the latter, for example, Army Corps of Engineers planning models for investments in the waterway generally take the railroad rate as given. Of course, if railroads profit maximize and react to competitive pressures, such investments will have an influence on railroad prices.

OBJECTIVES

The primary objective of this research is to develop a model of transport pricing wherein one mode (the railroad) has market power and the other mode (barge, truck-barge) is competitively determined. Demanders are located over space, and each point in space is priced by the railroad. There are several cases considered. In the first variant, the market areas of railroads with monopoly power are identical to those based on competitive pricing. Shipper quantities are fixed and railroads are not capacity constrained. In subsequent variants, demander reservation prices, alternative markets, downward-sloping shipper demands, railroad capacity constraints, and backhaul markets are considered. In some of these cases, the strong welfare property holds, while in others it does not.

FINDINGS

It is clear from this primarily theoretical work that market power varies over space and the degree to which market power can be exercised depends on distance from the waterway. When shipper quantities are variable, market power results in a deadweight loss, and when railroads are capacity constrained, shippers distant from the waterway face higher prices.

Source: Anderson, Simon P. and Wesley W. Wilson. "Spatial Competition, Pricing, and Market Power in Transportation: A Dominant Firm Model." Journal of Regional Science (Forthcoming). Planned May, 2008 issue.

Estimation on Stated-Preference Experiments Constructed from Revealed-Preference Choices

BACKGROUND—MOTIVATION

Estimates of transportation demand are central to the evaluation of transportation investment and policy. Yet, most studies of freight demand rest on aggregated data (time series or cross-sectional data) which typically yield imprecise estimates and/or are aggregated to levels beyond that used in benefit models. Further, the benefit models often require estimates beyond the range of available revealed data.

OBJECTIVES

The primary objective of this line of research is to develop a methodology that combines the realism of revealed data and also the added variability of stated preference data. To do so, stated preference data are constructed on the basis of the revealed choice. This allows an extremely convenient method to collect data for both destinations (origins) and modal choices. However, the stated preference attributes are endogenous

to the revealed choice. This paper derives and applies an estimation strategy using wheat shipments from the Columbia-Snake River basin.

FINDINGS

The paper reports a variety of specifications to illustrate the usefulness of the approach. First, a standard fixed coefficient model is estimated using only revealed data. Stated preference data are then added and yield much more precise estimates of key decision parameters. Finally, a mixed logit specification is estimated. This allows the response of different shippers to decision variables to vary randomly. This permits the distributions of responses to be estimated, and the results point to wide fluctuations in the responses of shippers.

Source: Train, Kenneth and Wesley W. Wilson. "Estimation on Stated-Preference Experiments Constructed from Revealed-Preference Choices." Transportation Research—B (Forthcoming).

A Description of the Inland Waterway System and Planning Models

BACKGROUND—MOTIVATION

A critical element of any economy is its transportation infrastructure. The rivers, locks, dams, ports, and the like that make up the inland waterway system are of particular importance to the U.S. transportation infrastructure. For many commodities and locations, transportation by barge via the inland waterway system is a cheaper, and more economically sound, form of transporting goods than either rail or truck. This is especially true of low-value bulk commodities.

OBJECTIVES

This research provides an overview of the waterway system in the United States. The overview consists of a description of the major waterways in terms of size, traffic, and trends. It also provides a snapshot of the suppliers of barge transportation in terms of the structure of industry and performance measures. Finally, a review is provided of the methods that are used to evaluate improvements in the navigation infrastructure. This description is accompanied by recent criticisms of the modeling and recent research designed to address the criticisms.

FINDINGS

The basic upshot is that there is tremendous opportunity in the modeling of networks and, in particular, the modeling of the waterway component of the network. This research should continue to include the development of theoretical models that are grounded in the realities of transportation decision-making and are, or fit directly into, equilibrium-based models. Given the recent development of equilibrium-based theory that is grounded in the reality of transportation decision making, the next step is the development of both data and empirical methods that allow the theories to be applied to evaluating the costs and benefits of alternative policies to improve the performance of the industry.

Source: Henrickson, Kevin E. and Wesley W. Wilson. "A Description of the Inland Waterway System and Planning Models." Jeremy F. Plant ed. Handbook of Transportation Policy and Administration. Middletown, PA: CRC Press (2007): 53-78.

Spatially Generated Transportation Demands

BACKGROUND—MOTIVATION

In the last 30 years, it has become common to model transportation demands at a disaggregate level, typically modeled at a shipment level using choice models. Differences in options available to shippers are taken as differences in the mode choice set from which demand decisions are made. This paper differs from this approach by explicitly recognizing that shippers without access to rail, barge, or both have the option of shipping to an access point. These access costs can have an important effect on shipment decisions.

OBJECTIVES

Transportation demanders are located at different points in geographical space and have differential access to modes. Central to the planning of transportation infrastructure is the aggregation of different shippers by mode over space. The primary objective of this research is to develop a method to illustrate the mapping of shipper choice-based-demands into aggregation used by the Army Corps of Engineers.

FINDINGS

A modal choice model is estimated for rail and barge, using data drawn from a survey of primarily agricultural shippers in the Columbia-Snake River Valley. The logit model is framed in terms of decisions to use a routing that involves rail or barge. If a shipper does not have direct access to rail or barge, it can access rail or barge through a truck shipment. The mode decision then is based on profit-maximizing decisions where profits are a function of barge and rail rates, access (truck) costs and the rail car loading capacity of the shipper. A primary econometric finding is that the "spatial" models commonly used are nested in the model and then tested. The results indicate that access costs, barge and rail rates, and shippers' attributes matter significantly in mode choice, and that commonly used spatial models do not apply to these shippers. Finally, a simple network model with shippers geographically distributed over a region is then used to illustrate how "pool" level demands can be derived from the logit results. Essentially, the choice model is augmented by truck rate functions defined over space and used to derive spatially generated modal demand functions.

Source: Train, Kenneth and Wesley W. Wilson. "Spatially Generated Transportation Demands." Scott Dennis and Wayne K. Talley eds. Research in Transport Economics: Railroad Economics. San Diego: JAI Press (Elsevier) (2007): 97-118.

Spatial Modeling in Transportation

BACKGROUND—MOTIVATION

Evaluations of alternative transportation infrastructure improvements necessitate the evaluation of equilibrium outcomes both with and without the improvements across alternatives. Transportation, however, is a derived demand. That is, it is directly linked to the products transported and, hence, depends on the spatial differences in the origin and terminal locations. The products travel from origin to destination over transportation networks and geographic space. The transportation may be provided by different modes that may compete with each other or may be essential to completing a service, and, therefore, have both substitution and complementarities across modes. There are few models that have the capacity to integrate some or all of these factors into an equilibrium framework.

OBJECTIVES

The Samuelson (1952) and Takayama-Judge (1964) model (S-TJ model) is described and then a transportation market is added to the model. We then develop a "full spatial" equilibrium model in which mode choices drive modal demand functions. The model is then used to illustrate and compare the benefits

from a full spatial model versus S-TJ. This latter is very comparable to the models used by the Army Corps of Engineers to assess water investments.

FINDINGS

The models are compared in the context of a lock improvement. In the application, we describe the model used by the U.S. Army Corps of Engineers along with comparisons to S-TJ. We then use the full spatial model to compare the welfare consequences of lock improvements against USACE's methodology. This comparison identifies differences that could seriously impact the calculations of net benefits accruing to transportation infrastructure improvements.

Source: Anderson, Simon P. and Wesley W. Wilson. "A Spatial Modeling in Transportation." Jeremy F. Plant ed. Handbook of Transportation Policy and Administration. Middletown, PA: CRC Press (2007): 255-280.

A Model of Spatial Market Areas and Transportation Demands

BACKGROUND—MOTIVATION

Transportation occurs over space and, in some markets, the locations of different shippers and the transportation of goods necessarily involves spatial competition locally. In this paper, a model is developed of transportation demand and the interrelated supply decisions of agricultural shippers over a geographic space. These shippers use prices to both procure grain and to make output, mode, and market decisions. These decisions are each affected by the characteristics of the region and the level of spatial competition between the shipper and its rivals.

OBJECTIVES

Each of these factors is integrated into a model of derived demand and spatial competition. The model is applied to data representing barge elevators on the Upper Mississippi and Illinois rivers to estimate transportation demands and gathering areas. The primary objective then is to develop a model of spatial competition and evaluate its role in the estimation of transportation demands.

FINDINGS

The results provide demand elasticity estimates for annual volumes between -1.3 to –1.9, estimates which are sizably larger than previous estimates of similar traffic. The results also indicate that inbound transportation rates to the barge shipper have a significant influence on annual volumes as does the distance to the nearest competitor. A second model, explaining the size of the market area of elevators is also estimated. We find that the rates of alternative modes that compete for barge traffic have a strong influence on market areas as does the distance to the nearest competitor. The results provide for a strong argument that transportation demands are elastic and that spatial market areas vary substantially with transportation rates.

Source: Henrickson, Kevin and Wesley W. Wilson. "A Model of Spatial Market Areas and Transportation Demands." Transportation Research Record: Journal of the Transportation Research Board No. 1909, (2007): 31-38.

Transportation Demand for Agricultural Products in the Upper Mississippi and Illinois River Basin

BACKGROUND—MOTIVATION

This report continues the line of research introduced by the Navigation and Economics Technologies (NETS) to examine the structure of transportation demands for use in planning models. Over the past three years, a series of demand studies has been conducted under the NETS program. These studies include a survey of the existing literature on transportation demand modeling which along with various National Research Council reports pointed to a need to develop models that reflect the alternatives that individual shippers face and the responsiveness of the choices they make to changes in not only rates but also the time it takes to make shipments and the reliability of the various alternatives. Under NETS, this need has been addressed through a series of surveys of individual shippers located in the Upper Mississippi and Illinois Waterway, the Columbia-Snake Waterway, and the Ohio River. All of these are available on (http://www.nets.iwr.usace.army.mil). In each case, survey methods were used to identify and target shippers that could plausibly use the waterway. To this end, survey methods focused on shippers of commodities that have a historical presence on the waterway and on shippers of varying distance from the waterway to capture the effects of space that are central to the decision to use the waterway.

OBJECTIVES

Using these survey data, the objective was to estimate demand models that yielded significant evidence that shippers respond to rates, time in transit and reliability. The responsiveness is two-fold. Shippers' discrete decisions (where and how to ship the product) and continuous decisions (the volume of shipments) are both embedded in most of the studies. In all cases, the analyses reinforce the notion that shippers respond to changes in attributes that can be affected by Army Corps of Engineers infrastructure decisions.

FINDINGS

This particular report continues this line of research by applying the methods developed to a sample of 480 agricultural shippers in the Upper Mississippi and Illinois River Water Basins. The results generally point to the importance of rates, transit time, and reliability in affecting transportation demand decisions. The elasticities generated were relatively inelastic demands.

Source: Train, Kenneth and Wesley W. Wilson. "Transportation Demand for Agricultural Products in the Upper Mississippi and Illinois River Basin." Institute for Water Resources Report 07-NETS-R-02, 2007. http://www.nets.iwr.usace.army.mil/docs/ModelPrefUpperMissGrain/07-NETS-R-02.pdf.

Network Pricing, Service Differentials, Scale Economies, and Vertical Exclusion in Railroad Markets

BACKGROUND—MOTIVATION

In many industries, production takes place over a network. A key feature of these network industries is that firm decisions on one component of the network may influence decisions on other components, that is, there is either demand or supply side interdependencies. In this examination, railroads make pricing decisions over the network. The pricing decisions involve multiple markets, and the railroads can use pricing in one market to make it more difficult for rivals to compete, or even may result in rivals opting not to participate in the market (foreclosure pricing).

OBJECTIVES

The primary objective of the research is to theoretically and empirically examine vertically related pricing decisions by a monopolist in one market and a cost-disadvantaged firm in another market.

FINDINGS

The empirical work focuses on rail rates for wheat movements. Rates are point to point and there are markets with and without the potential for vertical exclusion pricing. In the empirical work, railroad data was used which allow rates to be associated with origin–destination pairs and allow estimation of a disaggregate model of railroad pricing. These data are extremely rich and permit construction of data that allow this form of pricing to be empirically evaluated. In particular, a variable is created that identifies whether or not barge competition exists in an upstream or downstream market. This enables a comparison of rates with, and without, a barge connection enabling the predictions of the theoretical model to be empirically assessed. The central empirical result is that rates on monopoly links connected to links with the potential for barge competition are higher than on links without a barge connection. The results vary across commodity, but corn rates are 6% higher and wheat rates are 25% higher on the connected link than the associated rates on links that are not connected to a barge link.

Source: Burton, Mark and Wesley W. Wilson. "Network Pricing, Service Differentials, Scale Economies, and Vertical Exclusion in Railroad Markets." Journal of Transport Economics and Policy 40(2), (2006): 255-277.

Market Adjustments Over Transportation Networks: A Time Series Analysis of Grain Movements on the Mississippi Inland Waterway System

BACKGROUND

Transportation markets involve the movement of specific commodities between a multitude of origins and destinations by a variety of modes or combination of modes. Important demand drivers include the prices of the commodity transported and, in international markets, ocean freight rates. Econometric analysis, based upon structural models, is complicated by the complexity of the interrelationships and by the lack of sufficiently detailed and consistent data across modes. This paper overcomes the structural modeling problem by using time-series techniques, and overcomes the data problem by focusing on key variables implied by the structure. Impulse response functions and variance decompositions are used to characterize relationships among six variables in a VAR model designed to trace the interconnections among variables in the model. The model contains six categories of variables, including lockages, rail deliveries, rail rates, grain bids, ocean freight rates, and barge rates and looks at both short and long time horizons.

OBJECTIVES

The overall objective of the research is to uncover dynamic and market interrelationships for transportation markets. These involve terminal markets, modal, and time substitution patterns. The model is also used to both make and evaluate its forecasting ability. The model is estimated using Grain Transportation Report data produced by USDA and focuses on agricultural products and the Upper Mississippi River Valley.

FINDINGS

A central result is that both barge demand and lock supply shocks have significant effects on variables in the model. In addition, the other supply and demand shocks examined have significant effects as well. Generally, the estimated model includes the primary variables affecting transportation markets and provides an excellent tool for forecasting. The results suggest that there is a high degree of precision in forecasting out-of-sample. As is common in forecasting, the ability to forecast out-of-sample depends upon how far ahead the out-of-sample forecasts are made. Precision falls when the number of periods increases, but even for six period ahead forecasts, the out-of-sample forecasting performance is strong.

Source: Thoma, Mark A. and Wesley W. Wilson. "Market Adjustments Over Transportation Networks: A Time Series Analysis of Grain Movements on the Mississippi Inland Waterway System." Journal of Transport Economics and Policy 40(2), (2006): 149-172.

Leading Transportation Indicators: Forecasting Waterborne Commerce Statistics Using Lock Performance Data

BACKGROUND—MOTIVATION

Market participants often need information about future market conditions at the earliest possible date. This information is used for a variety of purposes. Transportation firms use forecasts to assess equipment needs, to negotiate rates, to assess cost recovery, and to make employment decisions. Government agencies use forecasts to gauge the quality of data collection efforts, validate trends in data, and provide information. Transportation statistics, however, are often released with a lag that is quite significant.

OBJECTIVES

The objective of the study is to develop a procedure for predicting future values of a variable based upon its past history and upon leading indicators that appear either at a higher frequency or are released between the release dates of the variable of interest. The example used to demonstrate the procedure was to predict waterborne commerce (WBC) annual tonnages using Lock Performance Monitoring System (LPMS) data which is released between WBC data releases.

FINDINGS

For total tons, in all years (1997-2001), the forecast error is less than 1.1%, and in three years is less than 1%. For farm products, the forecast error ranges from a low of 0.5% to a high of 4.3%. The corresponding forecast errors for coal are 1.1% (low) and -7.3% (high). In all cases, both the lagged value of the WBC variable and the LPMS variable are needed to produce the most accurate forecasts.

Source: Thoma, Mark A. and Wesley W. Wilson. "Leading Transportation Indicators: Forecasting Waterborne Commerce Statistics Using Lock Performance Data." Journal of the Transportation Research Forum 44(2), (2005): 33-44.

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Estimated Value of Barge Freight Rates for Commodities Shipped on the Missouri River and Implied Freight Savings

BACKGROUND—MOTIVATION

The value of the Missouri River as a transportation arterial has been one facet of the debate on the quantity and timing of reservoir releases on the Upper Missouri River and tributaries. To assess the value of the Missouri River for barge transport the Food and Agricultural Policy Research Institute at the University of Missouri conducted a survey of 39 terminals and businesses along the Missouri River from Sioux City, Iowa, to the mouth of the river at St. Louis during the first quarter of 2004.

OBJECTIVES

The purpose of the survey was to ascertain the economic value of barge traffic—freight rates on the river relative to alternative transportation (rail and truck). Terminals reflecting the greatest volume of business were specifically surveyed for shipment of grains and oilseeds, fertilizer, cement, asphalt, and sand and gravel. As a result, this survey should not be viewed as a complete set of business along the river; however, considerable effort was made to insure that all regions of the river were adequately represented.

FINDINGS

Reported in the table are the estimated differential transportation savings associated with the ability to move the entire commercial average tonnage (1,236,200 tons as reported by the Corps of Engineers for the period 1998-2002) by barge—a river situation that is viable for barge transportation of commercial commodities. In this case, the industry is estimated to save $10,427,126 as this reflects the differential cost of shipping 1,236,200 tons via rail and truck.

Table. Cost Savings Associated with Availability of River Transportation Based on 1998-2002 Corps of Engineers Estimates of Shipments and FAPRI Survey Estimates of Cost Savings per Ton

	Corps of Engineers Average Shipments 1998-2002	FAPRI Survey* Estimates of Savings vs. Alternative Transport	Total Cost Savings Using Corps Shipments and FAPRI Survey Costs
	(Tons)	(per ton)	
Grains and Oilseeds	527,400	$4.85	$2,557,890
Fertilizer	326,400	$13.16	$4,295,424
Asphalt	225,200	$6.76	$1,522,352
Cement	157,200	$13.05	$2,051,460
Sub-total Commercial	1,236,200	$8.43	$10,427,126

* Conducted between January and April 2004

Source: Womack, Abner and Joe Trujillo. "Estimated Value of Barge Freight Rates for Commodities Shipped on the Missouri River and Implied Freight Savings." FAPRI-UMC Report #05-04, Food and Agricultural Policy Research Institute, University of Missouri, Columbia, Missouri, April 2004.

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Wyoming Freight Movement and Wind Vulnerability

BACKGROUND—MOTIVATION

The movement of freight within the state of Wyoming is critical to Wyoming's economy as well as the national economy. Wyoming's transportation system provides a vital link for the movement of commodities across the United States, in addition to providing access to the mineral, industrial, and agricultural resources of Wyoming. Concern with freight transportation is often focused on several broad areas including economics, safety, effects of freight vehicles on transportation infrastructure, and in the forefront today, transportation security and homeland defense.

OBJECTIVES

The objectives of the research were twofold; first, to get an overall understanding of freight movement within the state including freight vehicle counts, commodity volumes, and freight vehicle accidents. The research focused on truck and rail freight movement because air and water freight movement represents a very small proportion of goods moved within and through the state.

The second was to focus on freight vehicle safety in strong wind conditions. High wind conditions frequently cause freight vehicles to be blown over, forcing the shut down of interstate roadways and halting the movement of freight through these heavily used corridors.

FINDINGS

It was found that more than 90% of freight (based on value) was moving through the state as opposed to intra-state movements. For freight moving to, from, or within the state, the majority by volume is moved by rail. When compared on a value basis, this percentage is significantly reduced because a large portion of the rail shipments is low-value coal. Coal makes up the vast majority of products exported based on volume. When comparing by value, chemical and allied products and farm products are the top two commodities.

The wind vulnerability aspect of this research linked rollover accident data with wind speeds from the closest weather station. Initial results showed that the correlation between the two was better than expected. Wind speeds are thought to be highly localized and it is surprising to see that high levels of correlation exist. This suggests that weather station data could be used for developing operational guidelines for freight vehicles using the roadways. This will be addressed in followup research.

Source: Young, Rhonda, Joel Liesman, David Lucke, and Shane Schieck. "Wyoming Freight Movement and Wind Vulnerability." Mountain-Plains Consortium Report-05-170, Upper Great Plains Transportation Institute, Fargo, North Dakota, June 2005.

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Price Dynamics in U.S. Grain and Freight Markets

BACKGROUND—MOTIVATION

Exploring the degree to which new price information (shocks) is transmitted between market locations has become a universal topic in the study of commodity prices. Empirical researchers on spatial price relationships and market integration have generally ignored transaction costs (e.g., transportation costs) in spatial price analysis though several researchers have confirmed the importance of transportation costs in spatial market integration. For grain commodities, transportation costs are particularly crucial since they account for a significant portion of traded grain prices. Additional information of transportation costs would facilitate the spatial price analysis for grain commodities.

OBJECTIVES

The objective of this study is to develop a better understanding of the spatial price linkages in the U.S. grain and transportation markets through a multi-market, multi-transportation, inter-temporal framework. This study would evaluate the U.S. corn market integration with transportation costs incorporated. Also, this paper estimates the dynamic impact of various freight rates, including inland waterway, rail and ocean shipping, on domestic and export corn prices.

FINDINGS

Results suggest the Mississippi Gulf (lower Mississippi River port area) is the most dominant corn market among evaluated export and domestic markets. Also, grain barge rates on the upper Mississippi/Illinois Rivers influence domestic corn markets in contemporaneous time. In the longer-run, significant dynamic relationships between prices in domestic and export corn markets and freight rates are observed; perturbations in transportation rates affect the variation in corn prices considerably.

Source: Yu, Tun-Hsiang, David A. Bessler and Stephen Fuller. "Price Dynamics in U.S. Grain and Freight Markets." Canadian Journal of Agricultural Economics, (forthcoming).

Effect of Lock Delay on Grain Barge Rates: Examination of Upper Mississippi and Illinois Rivers

BACKGROUND—MOTIVATION

The upper Mississippi and Illinois rivers are important transportation arteries for moving export-destined grain from the U.S. Midwest to lower Mississippi River ports. Central to navigation on the upper Mississippi and Illinois rivers are 37 aged locks and dams that maintain a nine-foot channel for barge transportation. Greatest concern centers on lock capacity in the lower portions of these rivers where comparatively high traffic congestion generates extended delays for barges/tows. Grain producers argue that lock delay on the upper Mississippi and Illinois Rivers unfavorably influence barge rates on these transport arteries and consequently the competitiveness of U.S. grain in the international market.

OBJECTIVES

The purpose of this study is to identify if lock delay has a statistically significant impact on grain barge rates through a causal analysis. If the result is affirmed, this study then measures the impact of lock delay on grain barge rates. The focus of the analysis is lock delay on segments of the upper Mississippi and Illinois rivers and grain barge rates that link sections of these rivers to lower Mississippi River ports.

FINDINGS

Causal analysis results indicate that lock delay in the lower reaches of the upper Mississippi and Illinois rivers does affect barge rates that link the north central United States to the lower Mississippi River port area. However, findings from multivariate time-series analysis suggest that the dynamic impact of lock delay on rates is not large: a one hour increase in accumulated lock delay at locks 18 through 27 will increase the south Minnesota and north Iowa rates to lower Mississippi River ports by 2.83¢ and 2.14¢ per ton, respectively. The accumulated delay at the Peoria and LaGrange locks, and the Melvin Price lock and lock 27 increase the south of Peoria rate by 2.55¢ and 2.58¢ per ton, respectively.

Source: Yu, Tun-Hsiang, David A. Bessler and Stephen W. Fuller. "Effect of Lock Delay on Grain Barge Rates: Examination of Upper Mississippi and Illinois Rivers." Annals of Regional Science 40, (2006):887-908.

Freight Transportation Demands on the Upper Mississippi and Illinois Rivers

BACKGROUND—MOTIVATION

The upper Mississippi River extends from near Minneapolis, Minnesota, to St. Louis, Missouri, and is a 663-mile segment of the Mississippi River, while the Illinois River extends from Chicago, Illinois, to its confluence with the upper Mississippi River (349 miles) just north of St. Louis, Missouri. Grain is the predominant commodity transported on these rivers. Navigation on the upper Mississippi and Illinois rivers is facilitated by a system of locks and dams that impound water for purposes of maintaining a nine-foot navigation channel. The lock and dam structures are aged and the proposal of renovating this system by the U.S. Army Corps of Engineers has generated considerable debate.

OBJECTIVES

Since the knowledge of freight transportation demand is central to transportation planning and lack of research initiatives in this area poses significant obstacles for transportation planners, the objective of this study is to estimate freight transportation demands for the upper Mississippi and Illinois rivers. Information on forces that shift the barge demand schedule will provide necessary information for the feasibility analyses. In addition, using a system approach to estimate freight demands may provide insight that was not revealed by single-equation estimation methods and other methodologies employed in earlier efforts.

FINDINGS

Analysis suggests seemingly unrelated regression to be a superior method for estimating each waterway's structural demand. Results show barge rates, foreign and domestic demands, floods, season, and river water level influence demands. Further, the analysis suggests that a detailed analysis of river freight demand is a necessary precursor of a defendable study into the economic feasibility of improving transportation infrastructure on the upper Mississippi and Illinois rivers.

Source: Yu, Tun-Hsiang, Jin Zhang, and Stephen W. Fuller. "Freight Transportation Demands on the Upper Mississippi and Illinois Rivers." Journal of Transportation Research Forum 45, (2006):119-36.

The Measurement of Grain Barge Demand on Inland Waterways: A Study of the Upper Mississippi River

BACKGROUND—MOTIVATION

The United States is the primary producer and exporter of corn, soybeans, and wheat. Most of the export-bound grain is shipped to Mexico, Asian, and European countries through the lower Mississippi River ports. The upper Mississippi River is the primary transportation artery for moving corn, soybeans and wheat production from the north central U.S. to the lower Mississippi River port area. Although the importance of the upper Mississippi to U.S. agriculture is considerable, the studies regarding demand for grain barge transportation on the river, however, are very few. Moreover, none of the previous studies yielded direct estimates of the price elasticity for grain barge demand on the upper Mississippi River. Knowledge of grain barge demand on the river is important to the barge industry, grain companies and policymakers.

OBJECTIVES

The purpose of this paper is to estimate the structural demand for grain barge transportation on the upper Mississippi River and provide useful information to barge industries, grain companies, and authorities that maintain and manage the lock system on the river.

FINDINGS

Barge rates have a negative effect on grain barge demand or the quantity of grain transported by barge from upper Mississippi River origins to lower Mississippi River ports. A 1 percent increase in the grain barge rate will lower quantity transported by barge an estimated 0.5 percent in the short-run. For a long-run perspective, the own-price elasticity is elastic (-1.015) under the ceteris paribus assumption. Foreign grain demands localized to lower Mississippi River ports, the rail rate for Minnesota-originated grain shipped to the Mississippi River, the winter season, and floods, are also the factors influencing grain barge demand.

Source: Yu, Tun-Hsiang and Stephen W. Fuller. "The Measurement of Grain Barge Demand on Inland Waterways: A Study of the Upper Mississippi River." Journal of Transportation Research Forum 44, (2005):27-39.

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