Dr. Stephen W. Fuller

Lifetime Achievement Award

Dr. Fuller is a professor in the Department of Agricultural Economics at Texas A&M University. He received his B.S. in Agricultural Economics (1962) and M.S. in Agricultural Economics (1964) from Kansas State University. After employment as a grain buyer for Continental Grain Company for 3 years, he returned to Kansas State University to study for a Ph.D. in Economics, which he attained in 1970.

In 1970, Dr. Fuller was appointed as Assistant Professor in the Department of Agricultural Economics and Agricultural Business at New Mexico State University, and in 1974 he was appointed as Assistant Professor in the Department of Agricultural Economics at Texas A&M University. Dr. Fuller was promoted to Associate Professor in the Department of Agricultural Economics at Texas A&M University in 1976 and to Professor in 1983. While at New Mexico State University, he taught undergraduate and graduate courses in agricultural marketing, finance, policy, and agribusiness management, and at Texas A&M University he instructed undergraduate courses in agricultural marketing and price analysis and a graduate course in marketing.

Fuller has authored over 60 refereed journal articles and in excess of 200 reports and papers that deal with agricultural marketing, international trade, and transportation. He has addressed issues relating to international trade and competitiveness, product quality, weather, and transportation. However, it is his research into transportation of agricultural commodities for which he is mostly widely known.

Rob Harrison, Deputy Director of the Center for Transportation Research at the University of Texas at Austin, stated, "I believe Dr. Fuller is one of the top five experts in the United States in the area of agricultural transportation economics." Professor Phillip C. Baumel, Distinguished Professor of Agriculture at Iowa State University, wrote that, "Dr. Fuller is one of the most prolific researchers on applied agricultural transportation and marketing issues in the U.S." Keith Klindworth, of The Fertilizer Institute and formerly with U.S. Department of Agriculture (USDA), writes that Dr. Fuller "became de facto expert in the late 1990s on the economics of capital investment in U.S. inland waterways, and was frequently contacted by the USDA and agencies at the federal level to provide research and insight on such issues."

Dr. Fuller's research has been applied with strong emphasis on economic theory and

quantitative analysis. Professor Richard Beilock of the Food and Resource Economics department at the University of Florida, writes that "Steve is recognized nationally and internationally for his contributions . . . due to the high quality of his work and that it typically has important and widely applicable implications." When the federal government phased out economic regulations on interstate motor carriers, Texas maintained its controls. Dr. Fuller took this opportunity to compare service qualities and rates under unregulated interstate and regulated intrastate movements of agricultural commodities. Dr. Beilock stated that, "The work became important in Texas deliberations . . . and it was frequently cited in similar deliberations in other states and . . . in reviews of transportation reforms by both the U.S. and Canadian governments."

Research by Fuller into the effects of railroad deregulation on U.S. agriculture in the 1980s helped influence federal policy. Klindworth writes that, "His work on the effect of railroad contracting with shippers helped influence Interstate Commerce Commission policy on public disclosure with regard to these contracts, and the USDA position on this major railroad deregulation issue." He was asked to serve on several national USDA task forces with regard to the overall effect of railroad deregulation on U.S. agriculture. His "research and extensive practical knowledge of the agricultural marketing system . . . influenced findings of these groups," wrote Klindworth.

Early in Fuller's career, he developed network models for tracing grain movements to port and international markets. Professor Babcock, Professor of Economics at Kansas State University, writes about Dr. Fuller's models, "Over the years he has continually improved these models up to the quadratic programming models that he uses today. These have been applied to international corn, wheat, sorghum, and soybean transportation models that are the envy of the agricultural transportation research community." His efforts to keep his research and models up to date have not gone unnoticed, as Professor Beilock of the University of Florida writes, "he did not achieve success and then sit on his tenured laurels nor has his work become stale or narrow."

The U.S. Army Corps of Engineers, Institute of Water Resources (IWR) have had Dr. Fuller develop spatial models of the international grain economies. These models feature excess supply and demand regions and are used by the IWR analysts to gain perspective on investing the Inland Waterway Trust Fund. Paul Bertels of the National Corn Growers summarizes this effort by writing, "Dr. Fuller's model is the key tool used to measure impacts on grain transportation. This work has raised Dr. Fuller to national prominence."

Fuller's research has often had an international dimension. Recently, he evaluated the impact of changing the pricing policy and possible closing of the Panama Canal. Before the United States transferred control of the canal to Panama, Dr. Fuller carried out an extensive research effort to predict how world trade flows and U.S. exports of grain and oilseeds would likely be affected. His research showed that world trading partners would be altered, the use of U.S. ports would change (more use of Pacific ports and less use of Gulf ports), and the volume of U.S. exports would decline about 2%.

During his career, Dr. Fuller has been honored four times by the Transportation Research Forum for his transportation research by receiving the Outstanding Paper in Rural Transportation award. In addition, he has been designated as a Faculty Fellow by the Texas Agricultural Experiment Station for scholarly accomplishments and meaningful contributions to science through exceptional research leadership and grantsmanship. Recently, Dr. Fuller served on a National Academy of Science committee to address Freight Transportation Needs for the 21st century. He has served on three editorial boards and has served on five commissions and boards to investigate state, national, and international transportation policy issues.

In addition to carrying out an extensive research program, Dr. Fuller has been a major professor for 15 M.S. and 10 Ph.D. students. He received the Departmental Undergraduate Teaching Award in 1993 and was advisor to the WAEA Outstanding Masters Thesis in 1994, and Outstanding Graduate Paper as designated by the Transportation Research Forum in 2003.

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Transportation Sector from the Perspective of an Agricultural Economist

Stephen W. Fuller

I am very honored to be a recipient of the Southern Agricultural Economics Association's Lifetime Achievement Award and to be included among current and prior recipients of this award. When Dr. Cramer telephoned to inform that I was one of this year's award winners, he indicated I might view presentations "of earlier award recipients" in the *Journal* (*JAAE*) to gain perspective on a topic for my address or I could discuss agricultural transportation, my research orientation for 25 years. After viewing earlier addresses by recipients over recent years, I was most impressed with the presentations and the mountain of wisdom that had been offered regarding our profession and related matters. It was at this point I decided to talk about transportation rather than repeat many of the notions offered by earlier recipients. Accordingly, my presentation will focus on transportation economics from the perspective of an agricultural economist. I view myself as an agricultural economist who has focused much of my research career on transportation issues that have affected agriculture.

In my generation, most who came to focus on transportation issues important to agriculture were not formally trained in transportation economics. As a graduate student, my interest in the spatial dimension was kindled by writings of Bishop, Bressler, French, Judge, King, Sammet, Seagraves, Seaver, and other agricultural economists who were primarily located at North Carolina State University and the University of California. My research products have often been based on the spatial formulations of Takayama and Judge, therefore an orientation that hinges on my training in agricultural economics.

My initial research project involved an effort to resolve the least-cost organizational adjustment of the Rio Grande Valley cotton ginning industry to declining cotton production and the introduction of seed cotton storage technology. In the research vernacular of the time, it was an optimal number, size, and location study. The objective was to identify the least-cost number, size, and location of gin plants in the region, taking into account assembly and distribution costs, economies of size in gin plant operations, and a temporal dimension that permitted storage of seed cotton. I gained considerable knowledge from the effort; however, little had to do with agricultural economics. The normative study showed that selected gin plants could be closed to the betterment of cotton farmers in the region. Naively, I failed to appreciate that these selected gin plants had owners who could be very passionate regarding the suggested disinvestment in their facilities. As a result, I received a verbal thrashing by several gin operators that I still remember after 30 years. Although the cotton ginning study had a spatial dimension, most transportation economists would not classify it as part of transportation economics. It would probably be classified as a study in plant location economics, one of several dimensions associated with spatial economics. Over time, however, my research has focused on transportation issues; at least, transportation economics journals have been willing to publish my research efforts.

Revolutionary improvements in transportation are often cited when explaining agri-

cultural development in a long-run perspective. Lundgren offers an overview of developments in maritime transport and its implications for seaborne grain trade, noting that current maritime rates in international grain commerce are about 15% of historical rates in 1870 because of improved propulsion systems and hull design. Lundgren shows how declining seaborne grain rates helped foster the industrial revolution in Western Europe in the 19th and early 20th centuries and the impetus this provided for grain production in North and South America, currently the source for 75% of the world's grain exports. Declining transportation rates, in combination with economies of scale, facilitated economic growth and geographic specialization, which in turn allowed countries to exploit factor endowments that enabled low-cost, efficient agricultural production. Lundgren concludes that reductions in seaborne transportation costs are central to explaining regional location for much of the world's agricultural production and its associated production efficiencies. Clearly, Lundgren's observations about efficient transportation and the facilitation of regional specialization with the associated production efficiencies is also applicable to domestic economies and must be partially responsible for the comparatively inexpensive food supply that we enjoy as American consumers. Similarly, the increasing globalization of the U.S. economy that has resulted from liberalized world trade policies has been facilitated by the globalization of supply chains, with transportation as a central activity.

The Focus of Agricultural Transportation Studies

The orientation of most agricultural freight transportation research is possibly best communicated by the simple trade model that features an export region, an import region, and linking trade panel with transportation costs. You may recall that the demand for transportation in the simple trade model can be mathematically obtained from the region's excess demand and supply relations. Therefore, the demand for transportation service is a derived demand and, in part, based on the demands and supplies of agricultural products. Further, you will recall that high transport costs choke off interregional or international trade, leading to comparatively low prices in origin markets and high prices in destination markets while an efficient, low-cost transport sector facilitates regional specialization allowing regions (countries) to exploit factor endowments that enable low-cost, efficient agricultural production and comparatively low consumer prices. It follows that any transportation development that affects the efficiency of the linking transportation activity is a candidate for analysis by an agricultural economist who focuses on the transportation function. This may be a changing transportation regulatory policy (e.g., rail merger, truck safety, maritime regulation), new transportation technology, or force that affects the efficiency of the transportation activity.

When instructing with the simple trade model, agricultural economists often focus their students on agricultural demands and supplies of exporting and importing regions and changing prices, while taking the linking transportation costs as given. Historically, in a highly regulated transportation environment it was appropriate to view the linking transportation rate as given in the simple trade model, but with the economic deregulation of the transportation sector, transportation markets have formed with market forces the determinant of transport rates. As such, it may be appropriate to complicate the simple trade model by including transportation markets in combination with agricultural product markets.

Transportation and Agriculture: Trends and Issues

Agriculture is highly dependent on an efficient and reliable transportation system. The USDA reports that the agricultural sector is the largest user of freight transportation services in this country. By aggregating the movements of raw agricultural commodities with the movements of processed products and agricultural inputs, agriculture accounts for about one-

third of all freight transportation service demanded in the country (USDA). This observation is reinforced by a previous U.S. Department of Transportation (USDOT)study that used input–output methods to determine the extent to which transportation is incorporated into the output of various sectors. Their study shows $0.15 of transport service required for each $1 increase in final demand for agricultural products, the highest transport requirement of any sector (USDOT). It follows that transport costs embodied in agricultural product prices are comparatively great, hence the potential importance of transport cost on product price, and region and country competitiveness.

The USDOT indicates that trucks are the primary carriers of agricultural products. They estimate that trucks generate about 45% of all ton-miles associated with the carriage of agricultural products and carry about 66% of the transported agricultural tonnage. Railroads follow with nearly 32% of total ton-miles moved, although their share is much higher for selected commodities that move in bulk. Barges have a 12% modal share, most of which is accounted for by movements on the Mississippi River and its tributaries. The remaining 11% is attributed to pipelines, air transport, and what is classified as other (USDA).

Fortunately, for U.S. agriculture, the United States possesses probably the finest freight transportation system in the world. However, there are important issues and challenges facing the transportation sector that have ramifications for agriculture.

Roadways and Trucking

The development of truck and roadway technologies in the 20th century freed many agricultural businesses from the need to locate near rail lines. The interstate highway grid network initiated during the mid-20th century now connects cities and regional economies. The majority of the nation's gross national product is created in proximity to the interstate highway system. Currently, trucks move about 78% of the nation's domestic freight tonnage and compete with passenger cars for highway capacity (AASHTO). At selected points in the largely public-funded highway system, primarily in the vicinity of metropolitan centers, highway congestion is becoming intolerable. Highway congestion maps produced by the USDOT show numerous areas where highway congestion is critical. Congestion disrupts truck freight service by making trips slower, less reliable, and more expensive (AASHTO). Agriculture, as well as the rest of the economy, is affected by highway congestion since much of the agricultural output moves to these centers, where most of the nation's consuming population is, or through these centers to destination markets. Some argue that the nation's dependence on motor carriers and the resulting highway congestion is an outcome of bad transportation policy that has subsidized trucking by not requiring it to bear the full cost of using public highways. Regardless, the highway capacity problem exists and the historic solution of pouring more concrete to expand capacity is less feasible since the social, economic, and environmental cost of expanding highway capacity is becoming prohibitive. This suggests the need for better management of our highway infrastructure through peak-loading pricing schemes, and the development and installation of intelligent transportation systems and other technologies.

Although agriculture is unfavorably affected by highway congestion, the most detrimental impact will be diminished resources for the rural road system. Urban interests demand that scarce highway dollars go for congestion mitigation, noise and air pollution abatement, and mitigation of environmental degradation, leaving fewer transportation resources for rural areas. This is particularly unfortunate since rural areas have become increasingly dependent on motor carriers as a result of railroads' disinvestments in the rural transportation network.

Railroads

As a result of economic deregulation of the railroad industry in 1980, railroads have been restructured through merger and reorganization. System mileage has been reduced by half since the peak in 1920 and the number of class

I carriers has declined from 40 to 7 since 1980. These long-distance, class I carriers account for about 71% of rail route mileage and 91% of revenues. The remainder of the rail activity is undertaken by regional and short-line railroads. Before 1980 there were 220 regional and short-line carriers, but since 1980 the number has increased to 551. Economic deregulation permitted class I carriers to shed low-density traffic lines that facilitated the dramatic increase in regional and local carriers. The merger of class I railroads has also created redundant trunk lines that were purchased by regional carriers (AASHTO).

The smaller railroads, the local and regional carriers, are particularly important to agricultural and rural shippers since they have preserved railroad service for some rural communities. The regional and local railroads act as a gathering system for the class I carriers who facilitate the long-distance haulage required for many agricultural products. Unfortunately, the survival of the small railroads is in question. Among the factors affecting the economic viability of short lines is their dependence on connecting class I carriers and disputes associated with sharing of freight revenues, changes in the railroad industry due to merger and technology, and the poor track condition of the lines on which short lines operate. Unfortunately, demise of the small railroads places increased demands on rural roads and their maintenance, for which additional funding is questionable.

Those states east of the Mississippi River are dominated by two class I carriers, the CSX and Norfolk Southern, whereas the Western states are dominated by the Union Pacific and Burlington Northern/Santa Fe systems. Other class I carriers are the Canadian National and Canadian Pacific Railroads and the Kansas City Southern Railway. Two Mexican railroads would qualify as class I railroads if they were U.S. companies. They are Transportacion Ferrovaria Mexicana, which is partially owned by the Kansas City Southern Railway, and the Ferrocarril Mexicano, which is partially owned by the Union Pacific Railroad. As the names and ownership linkages imply, the U.S. railroad network has evolved into a North American system with links into Canada and Mexico.

In the "freight transportation service spectrum," railroads occupy a place between and overlapping trucking and water transport. Railroads compete with trucking for higher-value product transportation and containerized shipments moving longer distances. It is often the preferred mode for a number of economically important, but heavy and bulky, commodity groups such as coal, grain, and minerals. Railroads have become central to long-distance haulage of U.S. grain to export and out-of-region markets, with most moving in unit or shuttle trains that often include over 100 cars. Railroads have offered incentives to grain receivers/shippers to modify facilities to accommodate large multicar shipments, and in so doing have modified the structure of the industry. Many grain handlers have become frustrated with the class I carriers and the incentive they offer to restructure the grain industry. Much of this frustration is due to the increased concentration of class I carriers and their market power, redefinition of the common carrier obligation, the shrinking rail network, the push for shuttle train operations, an altered car ordering and rate-setting procedure, and other factors due to deregulation of the industry.

Along with the bulk transport service offered by railroads is the intermodal or container service that is increasingly important for the transport of high-value agricultural products (e.g., meat, fresh produce) into international markets. Containers are also important to the biotechnology revolution since they offer the potential to segregate specialty grains and oilseeds with high-value traits. Containerized, refrigerated transportation has been central to the 275% increase in meat exports during the past decade. Hudson argues that the static whole-grain export levels during the past decade offer a misleading view as to the role of the international market for agriculture when considering meat and processed grain exports made possible via containerized transport. In particular, Hudson argues that after accounting for containerized exports of meat and processed grain exports, about 30% of corn

production is exported rather than the 20% attributed to whole corn exports. Some argue that agriculture should be more concerned with efficiently accessing railroads' containerized traffic streams and less concerned with the historically important bulk handling transportation systems (Hudson).

Inland Waterways

The upper Mississippi and Illinois Rivers are important arteries for transporting export-destined grain from north central United States to lower Mississippi River ports. Navigation of the upper Mississippi and Illinois Rivers is made possible by a lock and dam system that is aged. Concern over the navigational efficiency of these arteries has centered on locks in the lower reaches of these rivers where tows experience comparatively high levels of delay. Since up to half of annual U.S. corn and soybean exports originate on these arteries, there is concern regarding the effect of lock delays on barge rates and grain prices in lower Mississippi River ports, and subsequently international competitiveness. Recently, the U.S. Army Corps of Engineers completed a $55 million study to determine the feasibility of expanding lock capacity, but reviewers show that the study was seriously flawed. As such, a new study has been initiated. The Mississippi River and its tributaries are important transport arteries for U.S. agriculture and hopefully the Corps will soon produce a defendable research effort.

Other transportation challenges for U.S. agriculture are North American Free-Trade Agreement-related transportation and infrastructure needs, infrastructure improvements in competing world regions, and changing demands for U.S. port infrastructure and maritime services.

Transportation as a Focus for an Agricultural Economist and Observations about Transportation Economists

Regardless of the transportation sector and its importance to the domestic and international economies, it is an activity that generally commands modest attention in agricultural circles until the occurrence of an unfortunate event that features a transportation dimension. With the occurrence of these events, questions arise about transportation and its implications for agriculture or the role it may have played in explaining a particular development that affects agriculture. Although transportation may be central to explaining or resolving selected problems facing agriculture, the agricultural economist who focuses on transportation seldom has a client base, as do peers that focus on production, marketing, and policy questions. Accordingly, to finance a research program in the area requires entrepreneurial zeal that focuses on regional and national producer organizations and state and federal government agencies that have interest in agricultural transportation issues. Although there are few agricultural economists that carry out research on transportation issues, competition for research dollars is keen since a large number of consultants specialize in transportation.

Transportation economics and agricultural economics have much in common, but their associated academic professions are organized quite differently. Both agricultural and transportation economics are applied disciplines with economics as their genesis. In spite of the similarities, the academics in agricultural and transportation economics are organized quite differently. The differences are most likely due to federal legislation that created the land-grant institutions and associated agriculture colleges. To my knowledge every state has a land-grant institution and a department of agricultural economics or agribusiness that includes agricultural economists. However, I believe there are no departments of transportation economics in the United States. Most transportation economists are in departments of economics; selected universities have strong programs in transportation economics where a variety of undergraduate and graduate courses are offered. However, the training of students for employment in the transportation sector is largely carried out in departments that focus on logistics and the management of firm transportation activities in colleges of business. In contrast, the preparation of students

for careers in agricultural economics and agribusiness is largely accomplished in departments of agricultural economics and agribusiness.

Recently, I had an experience that suggests that the model for the agricultural economics profession is probably superior to that of the transportation economist. I was appointed to a committee by the Transportation Research Board to examine freight transportation needs for the 21st century. The Transportation Research Board is sponsored by the National Academy of Science and the National Research Council. The committee included transportation economists, practitioners, and administrators from the USDOT and other agencies. During committee deliberations, I came to learn that virtually all the public's investment in transportation infrastructure (highways, waterways, etc.) is done with little economic perspective. Transportation economics texts offer considerable discussion on benefit–cost analysis of infrastructure additions and improvements. However, there is little practical application of the science. Although agricultural economists may believe their counsel is inadequately regarded in public policy questions relating to agriculture, I am quite confident that we have been considerably more successful than our peers in transportation economics in shaping and influencing policy related to our sector. I believe this is largely due to the land-grant system to which we belong.

Finally, I realize that a transportation economist is not at the top of most agricultural experiment stations' "need-to-hire" list. Regardless, Texas A&M University has allowed me to pursue my interests in this subject and I am most grateful for that opportunity. I hope large departments that can afford specialization in transportation and other areas important to agriculture continue to have resources to allow this freedom.

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