EFFECTS OF PORT USER FEES ON EXPORT GRAIN FLOW PATTERNS

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Abstract

The purpose of this paper is to evaluate the effect of the proposed deep draft port user fee on export grain flow patterns and provide insight into potential marketing system adjustment costs which may result from diverted flows. A multiperiod, network flow model is used to conduct the analysis. Analyses show grain flow patterns to be affected most by a port specific fee which is based on weight. The annual variation in flows generated by imposition of port user charges is generally less than the historical year-to-year variation and, in most cases, the altered port area flows can be accommodated by existing infrastructure.

Key words: export grain flows, port user charges.

The federal government has historically borne the costs of maintaining and improving the United States' shallow (inland waterways) and deep-draft (ports) navigation facilities. The current political climate, however, is one which increasingly favors alternative means of supporting these transportation arteries. In 1978, the Inland Waterway Revenue Act (Public Law 95-502) was approved. This Act established a fuel tax to partially recover operation, maintenance, and construction costs for these facilities. More recently, legislation seeking recovery of similar expenses incurred by the nation's deep-draft ports has been introduced to the United States Congress.[1] Since 1980, more than 30 pieces of port user fee legislation have been proposed by various members of Congress. Delay in passage, in part, emanates from the debate over some of the proposed features of the user fee system.

Although there is commonality among the proposed port user fee legislation, there are several major differences which have become issues. Debate centers on the basis for levying the fee, the fees form, and costs and level of costs to be recouped by the fee. Several proposals base the fee on the value of exported and imported items (ad valorem), while others offer a fee based on weight. Debate also focuses on the form of the tax. Two user fee forms are proposed: with one the fee would be uniformly applied to all ports across the nation and, with the other, a port-specific user fee would reflect each port's unique costs and would give rise to an unequal fee structure. With respect to costs to be recovered, some legislation proposes to levy fees which cover only operations and maintenance costs of the existing systems, while others call for additional fees which cover new construction costs.[2] In addition, the recommended recovery level varies widely for each particular cost.

With the exception of minor grain exports that are shipped by rail to Mexico and Canada, all of the United States grain exports are shipped via ocean-going vessels. The imposition of a user charge on commercial users of deep-draft ports would tend to increase ocean-shipping rates by the amount of the

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[1]Deep draft ports include ocean and Great Lake ports which have a federally authorized depth of more than 14 feet. This does not include the St. Lawrence Seaway.

[2]Operations and maintenance costs include the Corp of Engineers dredging and channel maintenance activities. New construction costs are incurred when the Corps of Engineers deepens, widens, or lengthens an existing channel or develops a new channel.

fee.[3] Port authorities and grain exporting firms fear that interport competition and grain flows may be altered as a result of the user charge. Further, port elevators and the associated infrastructure are critical links in the export marketing system and, if grain flows are altered, the port area's intermodal transfer capacity may be inappropriately located to accomodate the diverted flow. Thus, an imposed port user fee could generate adjustment costs for the export grain marketing system.

The extent to which interport competition and flows will be altered by a user charge would seem to depend on the magnitude and the form of the fee. Intuitively, a uniform fee, regardless of whether it is based on weight or value (ad valorem), would leave interport competition unchanged since a similar fee would be levied on all ports. Ports that are heavily subsidized by the federal government would tend to favor this fee form. Conversely, a port-specific user fee would be based on costs incurred in each port area. This would yield an unequal user charge at each port which would leave low-volume, heavily-subsidized ports at a competitive disadvantage.

The purpose of this paper is to evaluate the impact that a deep-draft port user fee would have on interport competition and export grain flows. The analysis is designed to measure the impact of the various user fee issues (uniform vs. port specific fees, ad valorem vs. weight-based fees, and costs to be recovered) on export grain flow patterns and to provide insight into potential adjustment costs which may result for the diverted grain flows.

PREVIOUS RESEARCH

An input-output model was employed by Bushnell, Pearsall, and Trozzo, Inc. to evaluate the impact of port user fees on various sectors of the economy. The study concluded that, at the sector level, the impact of the user charge would be small. The agricultural, petroleum and chemical, and coal and mining sectors were judged to be the most affected, with income and employment levels projected to decline.[4]

Several studies have been conducted to evaluate the effect of inland waterway user charges on grain producers and participants in the grain marketing system (Bunker; Binkley et al., 1978; Casavant and Thayer; Conley and Hill; Baumel et al.; Data Resources, Inc.). Section 205 of PL 95-502 instructed the Secretaries of Transportation and Commerce to evaluate the impact of user charges on the United States inland waterway system. Two separate studies were commissioned—one study was conducted by Data Resources, Inc. (DRI) and the other was undertaken by Iowa State University (ISU). With use of DRI's macroeconomic models, barge traffic for the years 1980, 1985, 1990, 1995, and 2000 was estimated. The study concluded that inland waterway user charges unfavorably affect barge operators and farmers in the short term but, in the longer run, the expected strong growth in corn and soybean exports would counterbalance this effect. ISU's study focused on the impact of user charges on grain flow patterns (Hauser, 1982). Study results indicate the user charge would not be a major factor affecting the well-being of concerned groups during the next two decades.

MODEL AND PROCEDURES

A multiperiod, cost-minimizing spatial model was used to conduct the analysis associated with this study. This methodolgy has been useful to analyze research questions dealing with grain logistics (Baumel et al.; Binkley et al., 1978; Binkley et al., 1978 and 1979, Fuller et al., 1983). This model links United States surplus grain and soybean producing regions to domestic and foreign demand locations. The model includes all estimated grain handling and storage costs associated with marketing and distribution. The model includes corn, soybean, sorghum, and wheat (hard, soft, and durum) and rep-

[3]It is argued that ports which receive new construction (deepened and widened channels) will benefit by attracting larger, more-efficient ships which have lower rates. It is held that the additional user fees will be offset by lower shipping rates. However, agricultural interests have serious reservations regarding this effect on international grain commerce. It is argued that grain commerce moves in smaller vessels because many grain receiving ports are of limited water depth, international grain commerce involves trade in smaller lots, and the Panama Canal has limitations on the size of ship which may be accommodated. Accordingly, the analyses assumed that deepened channels would not benefit the grain trade and the user fees would simply increase grain ship rates.

[4]The port user fee may be viewed as a tax on imports and, accordingly, would tend to protect domestic industries whose products compete with imports. For some industries, the user fee would have mixed effects. For example, petroleum producer's welfare would be expected to improve, while petroleum refiners would become worse off through reduced oil imports.

resents 4, 3-month quarters or one crop year. The model includes 165 grain and soybean producing regions. Some regions have grain and/or soybean surpluses since estimated production exceeds estimated deficits. Domestic grain and soybean consumption estimates reflect livestock, poultry, human, and industrial demands. The model includes 85 domestic regions with estimated grain and soybean deficits. In addition, foreign demand for United States' grain and soybean production is included for 25 world subregions. These estimated demands represent total world demand for United States produced grain and soybeans. Foreign demand and regional grain surplus and deficit estimates are predetermined quantities which are calculated exogenously of the spatial model.

Surplus grain producing regions are linked to the grain-deficit domestic regions and to United States port areas by applicable transportation costs and/or rates. Domestic transportation may be by truck, rail, barge, or any combination of these modes. The two major river systems (Mississippi River and tributaries and the Columbia-Snake systems) are included in the model by 43 barge loading locations. Truck and rail costs link United States surplus grain producing regions to the 43 barge loading locations. Barges may transport grain to other selected river locations or applicable ports for unloading. The model considers 16 port areas which include two Atlantic ports, five Gulf ports, four Great Lakes ports, and five Pacific ports. Each port is linked to the 25 world subregions by ocean shipping rates. The described model was initially developed by Taylor and was then modified by Fuller et al. (1983 and 1984), Makus, and Viscencio-Brambilla to investigate various grain transportation issues.

Since some Plains and most Corn Belt areas have access to unit trains, the rail parameters linking these areas to Atlantic and Gulf ports reflect either 50, 75, or 100-car shipments. Similar movements to Pacific ports are represented by 50-car unit trains. In all other movements, single-car parameters are used.

The least-cost model selects the grain distribution pattern that minimizes total costs (grain handling, storage, and transportation) and satisfies the predetermined domestic and foreign demands. The solution was obtained with an out-of-kilter network code (Fuller and Shanmugham).

The model is calibrated to include domestic and foreign grain demands that are representative of the latter 1980's and costs that reflect 1982-83 levels. The solution to this model represents a "baserun." To gain insight into the realism of the baserun solution, the model-generated flows were compared with results of a national grain flow study (Leath and Hill). Comparisons centered on grain flows to the various port areas, the relative role of each mode in moving grain to the various port areas, and the significance of various states in supplying grain to domestic demand and United States port locations. In general, the model-generated flow patterns and modal shares correspond closely to historical flows.

Since the proposed user fee would be charged to loaded ocean-going vessels as they exit the various United States ports, the user fee would, in effect, increase ship rates that link United States ports with their foreign markets. To conduct the analyses, the estimated user charges are entered into the described model by increasing appropriate ship rates. The model is subsequently solved and its flow pattern compared with that of the baserun solution.

Because of the various issues which surround the proposed deep-draft port user fee, several different calculations were made to estimate these proposed charges. Some legislative proposals call for fees which cover operations and maintenance costs, others support fees which reflect new construction costs and, yet others, offer proposals to cover both costs. Accordingly, scenarios are developed which include each of these cost categories. To estimate weight-based charges, the various costs are divided by port tonnage, while parameters to estimate ad valorem-based charges are calculated by dividing the various costs by the value of exports and imports.

DATA

Substantial data were required to develop the spatial model. The United States grain and soybean producing and consuming regions needed to be identified and estimation of each region's surplus or deficit was required. In addition, it was necessary to estimate the demand for United States produced grain and soybeans for each of the 25 world subregions. Estimates of the grain handling and storage costs were required, as were estimates of transportation costs that link the surplus production regions to domestic and foreign demand regions.

Examination of each state's geographical production pattern made possible the development of a regional demarcation scheme for each commodity. In those states with substantial production, crop reporting districts were used as the demarcation unit, while in states with small productive capabilities crop reporting districts were aggregated. The USDA's National Interregional Agricultural Projection (NIRAP) model's output and a report by Lazarus et al. were the basis for developing estimates of each region's expected grain and animal production. Estimates of grain, livestock, and poultry production were representative of the latter 1980's. Estimates of animal rations and grain consumption were derived from the USDA's *Livestock-Feed Relationships: National and State.* Projected domestic processing demands for wheat and corn were based on trends of historical consumption and population projections and were designed to represent the latter 1980's. Projected soybean crushings were based on historical relationships between soybean crushings and soybean exports. Projected crushings were allocated to regions based on current processing capacities (Hauser, 1982).

Information to estimate foreign demand by world subregion was obtained from data included in the USDA's *Grain Market News.* Demand projections for the latter-1980's were estimated for the 25 world subregions with the historical export data. The USDA's International Economics Division personnel are involved in projecting United States export demand and provided counsel to adjust several estimates. Projected world demands for United States produced corn, wheat, soybeans, and sorghum were 2.47, 1.39, .77, and .26 billion bushels, respectively. This total outflow of 4.89 billion bushels approximates the United States' peak export levels of 1980 and 1981 when respective outflow was estimated at 4.87 and 4.83 billion bushels. Current export levels are nearly .6 billion bushels below this peak outflow.

The estimated truck and barge cost parameters are believed to be representative of rate levels in the long run. Because these transportation industries exhibit competitive behavior, total costs are used as a proxy for rates (Sorenson). Costs were calculated to reflect sufficient returns to encourage reinvestment. Trucking cost estimates were obtained with a computer algorithm that employed budgeting and economic-engineering cost estimating techniques. A truck cost equation reflecting different taxing procedures, licensing fees, and wage rates was developed for each state. The cost of a particular truck movement was based on the originating state and distance. All truck costs reflect 1982 operations of tractor semi-trailers. Barge and towboat costs were estimated using budgets developed by the United States Army Corps of Engineers, 1983. Information regarding towboat and barge operating characteristics on the various river segments was used to obtain unit costs on barge transportation between various locations.

Railroads were assumed to charge the highest rate which intermodal competition would permit. After identifying the maximum revenue-to-variable cost ratio allowed by intermodal competition in surplus grain producing regions, the identified ratio is multiplied by variable rail cost to convert to a rate parameter. Variable rail cost estimates were based upon costs published in the Interstate Commerce Commission's (ICC) Statement No. 1C1-77, *Railroad Carload Cost Scales, (1977).* This document is based upon an application of Rail Form A, reflecting the operations of Class I line-haul railroads. *Rail Update Ratios* issued by the ICC were used to update these costs to 1982. A computerized algorithm estimated rail costs by reconstructing the formulae presented in the ICC's cost scale publication. The algorithm includes a multiple-car program which adjusts various parameters (e.g., way train mileage, train size, switching time, turn-around time, etc.) to obtain 25-, 50-, 75-, and 100-car unit train costs. The algorithm was obtained from the Department of Economics, Iowa State University (Hauser, 1980).

Estimated ship rates are based on ship charter data collected by Maritime Research, Incorporated for the years 1976-1982. The ship charter data contain 8,803 observations and include information on origin and destination of haul as well as the ship's net grain tonnage and rate. It was important that relative ship rates from each port area to the 25 world subregions be representative. Because Gulf ports typically tranship up to 60 percent of the United States grain exports, rates linking Gulf ports with the world subregions were taken as a base. Rates from the other United States ports to the identified world subregions were compared to the Gulf rate for purposes of calculating an index number. Then, absolute ship rates of the early 1980's were adjusted with use of the index numbers to estimate a relative ship rate structure which was historically correct.

Necessary data to estimate the proposed port user fees were obtained from the United States Army Corps of Engineers. The publication, *Deep Draft Navigation Cost Recovery Analysis* was the source of information for port operation and maintenance costs, tonnage, and value of exports and imports. Estimates of port new construction costs were obtained via an unpublished memorandum furnished by the United States Army Corps of Engineers, Chief of Engineers, Directorate of Civil Works, Office of Policy in Washington, D.C.[5] Information on port operation and maintenance cost, new construction cost, and tonnage are reported in Table 1. New construction costs are for those ports which have been authorized by the United States Congress for construction; however, in no case, have monies been appropriated. New construction costs were amortized over a 30-year period for purposes of estimating annual costs.

Table 2 includes an estimate of the proposed user fees; included are weight (per ton) and ad valorem-based fees for the principal United States grain port areas. In general, per ton fees were estimated by dividing cost by port tonnage while ad valorem charges were based on the value of exports transiting ports and grains' share of this value. Fees are calculated which incorporate operations and maintenance costs (OM), new construction costs (NC), and the aggregate of these costs (OMNC).[6] In addition, Table 2 includes the estimated charge for the proposed uniform user fee.

RESULTS

The information in tables 3 and 4 relates the respective effects of weight-based and ad valorem-based user charges and contrasts how the form of the fee (port specific or uniform) affects grain flows. In addition, the analyses identify the effect on flows of recovering operations and maintenance costs (OM), new construction costs (NC), and the aggregate of these costs (OMNC). Finally, an effort is

TABLE 1. PORT OPERATIONS AND MAINTENANCE COSTS SUBJECT TO RECOVERY AND ESTIMATED NEW CONSTRUCTION COSTS, SELECTED PORT AREAS, UNITED STATES, 1982

Port area	Operations and maintenance costs[a]	New construction costs[a]	Port tonnage[b]
East Gulf:			
Mobile, Ala.	5,303.2	447,720.0	19,541.3
Mississippi River:			
New Orleans, La.	23,037.9	525,000.0	133,421.8
Southeast Texas:			
Galveston, Tex.	9,093.6	595,000.0	78,189.5
South Texas:			
Corpus Christi, Tex.	6,130.9	92,000.0	31,525.8
North Atlantic:			
Baltimore, Md.	2,420.9	400,000.0	39,035.7
South Atlantic:			
Charleston, S.C.	5,483.2	80,100.0	8,231.5
Lake Superior-Michigan:			
Chicago, Ill.	1,020.2	—	13,155.0
Duluth, Minn.	2,384.1	10,780.0	39,425.1
Lake Huron-Erie:			
Toledo, Ohio	3,493.1	—	22,279.7
Saginaw, Mich.	6,730.2	—	2,281.7
Seattle area:			
Seattle, Wash.	482.2	82,240.0	25,035.1
Portland area:			
Portland, Ore.	19,063.8	3,160.0	26,712.3
California:			
San Francisco, Calif.	2,414.7	276,600.0	7,538.3
Long Beach, Calif.	144.0	460,000.0	66,999.4
San Diego, Calif.	0.0	—	2,344.6
Subtotal	87,148.0	2,972,600.0	515,716.8
Other ports	249,357.2	3,957,860.0	1,157,828.2

Source: United States Army Corps of Engineers.
[a]Represents 1982 costs.
[b]Estimated 1981 tonnage in short tons.

[5]There is some disagreement among engineers regarding the operations and maintenance costs necessary to maintain ports after their improvement. The U.S. Corps of Engineers advised that the current maintenance and operations costs were good estimates of these costs. If current costs underestimate the operations and maintenance cost associated with new construction, the projected flow levels will be biased downward.

[6]There is little information on how a port's cost will be altered as a result of increasing port size (new construction). If ports experience decreasing costs, the estimated parameters in Table 2 will generate user fee receipts in excess of costs; conversely, if costs increase, the generated receipts will be inadequate. Further, numerous exogenous factors will alter the value and volume of commerce transiting a port through time. Accordingly, there will be a need over time to adjust the user charge as fee receipts and costs tend to diverge.

TABLE 2. ESTIMATED AD VALOREM AND WEIGHT-BASED PORT USER CHARGES FOR OPERATIONS AND MAINTENANCE (OM), NEW CONSTRUCTION (NC), AND THE AGGREGATE OF THESE COSTS (OMNC), SELECTED PORT AREAS, UNITED STATES, 1982[a]

Port area	Cost subject to recovery					
	OM		NC		OMNC	
	Weight	Ad valorem	Weight	Ad valorem	Weight	Ad valorem
	$/ton[b]	pct.	$/ton[b]	pct.	$/ton[b]	pct.
East Gulf:						
Mobile, Ala.	0.2714	0.17002	2.4548	1.53786	2.7262	1.70788
Mississippi River:						
New Orleans, La.	0.1727	0.05067	0.4216	0.12372	0.5943	0.17439
Southeast Texas:						
Galveston, Tex.	0.1163	0.02556	0.8153	0.17922	0.9316	0.20478
South Texas:						
Corpus Christi, Tex.	0.1945	0.10720	0.3128	0.17240	0.5073	0.27960
Brownsville, Tex.	—	—	—	—	—	—
North Atlantic:						
Baltimore, Md.	0.0620	0.01331	1.0979	0.22330	1.599	0.23661
South Atlantic:						
Charleston, S.C.	0.6661	0.06229	1.0504	0.09823	1.7165	0.16052
Lake Superior-Michigan:						
Chicago, Ill.	0.0766	0.06446	—	—	0.766	0.06446
Duluth, Minn.	0.0605	0.09565	0.0293	0.04632	0.0898	0.14197
Lake Huron-Erie:						
Toledo, Ohio	0.1568	0.21908	—	—	0.1568	0.21908
Saginaw, Mich.	2.9496	3.74800	—	—	2.9496	3.74800
Seattle area:						
Seattle, Wash.	0.0171	0.00224	0.3520	0.05240	0.3691	0.05464
Portland area:						
Portland, Ore.	0.7137	0.25473	0.91270	0.00452	0.7264	0.25925
California:						
San Francisco, Calif.	0.3203	0.02711	3.9313	0.89572	4.2516	0.96871
Long Beach, Calif.	0.0021	0.00032	0.7356	0.11055	0.7377	0.11087
San Diego, Calif.	—	—	—	—	—	—
Average port specific fee	0.1688	0.04283	0.6172	0.15654	0.7860	0.19937
Uniform fee	0.2010	0.08361	0.4436	0.18452	0.6446	0.26813

[a]User charge estimates for a 100 percent cost recovery level.
[b]Represents short tons.

made to identify whether the altered flows can be accommodated by existing port capacity.

Weight-based, Port Specific User Fee

A weight-based user charge aimed at recovering operations and maintenance (OM) expenses with use of a port specific fee would only modestly affect the aggregate flow of grain and soybeans to Gulf, Atlantic, Great Lakes, and Pacific coast areas, Table 3. The greatest relative effect is in the Atlantic and Great Lakes coastal areas where respective changes in flows are 3.9 and −2.3 percent of the base solution. In the Great Lakes area, Lakes Superior and Michigan gain in grain handled while Huron and Erie lose volume. Lakes Huron and Erie ports incur large operations and maintenance expenses relative to their handled grain volume and, accordingly, they have relatively large user fees. Also, because of the relatively modest operations and maintenance expenses at Atlantic ports and the associated small user charge, a portion of the grain originally routed to Lakes Huron and Erie is rerouted to Atlantic ports.

Even though there is only modest redirection of flows to the various coastal areas, there is substantial rerouting of grain among ports in coastal areas—in particular, in the Pacific Northwest (interport flows). The estimated port specific user fee in the Seattle area is about 5 percent of the Portland area fee; consequently, eastern-Washington wheat is redirected (50 million bushels) from the barge-served Portland port area and routed to Seattle via railroads.

Port specific user fees that are based on recovery of new construction (NC) costs generate more dramatic changes in flows than user fees based on operations and maintenance costs. Since a port's operation and maintenance expense and capital expenditure on new deep-draft facilities are not directly related, a different flow pattern scheme often exists. Port areas in the Great Lakes are scheduled for less investment on new deep-draft facilities and, as a result, they tend to benefit from imposition of a port specific fee based on these costs. This is particularly true for the Lake Superior-Michigan area. The Atlantic port area loses grain volume to Lake and Gulf ports, with the North Atlantic area bearing most of the volume loss. The North Atlantic ports have been approved for new

TABLE 3. EFFECT ON UNITED STATES PORT AREA GRAIN AND SOYBEAN FLOWS OF A WEIGHT-BASED USER FEE, SELECTED PORTS, UNITED STATES[a]

	Port specific fees						Uniform fees					
	OM[b]		NC[b]		OMNC[b]		OM[b]		NC[b]		OMNC[b]	
Port area	Change in volume[c]	Pct. change[d]	Change in volume[c]	Pct. change[d]	Change in volume[c]	Pct. change[d]	Change in volume[c]	Pct. change[d]	Change in volume[c]	Pct. change[d]	Change in volume[c]	Pct. change[d]
Gulf:												
East Gulf	−0.05	−0.03	−159.59	−83.34	−159.61	−83.35	−0.1	−0.03	−0.1	−0.07	−0.2	−0.10
Mississippi River	−8.20	−0.39	248.51	11.47	216.80	10.00	9.9	0.45	8.3	0.37	7.0	0.31
Southeast Texas	−0.28	−0.04	−14.89	−2.06	−15.29	−2.08	−0.4	−0.05	−0.9	−0.12	−1.5	0.21
South Texas	0.01	0.02	0.88	1.20	0.88	1.23	0.0	0.00	0.0	0.04	0.1	−0.08
Total	−8.55	−0.27	74.89	2.38	42.75	1.36	9.5	0.30	7.3	0.23	5.3	0.17
Atlantic:												
North Atlantic	22.74	4.19	−107.89	−19.89	−60.44	−11.14	−10.5	−1.93	−12.6	−2.32	−14.3	−2.63
South Atlantic	−0.01	−0.02	−0.03	−9.07	−0.03	−0.07	0.0	−0.01	0.0	−0.04	0.0	−0.07
Total	22.73	3.90	−107.92	−18.52	60.47	−10.38	−10.5	−1.82	−12.6	−2.16	−14.3	−2.46
Great Lakes:												
Superior-Michigan	10.69	2.66	18.59	4.62	17.19	4.27	−0.4	−0.10	−0.4	−0.09	−0.3	−0.09
Huron-Erie	−25.77	−10.21	5.46	2.15	−11.38	−4.51	−0.1	−0.03	−0.2	−0.06	−0.2	−0.08
Total	−15.08	−2.30	24.05	3.67	5.81	0.89	−0.5	−0.07	−0.5	−0.08	−0.6	−0.09
Pacific:												
Seattle area	50.17	23.76	−2.37	−1.12	49.90	23.76	−2.2	−1.04	−2.3	−1.11	−2.4	−1.15
Portland area	−52.43	−22.14	−0.18	−0.08	−52.66	−22.14	0.0	−0.02	−0.1	−0.04	−0.2	−0.09
California	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	0.0	−0.03	0.0	−0.04
Total	−2.26	−0.48	−2.56	−0.54	−2.76	−0.58	−2.2	−0.47	−2.4	−0.51	−2.6	−0.55
Total Port Exports[e]	−3.16	−0.06	−11.53	−0.24	−14.67	−0.30	−3.7	−0.08	−8.3	−0.17	−12.1	−0.25

[a]Numbers at the coast level may not add up to totals due to rounding.
[b]OM, NC, and OMNC represent Operations and Maintenance Expenses, New Construction Costs, and Operations and Maintenance Expenses and New Construction Costs Combined, respectively.
[c]Millions of bushels.
[d]Percent change from baserun volume.
[e]Overall reduction in United States grain exports resulting from an increase in export price due to user charge imposition.

TABLE 4. EFFECT ON UNITED STATES PORT AREA GRAIN AND SOYBEAN FLOWS OF AN ADVALOREM USER FEE, SELECTED PORTS, UNITED STATES[a]

	Port specific fees						Univorm fees					
	OM[b]		NC[b]		OMNC[b]		OM[b]		NC[b]		OMNC[b]	
Port area	Change in volume[c]	Pct. change[d]	Change in volume[c]	Pct. change[d]	Change in volume[c]	Pct. change[d]	Change in volume[c]	Pct. change[d]	Change in volume[c]	Pct. change[d]	Change in volume[c]	Pct. change[d]
Gulf:												
East Gulf	−9.67	−5.05	−45.66	−23.84	−180.34	−94.17	−0.0	−0.03	−0.1	−0.04	−0.1	−0.06
Mississippi River	−19.92	−0.91	63.61	2.93	180.74	8.34	10.4	0.45	9.3	0.42	8.4	0.38
Southeast Texas	−0.56	−0.08	25.27	3.49	9.41	1.30	−0.2	−0.05	−0.5	−0.07	−0.7	−0.10
South Texas	0.00	0.00	0.00	0.04	0.01	0.05	0.0	0.00	0.0	0.01	0.0	−0.02
Total	9.68	−0.31	43.21	1.37	9.79	0.31	10.1	0.30	8.7	0.28	7.6	0.24
Atlantic:												
North Atlantic	6.43	1.18	−44.56	−8.21	−30.29	−5.58	−9.7	−1.78	−10.7	−1.99	−11.7	−2.15
South Atlantic	0.00	0.00	−0.01	−0.03	0.02	−0.05	0.0	−0.02	0.0	−0.05	0.0	−0.06
Total	6.43	1.18	−44.57	−7.65	−30.31	−5.20	−9.7	−1.66	−10.7	−1.86	−11.7	−2.01
Great Lakes:												
Superior-Michigan	10.68	2.65	−0.42	−0.10	23.16	5.76	−0.4	−0.10	−0.4	−0.10	−0.3	−0.10
Huron-Erie	−25.75	−10.20	−0.08	−0.03	−5.53	−2.19	−0.1	−0.02	−0.1	−0.04	−0.1	−0.06
Total	−15.06	−2.30	−0.50	−0.07	17.63	2.69	−0.5	−0.07	−0.5	−0.08	−0.5	−0.08
Pacific:												
Seattle area	50.24	23.79	−2.22	−1.05	50.08	23.72	−2.2	−1.02	−2.3	−1.07	−2.4	−1.11
Portland area	−52.41	−22.14	−0.06	−0.02	−52.46	−22.16	0.0	−0.01	−0.1	−0.03	−0.1	−0.04
California	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	0.0	0.00	0.0	0.00
Total	−2.18	−0.46	−2.28	−0.48	−2.38	−0.50	−2.2	−0.46	−2.4	−0.49	−2.5	−0.51
Total Port Exports[e]	−1.13	−0.02	−4.14	−0.08	−5.27	−0.11	−2.2	−0.05	−4.9	−0.10	−7.1	−0.15

[a]Numbers at the coast level may not add up to totals due to rounding.

[b]OM, NC, and OMNC represent Operations and Maintenance Expenses, New Construction Costs, and Operations and Maintenance Expenses and New Construction Costs Combined, respectively.

[c]Millions of bushels.

[d]Percent change from baserun volume.

[e]Overall reduction in United States grain exports resulting from an increase in export price due to user charge imposition.

construction activity; thus, a user fee designed to recover these costs directs grain from this area.

Imposition of a port specific user fee which recovers new construction costs increases Gulf coast export volume by about 2 percent, or 75 million bushels. Of more interest, however, is the altered interport competition within the Gulf coast area. Both Mississippi River and Southeast Texas (Houston-Galveston area) port areas increase their volume at the expense of East Gulf ports. The East Gulf ports have been approved for new construction and the resulting user fee is projected to redirect nearly 160 million bushels of corn and soybeans from this port area. This grain is redirected to Mississippi River ports which are projected to increase export volume by 248 million bushels—a portion of this increased grain volume is rerouted from Atlantic coast ports.

User charge scenarios which assume the combined recovery of operations and maintenance and new construction expenses (OMNC) yield somewhat different results than those based on recovery of either cost. In some coastal areas, altered grain flows resemble those already discussed, while in others, there appears to be little relationship. This is not surprising since the aggregated magnitude of the OM and NC expenses may be similar or quite different than a user charge based on a particular cost. For instance, the Lakes port area has virtually no projected expenditures for new construction, but has comparatively large operations and maintenance costs. Thus, when all costs subject to recovery are combined, the resulting user charges are comparable to those of other ports.

Due to its relatively high port user fees, Atlantic ports lose about 10 percent of their base volume when fees incorporate full recovery of all costs (OMNC). In all other coastal port areas, flows are altered about one percent or less. Changes in interport flows are, in some cases, substantial and in most cases, similar to those generated by user fees designed to recover new construction costs.

Weight-Based, Uniform User Fee

Weight-based user charges which are uniformily applied to all United States ports have a small effect on intercoast and interport competition, Table 3. In all cases, Lake ports suffer minor grain losses to Gulf ports, regardless of the cost being recovered. This outcome confirms the belief of some legislators that uniform fees would leave port competition and port volumes undisturbed.

Ad Valorem-Based, Port-Specific User Fee

Ad valorem-based user fees are generally different in magnitude than weight-based fees, since they are dependent on the value of exports transshipped through a port. Thus, the product mix of a particular port is an important factor determining the magnitudes of this fee. The effect of an ad valorem-based fee is made more complex since each grain has a different value and, as a result, ocean shipping rates are unique to the commodity being shipped.

Port specific fees designed to recover port area's operations and maintenance expenses (OM) do not seriously alter flows, Table 4. Atlantic and Gulf coast ports experience modest increases in grain export volume, while the Lake and Pacific coast port areas suffer losses. Interport competition is relatively modest in all coastal areas with the exception of the Pacific Northwest. Seattle and Portland ports are sensitive to ad valorem-based user fees, even though the changes in relative ocean freight rates from these port areas to foreign destinations are comparatively small. In the Gulf, small quantities of the East Gulf ports grain volume are redirected to the Mississippi River port area, while ports located in the Lake Huron-Erie area lose export grain and those in the Lakes Superior and Michigan area gain volume.

Port specific user fees that seek to recoup new construction costs would leave flows to various coastal areas largely unchanged. The exception is the Atlantic Coast which would lose about 8 percent of its grain shipments. Interport competition with the Gulf area is altered as both Mississippi River and Southeast Texas ports' export volumes increase, while sizable losses are incurred by the East Gulf ports.

Port specific fees which incorporate the aggregated operation and maintenance and new construction costs (OMNC) do not redirect grain from one coastal area (Atlantic, Gulf, Great Lakes and Pacific) to another; however, grain is redirected among ports in a particular coastal area, Table 4. In the Gulf area, East Gulf ports experience a dramatic loss of grain exports, while Mississippi River ports' volume increases 8 percent or about 180 million bushels. In the Great Lakes, the Lake Superior-Michigan area has an advantage over Huron-Erie ports because of a comparatively low level of costs subject to recovery; thus, the former increases its volume by about 6 percent, while the latter faces a loss of nearly 3 percent. Again, Seattle's export volume increases with imposition of the ad valorem-based, port specific user fee by diverting grain exports from Portland. Losses in the Atlantic Coast are constrained to the North Atlantic area.

Ad Valorem-Based, Uniform User Fee

Ad valorem-based, uniform user fees produced little change in grain export flow patterns, as was the case with weight-based, uniform charges, Table 4. In all cost recovery schemes, the Atlantic port area would be the most affected, though the impact is relatively inconsequential.

Altered Flows and Port Elevator Capacity

Five port areas emerged as experiencing increased volumes under the analyzed user charge scenarios. These include the Mississippi River, Seattle, Lake Superior-Michigan, Southeast Texas, and North Atlantic port areas.

The Mississippi River port area is the most important grain outlet in the nation, accounting for up to 60 percent of United States agriculture's grain exports. Depending on the user fee scenario analyzed, increases in export volumes ranged from 6.2 percent in 1978/79 to 11.4 percent in 1979/80, suggesting that even an increase of 248 million bushels (11.5 percent) might be handled by Mississippi ports. However, such an increment would require maximum utilization of port elevator capacity. Research by Barnett showed that the Mississippi River port area operates up to 59 hours per week in peak volume months. This suggests that the extra volume generated by the user fees may be handled by increases in hours worked per week. It is estimated that port area capacity would need to operate 12 hours per week to accommodate this additional outflow.[7] In summary, the Mississippi River port area may be able to handle the large increase in exports brought about the imposition of a port specific, weight-based user fee. However, there may be additional congestion during peak volume periods.

The Seattle area is an important outlet for export-destined corn and soft, hard, and durum wheats. The analysis shows Seattle to increase its grain exports (wheats) at the expense of Portland when user fees are imposed. If a port specific fee, based on either weight or value, were imposed to cover OM costs, the Seattle port area would increase its grain exports by nearly 50 million bushels. Since this yields a total outflow which approximates some historical levels, the additional volume could in all likelihood be accommodated.

The analyses show the Lake Superior-Michigan port area to increase grain exports about 6.0 percent above the base volume if a port specific, ad valorem-based fee, which is designed to cover OMNC costs, were introduced. This maximum increase could be accommodated by operating facilities an additional 3 hours per week. Therefore, this modest increase could be accommodated by existing port elevator capacity.

Southeast Texas ports were shown to experience grain volume increases that range from 1.30 to 4.85 percent of the base volume. The generated variation in flows is generally less than the year-to-year variation and, based on estimated port area capacity, the maximum flow could be accommodated by operating facilities an additional 2 hours per week.

The North Atlantic port area is an outlet for United States produced soybeans and corn and is a competitor with Great Lake ports. The analyses show a port specific fee (weight-based), including only operations and maintenance cost, would redirect grain to this port area; however, the maximum increase is estimated to be only 4 percent above the base volume. This could be accommodated by operating port infrastructure an additional 2 hours per week. Barnett et al. show elevators in this area operate less than 40 hours per week, thus few capacity problems should result.

The additional annual variation in flows generated by imposition of port user charges is generally smaller than the historical year-to-year variation in flows and, in most areas, the modest increase in flows can be accom-

[7]Per hour handling capacity of port elevators was identified from Dezik and Fuller and capacity of recently constructed facilities was obtained via telephone conversations with operators.

modated with increases in operating hours.[8] The exception may be the Mississippi River port area, where the infrastructure would need to operate an additional 12 hours per week if a port-specific user fee designed to recoup new construction costs were introduced.[9]

SUMMARY AND CONCLUSIONS

The purpose of this paper was to determine the effect of the proposed deep-draft user fee on export grain flows. User charge scenarios were generated to include the major features of legislation presented to Congress in the past several years. The analyses focused on weight and ad valorem-based charges which may be applied on a uniform or port specific basis. In addition, there were differing types of costs which may be subject to recovery by the federal government. These include port operations and maintenance expenses and new construction costs.

A multiperiod, network flow model was used to analyze possible changes in grain flow patterns. The model minimized grain handling and storage costs and transfer costs which included truck, rail, barge, and ocean shipping rates. The model is international in scope and includes 165 United States domestic grain surplus regions, 85 domestic grain deficit regions, 53 river points, and 16 representative United States grain shipping port areas which are linked to 25 foreign demand regions.

Analyses show grain flow patterns to be affected most by the form of the user fee (uniform vs. port specific) and, to a lesser extent, by the basis for levying the fee (weight vs. value). Results indicate that uniform fees, both weight and ad valorem-based, alter flows least. In essence, uniform fees leave flow patterns unchanged. Because of great dissimilarities in port costs, the principal disruptions are limited to port-specific fees. And, in general, the port specific, weight-based fee yields greater flow pattern changes than the ad valorem-based fee; however, the general effect of either user fee is similar. Because grain is relatively low-valued, the share of the ad valorem-based user cost borne by grain is small as compared to a user fee based on grain weight.

It is difficult to generalize regarding the effect and the various recouped costs (OM, NC, and OMNC) on grain flow patterns. A port specific, weight-based user fee designed to cover operations and maintenance costs would reroute substantial quantities of wheat (50 million bushels) from Portland to Seattle. When new construction costs are incorporated into this type of user fee, relatively dramatic changes in flows occur. In particular, East Gulf and North Atlantic ports lose 160 and 108 million bushels, while Mississippi River ports increase their outflow by 248 million bushels. A port specific, weight-based user fee which covers the aggregated OM and NC costs yields flows that are similar to those generated by a user fee which is based on new construction. In general, most of the major changes in flows are limited to flows within a coastal area (interport) rather than flows between coastal areas.

In most cases, port area intermodal transfer capacity appeared sufficient to accommodate flows modified by imposition of user fees. The exception may be the Mississippi River port area which may have inadequate capacity to handle an additional 248 million bushels. This maximum additional volume is projected to occur through imposition of a port specific, weight-based fee which recoupes new construction costs.

Finally, it is important to note that the analyses assumed a 100 percent recovery of costs and assumed peak export levels which approximated those of the 1980-81 period. Whether the 100 percent cost recovery rate becomes reality depends on the legislation enacted by Congress. Further, since export amounts were assumed to be at peak levels, rather than current levels, the magnitude of the altered flows are increased and pressures on port intermodal capacity are possibly overstated. Accordingly, the presented results should be viewed as reflecting the most dramatic effects of imposing user charges.

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[8] For example, for the years 1975-83, the Great Lakes average year-to-year variation in total grain and soybean outflow was about 24 percent; i.e., the quantity of corn exported per year averaged either 24 percent more or less than the previous year. The Gulf, Atlantic, and Pacific coasts average year-to-year variation was 8, 17, and 27 percent, respectively. This variation is substantially greater than that introduced by any port user charge.

[9] Total grain handling, storage, and distribution costs were collected for each examined scenario. In general, costs increased about $.004 per bushel in those scenarios involving fees designed to collect operations and maintenance costs. In those scenarios involving user charges which recoup all costs, the solution value increased about $.02 per bushel.

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