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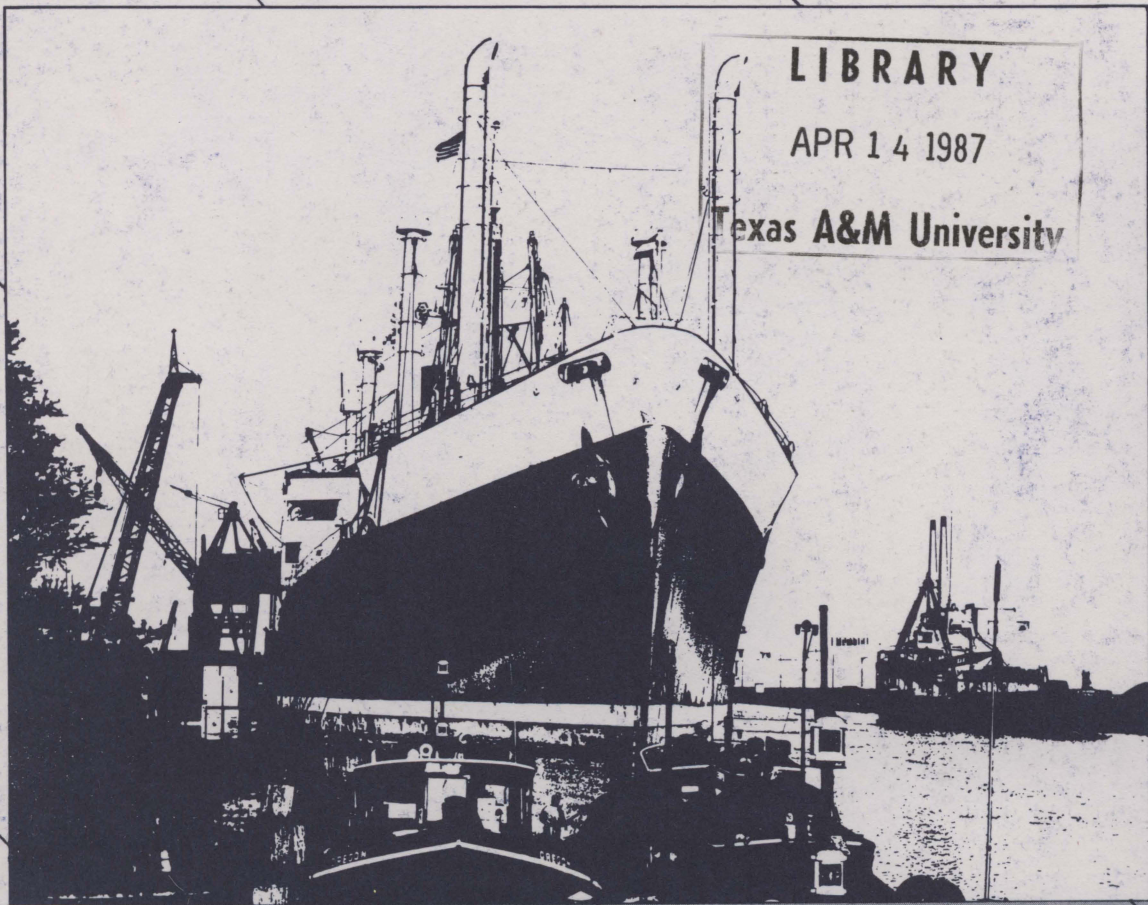

Effect of Proposed Port User Fees on Export Grain Flow Patterns

The Texas Agricultural Experiment Station/Neville P. Clarke, Director/The Texas A&M University System/College Station, Texas

Table of Contents

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Preface

Historically, the federal government has funded the maintenance and construction of the nation's deep-draft ports. However, legislation has been submitted to the U.S. Congress which would allow the federal government to recover a portion of these costs through imposition of port user charges. Farm interests are concerned that user charges would increase the price of U.S. agricultural commodities, reducing export volumes and their income. The purposes of this research are to evaluate the effect of the proposed deep-draft port user fee on export grain flow patterns and export levels and provide insight into potential marketing adjustment costs which may result from diverted flows.

Acknowledgements

The authors express appreciation to the U.S. Department of Agriculture and the U.S. Army Corps of Engineers for counsel provided during this project. Substantial contributions were made by Bill Gallimore and Jim MacDonald of Economic Research Service, U.S. Department of Agriculture. Special appreciation is expressed to Fred Ruppel for improving the exposition of Appendix I, in particular that portion dealing with the effects of user charges on international markets. Appreciation is expressed to reviewers Orlo Sorenson, Kansas State University; Mack Leath, U.S. Department of Agriculture, University of Illinois; and Don Farris and Warren Grant, Department of Agricultural Economics, Texas A&M University. This research was partially supported through U.S. Department of Agriculture cooperative agreement number 58-3523-2-034.

Effect of Proposed Port User Fees on Export Grain Flow Patterns

Introduction

The Port User Charge

In the past few years, more than 30 pieces of proposed legislation have been submitted to the U.S. Congress that, among other things, would allow the federal government to recover a portion or all of the operations and maintenance expenses and the capital expenditures incurred in keeping the nation's deep-draft facilities navigable. The legislative efforts propose a variety of user charge schemes as well as various cost sharing formulas between federal and nonfederal jurisdictions as a means to preclude further subsidization of commercial deep-draft navigation. Some legislators have favored weight-based user fees while others have favored ad valorem-based user fees. Either type of fee would be applied on a port-specific or uniform basis. Port-specific fees would be based on the unique costs at each port whereas a uniform fee would represent a flat fee to all ports. Further, there is debate over which expenditures should be recovered by the user fee. Some legislation proposes fees which recoupe new construction costs, others propose recovery of operations and maintenance costs, while some call for recovery of both costs.

Possible imposition of a port user charge has raised concerns among farm interests, port authorities, and transport operators. Farmers are concerned that user charges would increase the prices of U.S. agricultural commodities—reducing export volumes and, thus, their income. Port authorities are concerned that such levies could alter grain flow patterns, ports' market areas, and interport competition. If grains flows are diverted, the viability of railroads and barge firms may be unfavorably affected on some transportation corridors. This might render location of the marketing system infrastructure inappropriate.

The Nature of Funds Subject to Recovery

Several federal programs administered by the Coast Guard, the U.S. Army Corps of Engineers, and the Economic Development Administration (U.S. Department of Commerce) support commercial navigation on deep-draft harbors, ports, and channels. Federal resources are expanded to cover operations and maintenance costs of the existing port system as well as construction of new facilities.

For purposes of this study, operations and maintenance costs include those costs incurred by the Army Corps of Engineers in maintenance of the existing ports' navigation facilities. New port construction costs also are an important expense of the federal government. Port areas require two types of new construction. First, there are expenditures for infrastructure which complement port operation (piers, etc.). These investments are generally made by the local jurisdiction. Then, there are new construction expenditures made by the federal government (Army Corps of Engineers) which involve the deepening, widening, or lengthening of channels; it is these expenditures which are to be recovered with user fees.

The Research Problem

International trade represents a vital economic activity for the U.S. farm sector. Grains and soybeans are the U.S.'s principal agricultural exports, accounting for over 60 percent of the value of U.S. farm exports in 1983. The value of U.S. grain and soybean exports and related products, moreover, increased almost sevenfold during the 1970-81 period, and accounted for 30 percent of the U.S. farm income (Cramer and Heid). During the marketing year 1981-82, U.S. farmers produced 16.8, 47.6, 32.4, and 62.6 percent of the world's total wheat, corn and other coarse grains, and soybeans, respectively. In calendar year 1981, the U.S.'s share of world exports amounted to 40, 58, and 37 percent, respectively, for food grains, feed grains, and oil crops and meal.

Price competition is a major economic aspect of grain and soybean world markets. The viability of a grain exporter, such as the United States, rests on its ability to remain price competitive. The existence of aggressive grain exporters such as Argentina, Australia, Thailand, and Brazil makes it difficult to remain a competitive supplier to the world market (Paggi; Longmire and Morey). If a user charge is approved, the increase in transportation costs will increase the price of U.S. grain and soybean exports to importing nations and subsequently reduce U.S. sales and farm prices.[1] Whether or not the user charge would significantly impact U.S. grain and soybean exports and agricultural products is an empirical question and depends upon the type and size of the fee as well as on the supply and demand relationships prevailing in the world markets.

In summary, the levying of a user charge on deep-draft ports raises the following issues: (1) To what extent will U.S. exports of grain and soybeans be affected? (2) How will competition among U.S. ports change? and (3) Will grain and soybean flow patterns be significantly altered? This study attempts to answer these questions for selected commodities (wheat, corn, sorghum, and soybeans).

Objectives

The purpose of this study is to evaluate the effect of port user charges on the U.S. export grain economy. Specific objectives are:

1. Develop a procedure to estimate the size of a user charge under various scenarios, based on recent legislation proposed by Congress.
2. Estimate how the proposed user charge affects foreign demand for U.S. produced wheat, corn, sorghum, and soybeans.
3. Estimate the impacts of the user charge on U.S. and export grain flow patterns.
4. Analyze the extent to which the user charge would change the competitive positions of U.S. ports.
5. Provide insight into potential logistical inefficiencies which may result from the diverted grain flows.

Methodology and Procedures

Based on available legislative initiatives, a procedure to estimate user charges will be developed. Second, an economic procedure based on an international trade model will be required to estimate the effect of a port user charge on grain prices and quantities traded in the international and U.S. domestic markets. Finally, transportation models for each commodity, modified to account for relevant changes in ocean shipping rates and in quantities supplied and demanded in all involved markets, will be used to estimate the effect of a port user charge on export grain flow patterns.

Because no legislation has been enacted to date, user charge scenarios will be generated based on major features of the many pieces of proposed legislation. These include (1) the type of fee, weight- or ad valorem-based; (2) the fee's form, (port-specific or uniform); (3) the nature of costs subject to recovery (operations and maintenance costs and/or capital expenditures); and (4) the level of cost recovery; i.e., the cost-sharing formula between federal and nonfederal jurisdictions.

The interaction of excess supply and demand relationships determines prices and quantities traded in the international grain and soybean markets. There exists a vast amount of economic literature dealing with econometric models which estimate grain supply relationships in international spatial equilibrium models which include both supply and demand relationships as well as grain flow patterns (Grennes, Johnson, and Thursby; Barr; Rausser). To estimate changes in prices and quantities in all relevant markets, a simple international trade model involving an exporting country (the United States), and an aggregate importing country (the rest of the world) is developed. This is shown in Appendix I. In addition, Appendix I describes the procedure used to evaluate the effect of weight- and ad valorem-based fees on markets.

Spatial models have been successfully used to analyze grain and soybean flow patterns regionally, nationally, and internationally (Leath and Blakely; Makus; Taylor; Fuller and Shanmugham; Barnett, Binkley, and McCarl). Multiperiod, network flow models, originally developed by Taylor and later updated by Makus, are employed in an attempt to quantify the impact of a user charge on export grain flow patterns. Taylor developed transportation mod-

[1]Conceivably the deepening of harbors and channels (new construction) would facilitate the use of larger carriers and, because of economies of ship size, rates on routes which link deep water ports would decline. In which case, the reduced rate may offset or partially offset the proposed user charge. Although this may occur for some commodities on selected routes, there was limited evidence that this effect would be widespread for bulk grain carriage. First, many of the world's grain-receiving ports have less water than the U.S. ports which are candidates for new construction. In which case, the destination or foreign port is the constraint to the use of larger vessels. The important exceptions are several major ports in western Europe, Taiwan, and Japan. In addition, it has been observed that evolving ship size is not satisfactorily explained by the assumption that port constraints determine ship size, i.e., there are other factors than port water depth which limit or affect optimum ship size (Kendall). Kendall shows that ship costs, terminal costs (port, handling, and storage costs), annual volume of trade, length of voyage, etc., interact to determine optimum ship size. To test Kendall's notion that ship size on various routes is affected by other factors than port water depth, data on grain ship size were collected for routes linking U.S. Gulf and Pacific Northwest ports with Japan. If water depth was the principal constraint, larger carriers would travel the Pacific Northwest to Japan route (Yokohama port) since both of these ports have deeper water (45-60 feet). (*Lloyd's 1984 Ports of the World*). Based on 1984 data, ship size on the Pacific Northwest route ranged from about 14,000 to 61,000 DWT with an average of 47,730 DWT (140 observations). On the Gulf route, ship size ranged from 25,000 to 53,000 DWT with an average of 48,550 DWT (176 observations). This outcome tends to support Kendall's work since it shows similar size vessels operating on both routes, i.e., other factors than port water depth appear to be affecting ship size on these routes.

Kendall's work implies that a deepened harbor may not substantially increase the size of grain carriers which frequent a port, in which case, rates may not be lowered. As a result, the user charge would not be offset by a lowered ship rate. For these reasons, it was assumed that any new construction which was financed through user fees would increase ship rates.

els for various commodities including wheat, corn, grain sorghum, and soybeans. In addition, separate models were developed for hard, soft, and durum wheats. In this study, the hard wheat model will be disaggregated into two models to account for differences in the geography of production and consumption of hard red winter and spring wheats. The spatial models used in this study include grain and soybean surplus producing regions, domestic grain deficit regions, barge loading locations, grain shipping ports, and foreign demand regions. Four modes of transportation are specified which include truck, rail, barge, and ocean shipping vessels. See Appendix II for an overview of the spatial model used in this study.

Effect of Port User Charge on Grain Trade: Methodologies and Procedures

To evaluate the effect of port user charges on export grain flow patterns, it is necessary to estimate (1) increases in ocean shipping rates that result from imposition of the user charge, and (2) market effects of the user charge; that is, the changes in prices and quantities traded in the international and U.S. domestic grain markets. The purpose of this section is to describe the methodologies and procedures used to obtain these estimates. The first section details the user charge estimation procedure. In the second section, methodologies and procedures to approximate the effects of port user fees on grain markets are developed.

User Charge Estimation Procedure

As stated earlier, various types of user charge schemes have been proposed. Figure 1 illustrates all aspects of the proposed user charge and accordingly identifies features of this user fee which must be taken into consideration by the estimation procedure. The port user charge scenarios are based on proposed legislation and opinions of transportation experts from the U.S. Department of Agriculture and the U.S. Army Corps of Engineers.

Table 1 presents the formulae used to estimate user charges which recoupe operations and maintenance expenses. A uniform user charge implies a flat rate applied to all ports regardless of a port's incurred costs or tonnage. Thus, this type of user fee is obtained through division of all ports' operations and maintenance costs by all ports' tonnage (weight-based) or the value of all ports' commerce (ad valorem-based). Formulae 1 and 3 in Table 1 were used to estimate the weight-and ad valorem-based uniform user charges. Port-specific user charge estimates take into account the costs, tonnage, and value of commerce transiting each port. This user fee is calculated by dividing the operations and maintenance costs of each port by the port's tonnage (weight-based) or the value of all commerce transiting a port (ad valorem-based). Formulae 2 and 4 in Table 1 are used to estimate these respective charges. Formulae to estimate user fees which recover new construction costs are obtained by replacing "operations and maintenance expenses" which appear in the various formulae in Table 1 with

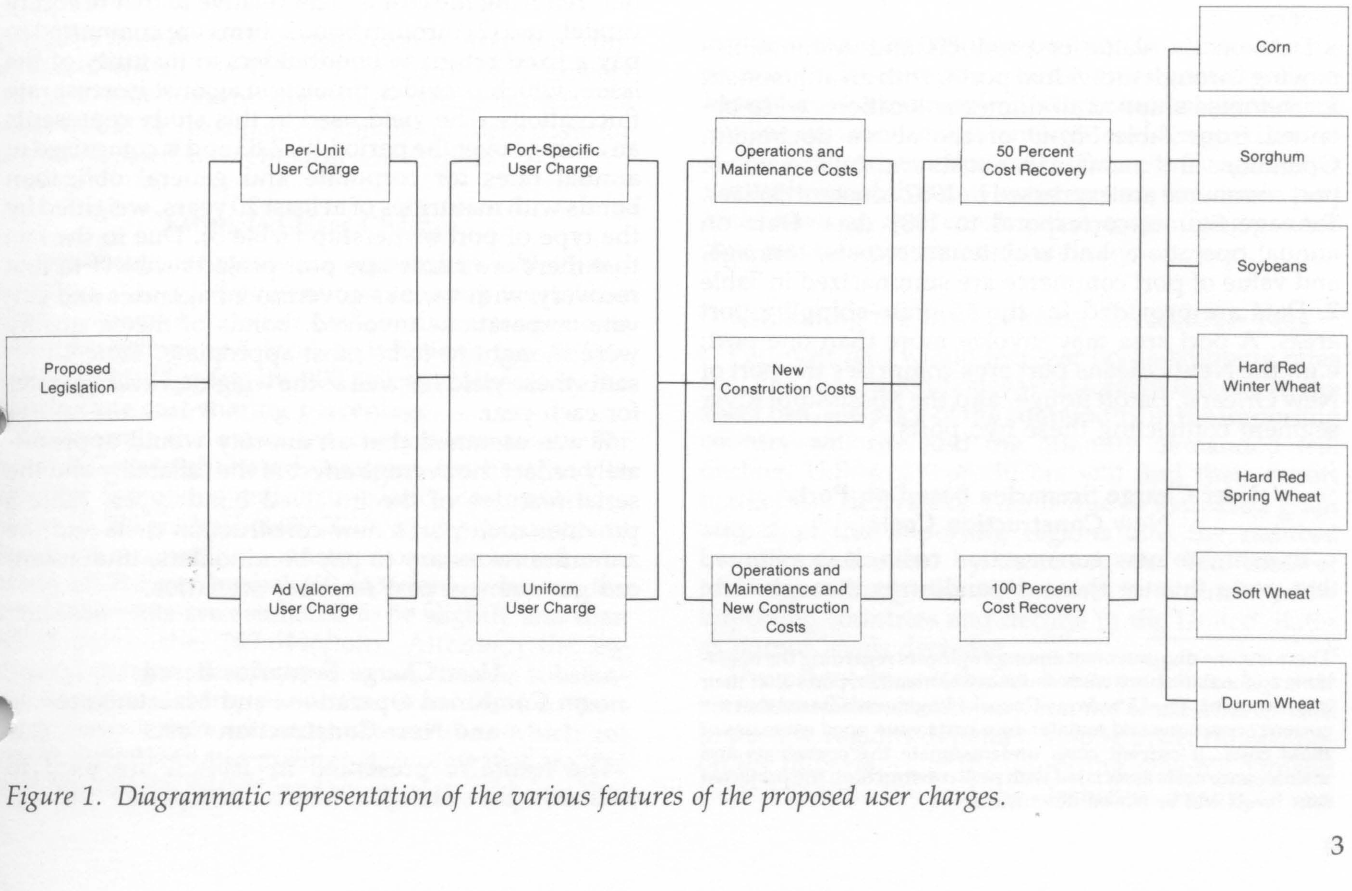

Figure 1. Diagrammatic representation of the various features of the proposed user charges.

Table 1. Formulae Used to Estimate Port User Fees

Number		Formula
Weight-Based User Charge (PUUC)		
(1)	Uniform PUUC =	$\frac{\text{All Ports' OM* Costs}}{\text{All Ports' Tonnage}}$
(2)	Individual Port-Specific PUUC =	$\frac{\text{Port's OM Costs}}{\text{Port Tonnage}}$
Ad Valorem User Charge (AVUC)		
(3)	Uniform AVUC =	$\frac{\text{All Ports' OM Costs}}{\text{All Ports' Value of Volume Serviced}}$
(4)	Individual Port-Specific AVUC =	$\frac{\text{Port's OM Costs}}{\text{Port's Value of Volume Serviced}}$

*OM = operations and maintenance.

"new constructions costs." User fees which include both costs are estimated by simply aggregating the two costs (operations and maintenance, new construction).

User Charge Scenarios Based on Ports' Operations and Maintenance Costs

Data on ports' operations and maintenance costs were obtained from the publication entitled, "Deep Draft Navigation Cost Recovery Analysis," prepared by the U.S. Army Corps of Engineers Office and the Chief of Engineers Directorate of Civil Works Office of Policy, published in September 1982. Specifically, Table 110.1-D in the publication provides data on operations and maintenance costs that are subject to cost recovery.

Data on the value of products and commodities moving through individual ports, with an adjustment for volumes shipped to domestic locations were obtained from Table 501-D of the above document. Operations and maintenance costs and dollar-value of port commerce are expressed in 1982 constant dollars. Tonnage figures correspond to 1981 data. Data on annual operations and maintenance costs, tonnage, and value of port commerce are summarized in Table 2. Data are provided for the 16 grain-shipping port areas. A port area may involve more than one port; e.g., the New Orleans port area comprises the port of New Orleans, Baton Rouge, and the Mississippi River segment connecting these two ports.

User Charge Scenarios Based on Ports' New Construction Costs

To estimate new construction costs, it is assumed that ports finance these expenditures through debt capital (bonds). This assumption can be justified on several grounds. First, since this type of construction does not represent a voluntary investment project, there is no *a priori* reason why the port authority should consider it as part of their investment portfolio. Second, historically, ports have financed their needs for funds mostly through general obligation bonds and revenue bonds. Third, the decision to issue bonds is largely influenced by the growth rate of fixed assets at the port. Long-term assets are often financed through long-term debt. Fourth, the cost of capital of externally-raised funds is frequently lower than that of internal sources (equity or new stock). Two important reasons accounting for the latter are (1) interest costs on debt capital are tax deductible while dividends are not, reducing the cost of debt relative to that of equity capital; and (2) through bonds, firms are committed to pay a fixed return to bondholders to maturity of the issue, which provides protection against interest rate fluctuations. The yield used in this study represents an average over the period 1977-83 and is comprised of annual rates for corporate and general obligation bonds with maturities of at least 20 years, weighted by the type of port ownership (Table 3). Due to the fact that there are numerous port projects subject to cost recovery, with various government agencies and private corporations involved, bonds of mixed quality were thought to to be most appropiate. Table 4 presents these yields as well as the weighted average rates for each year.

It was assumed that an annuity would appropriately reflect the average effect of the callability and the serial features of the involved bond types. Table 5 provides each port's new construction costs and the annuities necessary to pay bondholders, under various government cost recovery scenarios.

User Charge Scenarios Based on Combined Operations and Maintenance and New Construction Costs

The formulae presented in Table 1 are used to estimate port charges which incorporate the ag-

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

Table 2. U.S. Ports' Annual Operations and Maintenance Costs Subject to Recovery[1]

Port	State	Authorized Depth	Maintained Depth	Operations and Maintenance Costs	1981 Tonnage	Value of Commerce
		feet	feet	$1,000	1,000 ton	$1,000
Mobile	AL	40	40	5,303.2	19,541.3	3,119,252.680
New Orleans[2]	LA	40	40	23,037.9	133,421.8	45,466,130.007
Galveston[3]	TX	40	40	9,093.6	78,189.5	35,570,810.519
Corpus Christi	TX	45	45	6,130.9	31,525.8	5,719,312.431
Brownsville	TX	*	*	*	*	939,397.327
Charleston	SC	35	35	5,483.2	8,231.5	8,802,356.191
Baltimore	MD	50	42	2,420.9	39,035.7	18,192,283.640
Toledo	OH	28	28	3,493.1	22,279.7	1,594,432.189
Saginaw	MI	27	27	6,730.2	2,281.7	179,569.765
Chicago	IL	28	28	1,020.2	13,155.0	1,582,631.819
Duluth[4]	MN	28	28	2,384.1	39,425.1	2,492,417.947
Seattle[5]	WA	34	34	428.2	25,035.1	16,815,769.829
Portland[6]	OR	48	40	19,063.8	26,712.3	7,483,840.144
San Francisco[7]	CA	40	40	2,414.7	7,538.3	3,308,574.950
Long Beach[8]	CA	45	45	144.0	66,999.4	44,581,706.615
San Diego	CA	35	35	*	2,344.6	7,916,599.482
Subtotal				87,148.0	516,166.8	203,495,085.535
Other Ports				249,357.2	1,157,828.2	198,963,869.310
Total All Ports				336,505.2	1,673,995.0	402,458,954.845

Source: "Deep-Draft Navigation Costs Recovery Analysis," U.S. Army Corps of Engineers, September 1982; August 1984.
[1]All dollar figures in 1982 constant dollars.
[2]Includes New Orleans and Baton Rouge, LA.
[3]Includes Galveston and Houston, TX.
[4]Includes Duluth, MN and Superior, MI.
[5]Includes Seattle and Tacoma, WA.
[6]Includes Portland and Astoria, OR and Kalama and Longview, WA.
[7]Includes San Francisco, Stockton, and Sacramento, CA.
[8]Includes Long Beach and Los Angeles, CA.
*Not available.

gregated operations and maintenance and new construction costs. The U.S. Army Corps of Engineers advised that current operations and maintenance costs would be reasonable estimates of these costs for any anticipated new construction activity.

Estimated User Charges

User charge estimates are reported in Table 6 and correspond to a 100 percent cost recovery level. User charge estimates for other cost-sharing arrangements between federal and local jurisdictions can be obtained by multiplying the 100 percent estimate by the appropriate cost-sharing percentage.

In general, the estimated charges are small. For example, a weight-based, uniform fee designed to recoupe operations and maintenance costs averages about $0.006 per bushel ($0.201/ton). A similar type of fee which recovers new construction is estimated to be about $0.012 per bushel ($0.4436/ton), whereas the combined costs are estimated to be slightly less than $0.02 per bushel ($0.6446/ton). Although the estimated charges are relatively small, there is substantial variation among ports. For example, four port areas have estimated weight-based fees which recoupe operations and maintenance costs that are less than $0.0025 per bushel, and seven ports with fees that are less than $0.005 per bushel. In constrast, the Saginaw, Michigan port area has an estimated weight-based fee which is nearly $0.09 per bushel ($2.94/ton). Similar variation exists among fees designed to recoupe new construction costs. Because Congress has not authorized this new construction, four grain port areas have no new construction costs. Congress has thus far not appropriated funds for any port.

Estimating the Market Effect of Port User Fees

Port user fees would increase ocean shipping rates that link the United States with foreign buyers. In the short run, the price of the commodity in the importing country will rise and the quantity demanded will decline. U.S. grain producers will find their export market has decreased. This is due to increased grain output of the importing regions and the reduced quantity demanded by these regions. The costs of production (marginal) will increase with output in the importing countries and decline in the United States as output levels decrease.

The extent to which the burden of the ship rate increase will be shared between the United States and importing regions depends, among other things, upon the importance of the importing region's demand for the commodity and the elasticities of supply and

Table 3. U.S. Port Ownership Categories by Coastal Region

Region	Type of Ownership		
	State	Local	Private
		percent	
North Atlantic	28	24	48
South Atlantic	34	32	34
Gulf	8	44	48
South Pacific	10	61	29
North Pacific	0	48	52
Great Lakes	4	19	77
National Average	12	37	51

Source: National Port Assessment 1980/1990, An Analysis of Future U.S. Port Requirements. U.S. Department of Commerce, Maritime Administration, Office of Port and Intermodal Development. June 1980.

Table 4. Interest Rates for Municipal and Corporate Bonds

Year	Bond Rates		
	Municipals[1]	Corporate[2]	Weighted Rate
		percent	
1977	5.68	8.19	6.96
1978	6.03	8.97	7.52
1979	6.52	10.02	8.30
1980	8.59	12.70	10.69
1981	11.33	15.46	13.43
1982	11.66	14.45	13.08
1983	9.51	12.15	10.86
Average	8.47	11.70	10.12

Source: Federal Reserve Bulletin. Board of Governors of the Federal Reserve System, Washington, D.C. (various issues).

[1]Bond Buyer's Series. General obligations only, with 20-year maturity; issued by 20 state and local government units of mixed quality. Based on figures for Thursday.

[2]Aaa Utility Bonds. Compilation of the Federal Reserve. Issues included are long-term (20 years or more). Offered issues on Friday close-of-business quotations.

demand in the United States and importing regions. Assuming that the import demand is a significant portion of total demand, the U.S. export price will decrease by a greater amount (and the domestic price in the importing country will increase by a smaller amount) the less elastic is U.S. demand and supply. Thus, the United States will bear much of the burden if its domestic demand and supply are inelastic. A complete analysis of the various forces becomes too involved and detailed to present here. See Appendix I for a procedure to estimate the effect of the various user charges.

Based on the procedure outlined in Appendix I, the estimated effects of the various proposed port user fees on prices and quantities produced and traded are calculated. Table 7 identifies the estimated percent change in quantity demanded by foreign buyers of U.S. grain, the percent change in quantity supplied by

Table 5. Estimated Costs of Improvement and New Construction of U.S. Deep-Draft Port Areas[1]

Port	Total Estimated Cost	30-year Annuity Payment
	(million $)	
Mobile, AL	447.72	47.97
New Orleans	525.00	56.25
Galveston	595.00	63.75
Corpus Christi	92.02	9.86
Brownsville	—	—
Charleston	80.10	8.65
Baltimore	400.00	42.86
Toledo	—	—
Saginaw	—	—
Chicago	—	—
Duluth	10.78	1.15
Seattle	82.24	8.81
Portland	3.16	0.34
San Francisco	276.60	29.64
Long Beach	460.00	49.29
San Diego	—	—
Total	2,973.22	318.56
Other Ports	3,957.86	424.06
All U.S. Ports	6,931.08	742.62

Source: U.S. Army Corps of Engineers, Washington, D.C.
[1]All figures in 1982 dollars.

U.S. producers, and percent change in U.S. domestic consumption. As expected, the supply and foreign demand for U.S. grain declines while domestic U.S. consumption increases. In general, the ad valorem-based fees have the least effect on quantities produced and traded. Table 8 relates the estimated impact on domestic and international grain prices that results from imposing various types of user fees. The analysis reveals only modest price increases and declines in the international and U.S. domestic markets, respectively. Again, the ad valorem-based fee appears to have the least effect on prices.

Effect of Port User Charge on Export Grain Flow Patterns: Empirical Results

This section includes discussion of weight-based and ad valorem-based fees, both of which may be levied on a port-specific or uniform basis. In addition, the analysis evaluates the effect of recovering operations and maintenance expenses as well as new construction expenditures. The analysis assumes 100 percent recovery of costs by local jurisdictions. Altered flows associated with a 50 percent cost recovery level as well as individual commodity flows are included in Appendix III.

Weight-Based, Port-Specific User Fee

A weight-based user charge aimed at recovering operations and maintenance expenses through 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 9). The greatest relative effect is in the Atlantic and Great

Table 6. Ports' User Charge Estimates for All Types of Costs Subject to Recovery[1]

Port	OM Weight-Based	OM Ad Valorem	NC Weight-Based	NC Ad Valorem	OMNC Weight-Based	OMNC Ad Valorem
	$/ton[3]	percent	$/ton	percent	$/ton[3]	percent
Mobile, AL	0.2714	0.17002	2.4548	1.53786	2.7262	1.70788
New Orleans, LA	0.1727	0.05067	0.4216	0.12372	0.5943	0.17439
Galveston, TX	0.1163	0.02556	0.8153	0.17922	0.9316	0.20478
Corpus Christi, TX	0.1945	0.10720	0.3128	0.17240	0.5073	0.27960
Brownsville, TX	—	—	—	—	—	—
Charleston, S.C.	0.6661	0.06229	1.0504	0.09823	1.7165	0.16052
Baltimore, MD	0.0620	0.01331	1.0979	0.22330	1.1599	0.23661
Toledo, OH	0.1568	0.21908	—	—	0.1568	0.21908
Saginaw, MI	2.9496	3.74800	—	—	2.9496	3.74800
Chicago, IL	0.0766	0.06446	—	—	0.0766	0.06446
Duluth, MN	0.0605	0.09565	0.0293	0.04632	0.0898	0.14197
Seattle, WA	0.0171	0.00224	0.3520	0.05240	0.3691	0.05464
Portland, OR	0.7137	0.25473	0.01270	0.00452	0.7264	0.24925
San Francisco, CA	0.3203	0.02711	3.9313	0.89572	4.2516	0.96871
Long Beach, CA	0.0021	0.00032	0.7356	0.11055	0.7377	0.11087
San Diego, CA	—					
Overall 16-port fee[4]	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

Cost Subject to Recovery[2]: OM, NC, OMNC.

[1]User charge estimates for a 100 percent cost recovery level.
[2]OM operation and maintenance costs, NC = new construction costs, OMNC = operation and maintenance costs plus new construction costs.
[3]Short tons.
[4]Weighted port-specific fee for 16 grain-shipping ports.

Table 7. Estimated Market Effects of Port-User Charges: Percent Changes in Quantities

Commodity	Per-Unit User Charge, Port-Specific OM[1]	Per-Unit, Port-Specific NC	Per-Unit, Uniform OM	Per-Unit, Uniform NC	Ad Valorem User Charge, Port-Specific OM	Ad Valorem, Port-Specific NC	Ad Valorem, Uniform OM	Ad Valorem, Uniform NC
Percent Changes in U.S. Foreign Demand (−)								
Corn	0.095	0.347	0.113	0.249	0.030	0.109	0.058	0.128
Sorghum	0.118	0.433	0.141	0.311	0.037	0.136	0.073	0.161
Soybeans	0.035	0.128	0.042	0.092	0.023	0.086	0.046	0.101
Wheat	0.036	0.132	0.043	0.095	0.016	0.057	0.031	0.068
Percent Changes in U.S. Supply (−)								
Corn	0.012	0.043	0.014	0.031	0.004	0.013	0.007	0.016
Sorghum	0.018	0.066	0.021	0.047	0.005	0.021	0.011	0.023
Soybeans	0.008	0.030	0.010	0.021	0.005	0.020	0.011	0.023
Wheat	0.014	0.050	0.016	0.036	0.006	0.022	0.012	0.026
Percent Changes in U.S. Domestic Demand (+)								
Corn	0.024	0.086	0.028	0.062	0.007	0.027	0.014	0.032
Sorghum	0.036	0.132	0.043	0.095	0.011	0.042	0.022	0.049
Soybeans	0.011	0.040	0.013	0.029	0.007	0.026	0.014	0.031
Wheat	0.024	0.088	0.029	0.063	0.011	0.038	0.021	0.045

[1]OM and NC denote operation and maintenance costs and new construction costs, respectively.

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 grain while Huron and Erie lose exports. Lakes Huron and Erie ports incur large operations and maintenance expenses and handle a relatively small volume of grain; and since weight-based fees are estimated by dividing costs by tonnage, they have relatively large user fees. (See Table 1 for procedure to calculate fees.) 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.

Table 8. Estimated Market Effects of Port-User Charges: Percent Changes in Price per Ton

	Weight-Based User Charge				Ad Valorem User Charge			
	Port-Specific		Uniform		Port-Specific		Uniform	
Commodity	OM[1]	NC	OM	NC	OM	NC	OM	NC
				$/ton				
				International Market (+)				
Corn	0.106	0.387	0.126	0.278	0.033	0.122	0.065	0.143
Sorghum	0.063	0.229	0.075	0.165	0.020	0.072	0.039	0.085
Soybeans	0.107	0.393	0.128	0.282	0.072	0.262	0.140	0.309
Wheat	0.056	0.203	0.066	0.146	0.024	0.089	0.047	0.104
				U.S. Domestic Market (−)				
Corn	0.080	0.293	0.095	0.211	0.025	0.091	0.049	0.108
Sorghum	0.123	0.451	0.147	0.324	0.039	0.142	0.076	0.168
Soybeans	0.079	0.288	0.094	0.207	0.053	0.192	0.102	0.226
Wheat	0.131	0.478	0.156	0.343	0.057	0.208	0.111	0.245

[1]OM and NC denote operation and maintenance costs and new construction costs, respectively.

Table 9. Effect on U.S. Port Area Grain and Soybean Flows of a Weight-Based User Fee Which Is to Recoupe All Operations and Maintenance Expenses (OM), New Construction Costs (NC), and the Aggregate of These Costs (OMNC)[1]

	Port-Specific Fees						Uniform Fees					
	OM		NC		OMNC		OM		NC		OMNC	
Port Area	Change In Volume[2]	Percent Change[3]	Change In Volume	Percent Change	Change In Volume	Percent Change	Change In Volume	Percent Change	Change In Volume	Percent Change	Change In Volume	Percent Change
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
North 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	-1.81	-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	2.16	- 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[4]	- 3.16	- 0.06	- 11.53	- 0.24	- 14.67	- 0.30	- 3.7	-0.08	- 8.3	-0.17	-12.1	-0.25

[1]Numbers at the coast level may not add up to totals due to rounding.
[2]Million bushels.
[3]Percent change from baserun volume.
[4]Overall reduction in U.S. grain exports resulting from increase in export price due to user charge imposition.

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 by railroad.

Port-specific user fees that are based on recovery of new construction costs generate more dramatic changes in flows than user fees based on operations

Table 10. Effect on U.S. Port Area Grain and Soybean Flows of an Ad Valorem User Fee Which Is to Recoupe All Operations and Maintenance Expenses (OM), New Construction (NC), and the Aggregate of These Costs (OMNC)[1]

	Port-Specific Fees						Uniform Fees					
	OM		NC		OMNC		OM		NC		OMNC	
Port Area	Change In Volume[2]	Percent Change[3]	Change In Volume	Percent Change	Change In Volume	Percent Change	Change In Volume	Percent Change	Change In Volume	Percent Change	Change In Volume	Percent Change
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
North 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	0.311	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	- 0.4	-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[4]	- 1.13	- 0.02	- 4.14	- 0.08	- 5.27	- 0.11	- 2.2	-0.05	- 4.9	-0.10	- 7.1	-0.15

[1]Numbers at the coast level may not add up to totals due to rounding.
[2]Million bushels.
[3]Percent change from baserun volume.
[4]Overall reduction in U.S. grain exports resulting from increase in export price due to user charge imposition.

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. 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 construction activity, thus a user fee designed to recover these costs would direct 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. Most Mississippi River and North 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 yield somewhat different results than those based on recovery of either cost. In some coastal areas, altered grain flows resemble those already discussed, whereas in others, there appears to be little relationship. This is not surprising since the aggregated magnitude of the operations and maintenance and new construction 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. In all other coastal port areas, flows are altered about 1 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 uniformly applied to all U.S. ports have a small affect on intercoast and interport competition (Table 9). In all cases, Lake ports suffer minor grain losses to Gulf ports, regardless of the recovered cost. 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

Table 10 reports alterations in grain flow patterns that arise from introduction of an ad valorem-based user charge. Ad valorem-based user fees are generally different in magnitude than weight-based fees, since they are based on value of exports transshipped through a port. Thus, the product mix of a particular port is an important factor determining the magnitude 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 do not seriously alter flows (Table 10). Atlantic and Gulf coast ports experience modest increases in grain export volume, whereas 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 is redirected to the Mississippi River port area, whereas ports located in the Lake Huron-Erie area lose export grain while Lakes Superior and Michigan gain volume.

Port-specific user fees that seek to recoupe 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 within the Gulf area is altered at both Mississippi River and North Texas ports where export volume increases, while sizable losses are incurred by the East Gulf ports.

Port-specific fees which incorporate the aggregated operations and maintenance and new construction fees do not redirect grain from one coastal area to another; however, grain is redirected among ports in a particular coastal area (Table 10). In the Gulf area, East Gulf ports experience a dramatic loss of grain exports, whereas Mississippi River ports' volume increases 8 percent or about 180 million bushels. In the Great Lakes, the Lake Superior-Michigan area has the advantage over Huron-Erie ports because of the 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 seem to provide little change in grain export flow patterns, as was the case with weight-based, uniform charges (Table 10). 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 various user charge scenarios. These include the Mississippi River, Seattle, Lake Superior-Michigan, North Texas, and North Atlantic port areas.

The Mississippi River port area is the most important grain outlet in the nation, accounting for up to 40 percent of U.S. agriculture's grain exports. Depending on the user fee scenario analyzed, increases in export volumes range from 19 to 248 million bushels of grain, which represent percentage increases relative to the base solution of 0.9 and 11.5 percent, respectively. Historical year-to-year (positive) variation of export grain volume in this area 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 River ports. However, such an increment would require maximum utilization of port elevator capacity. Research by Barnett, Binkley, and McCarl 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 the Mississippi River's port facilities would need to operate an additional 12 hours per week to accommodate this outflow. In summary, the Mississippi River port area would probably be able to handle the large increase in exports brought about by imposition of a port-specific, weight-based user fee, however, there may be additional congestion during peak export 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 (wheat) by nearly 50 million bushels at the expense of Portland when user fees are imposed to cover operations and maintenance costs. Since this yields a total outflow which approximates some historical levels, the additional volume should not respresent a threat to system efficiency.

The analysis shows 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 operations and maintenance and new construction costs, were introduced. This maximum increase could be accommodated by operating facilities an additional 3 hours per week. Therefore, this modest increase could be accomodated by existing port elevator capacity.

North 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 U.S. produced soybeans and corn and is a competitor of Great Lake ports. The analysis shows a port-specific fee (weight-based), including only operations and maintenance costs, to redirect grain to this port area—the maximum increase is estimated to be 23 million bushels or about a 4 percent increase. This additional volume could be accommodated by operating port infrastructure an additional 2 hours per week. Since no port elevators in this area appear to operate more than 40 hours per week, there would seem to be few capacity problems (Barnett, Binkley, and McCarl).

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 cases, the modest increase in flows can be accommodated with increases in operating hours. The exception may be the Mississippi River port area, where infrastructure would need to operate an additional 12 hours per week if a port-specific user fee designed to recoupe 100 percent of new construction costs were introduced

Summary and Conclusions

The purpose of this study is to assess some of the effects of a proposed deep-draft user fee. User charge scenarios are generated to include the major features of legislation presented to Congress in the past several years. The analysis focuses on weight- and ad valorem-based charges which may be applied on a uniform or port-specific basis. In addition, the analysis examines the effect of recovering the various types of expenses—these include ports' operations and maintenance expenses and new construction costs.

Based on recent legislative proposals, various forms of the user fee are estimated. Then, with use of a multiperiod, network flow model, possible changes in grain flow patterns are analyzed. The model minimizes grain handling, storage, and transfer costs which include truck, rail, barge, and ocean shipping costs. The model is international in scope and includes 165 U.S. domestic grain surplus regions, 85 domestic grain deficit regions, 43 river points, and 16 representative U.S. grain shipping port areas which are linked to 25 foreign demand regions.

In general, the analysis shows the most likely port user fee for grain and soybeans to be small. At most grain ports, either weight- or ad valorem-based fees which recover operations and maintenance expenses would be less than $0.01 per bushel. If charges designed to recoupe authorized new construction and maintenance expenses were implemented, charges would average about $0.02 per bushel. Although the average fee is relatively small, there is substantial variation among ports. This is because (1) operations and maintenance expenses differ among ports; (2) only selected ports have been authorized for new construction; and (3) the volume and value of commerce transitting the various ports differ.

The least-cost analysis shows 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. The principal flow pattern 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 of user fees designed to recoupe the various types of costs. These costs include ports' operations and maintenance costs, improvement or new construction expenditures, and the aggregate of these costs. The most dramatic change associated with a user fee designed to recover operations and maintenance costs is a port-specific, weight-based user fee which would reroute about 20 percent of Portland's historic volume to Seattle. When new construction costs are incorporated into this type of user fee, several relatively dramatic changes in flows occur. In particular, East Gulf and North Atlantic ports lose 160 (83 percent) and 108 (20 percent) million bushels, respectively, while Mississippi River ports increase their outflow by 248 million bushels, or about 11 percent. A port-specific, weight-based user fee which covers the aggregated operations and maintenance and new construction 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 many cases, a port's advantage or disadvantage that would result from imposition of a user fee is small and, in the short run, a disadvantaged port's infrastructure may absorb some of the user fee. Therefore, the least-cost methodology employed in this study may tend to overestimate altered flows. It is important to note that the analyses assumed peak export levels which approximated those of the 1980-81 period. Therefore, the magnitude of altered flows is increased and the pressures on port intermodal capacity possibly overstated. Regardless, an effort was made to determine whether port area intermodal transfer capacity was adequate. In most cases, port area intermodal transfer capacity was adequate. The exception may be the Mississippi River port area which may have inadequate capacity to handle an additional 248 million bushels. This additional volume is projected to occur through imposition of a port-specific, weight-based fee which recoupes new construction costs.

In summary, the port user fee will not have a major effect on agriculture since the estimated unit fee is quite small. The magnitude of the user fee is closely associated with the amount of the charge to be recovered and the volume or value of freight transitting the port. In most cases, a port's relative cost advantage or disadvantage that results from imposition of a user charge is not large. Therefore, in the short run, a port's cost disadvantage is likely to be partially absorbed by lowering the rate of return on capital investment, thus minimizing abrupt disruptions in trade flows.

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Appendix I. Technical Discussion of Methods and Procedures

Procedure to Estimate the Effect of User Charges on Grain Trade

Market effects of both weight- and ad valorem-based user fees are similar with respect to the direction of change, but differ in magnitude (Figures 2 and 3). Major effects include an increase in the price of U.S. grain to foreign buyers and a subsequent decline in quantity traded. In the U.S. domestic market, price is lowered and quantities supplied and demanded decrease and increase, respectively. The purpose of this section is to develop a mathematical procedure which will allow one to obtain quantitative estimates of these effects.

Effect of Weight-Based Port User Charges

In this subsection, algebraic expressions which can be used to estimate the market effect of weight-based user charges are derived. Market effects involve changes in prices and quantities traded both in the internaitonal market, and the U.S. domestic market.

Changes in Prices and Quantities Traded in the International Market

Under the assumption of free trade and linear market relationships, let

(1a) $$Q_{se} = a + b\,P_e\,, \quad b \geqslant 0$$

and

(1b) $$Q_{de} = c + d\,P_e\,, \quad c \geqslant 0 \text{ and } d \leqslant 0$$

be the supply and demand equations in the exporting country's (United States) domestic market, and let

(2a) $$Q_{di} = g + h\,P_i\,, \quad g \geqslant 0 \text{ and } h \leqslant 0$$

and

(2b) $$Q_{si} = j + k\,P_i\,, \quad k \geqslant 0$$

be the demand and supply equations in the "aggregate" importing country's (Rest-of-the-World or ROW) domestic market. Q_{se} and Q_{de} are the quantities supplied and demanded, and P_e is the price in the exporter's market, while Q_{si}, Q_{di}, and P_i represent quantities supplied and demanded and price in the ROW markets, respectively. The letters a, b, c, d, g, h, j, and k respresent constants.

Using the "excess supply-excess demand" approach, the following expressions are obtained by subtracting (1b) from (1a), as well as (2b) from (2a):

(3a) $$ES = A + B\,P_e, \quad B \geqslant 0$$

and

(3b) $$ED = G + D\,P_i\,, \quad D \leqslant 0 \text{ and } G \geqslant 0$$

where $A = a - c$; $B = b - d$; $G = g - j$; and $D = h - k$; and where ES and ED are the quantites supplied and demanded in the international market, respectively.

Equilibrium conditions in the international market require that ES = ED = Q and $P_e = P_i = P$. Substituting these requirements into (3a) and (3b) and solving for P yields,

(4) $$P = \frac{G - A}{B - D}.$$

Introducing the weight-based transportation rate, t, into equation (3a) results in

(5) $$ES = A - Bt + BP_e\,.$$

The new equilibrium price P* in the international trade market is obtained by solving equations (5) and (3b), under the same equilibrium conditions as above,

(6) $$P^* = \frac{G - A + Bt}{B - D}$$

and the price differential is

(7) $$P = P^* - P = \left[\frac{B}{B - D}\right] t$$

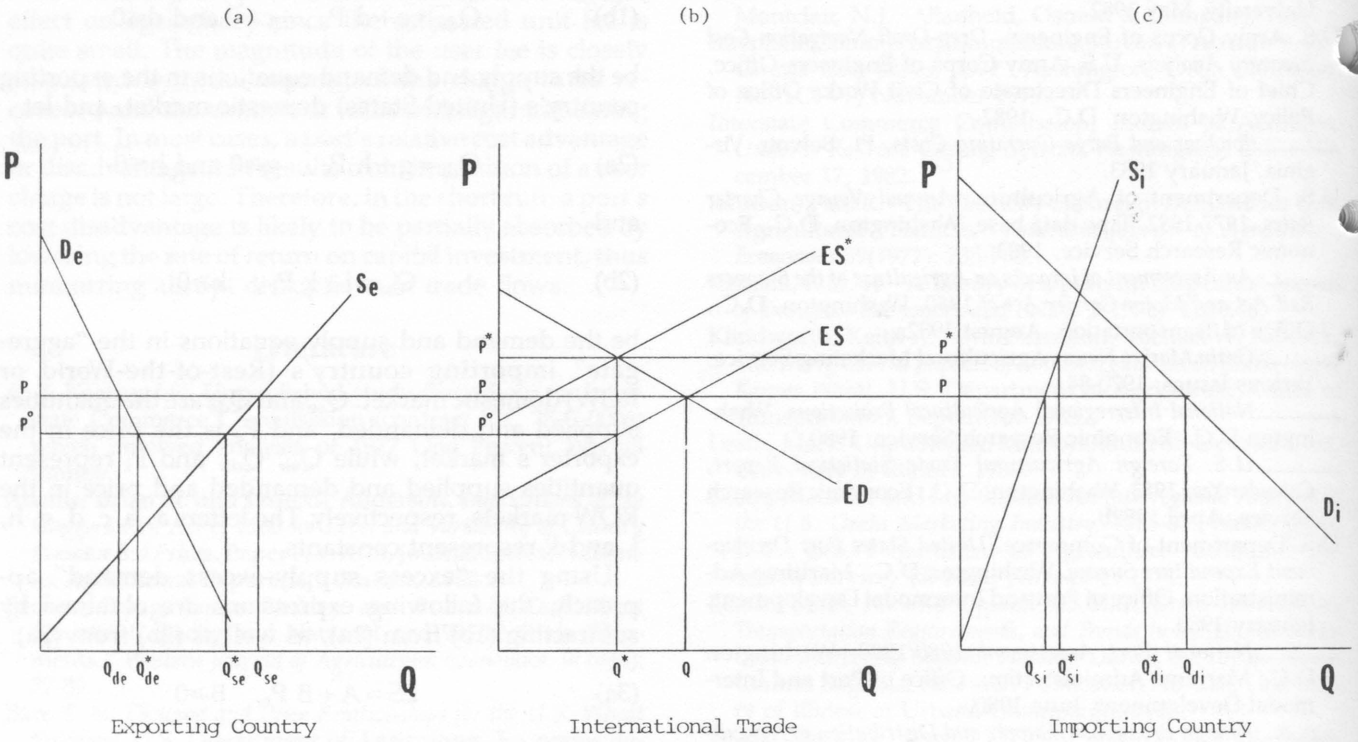

Figure 2. Effect of per-unit increases in transportation costs on international trade.

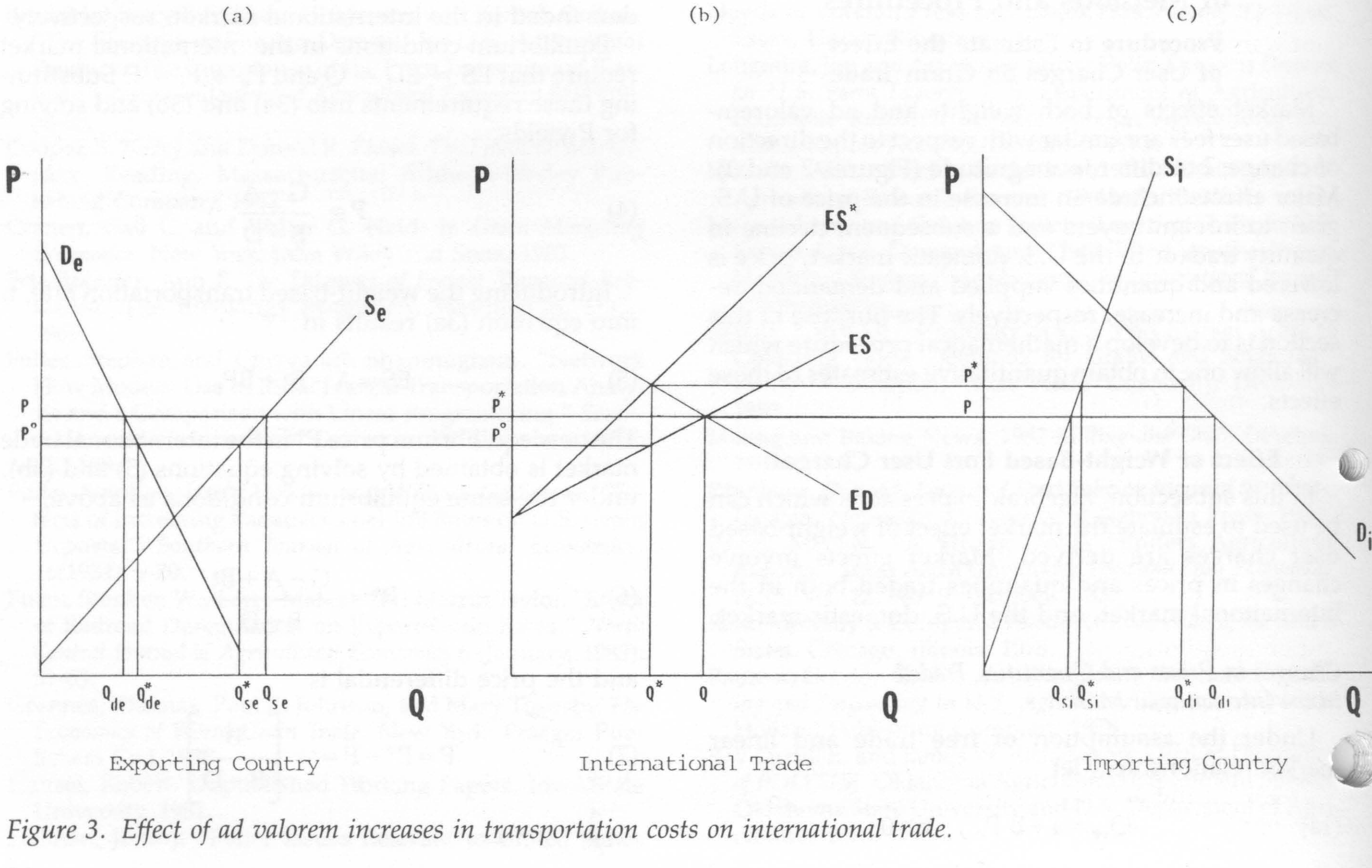

Figure 3. Effect of ad valorem increases in transportation costs on international trade.

where,

$$0 \leqslant \left[\frac{B}{B-D} \right] \leqslant 1.$$

From the equality of ES and ED, it follows that (7) can also be expressed in elasticity terms as

$$(8) \qquad P = \left[\frac{E_{es}}{E_{es} - E_{ef}} \right] t,$$

for small t, where E_{es} and E_{ef} are the elasticities of excess supply and excess demand, respectively.

By definition and since Q = ED = ES,

$$(9) \qquad E_{ef} = \frac{Q}{P} \frac{P}{Q}$$

and

$$(10) \qquad \frac{Q}{Q} = E_{ef} \frac{P}{P}.$$

Substituting (8) and (10) yields,

$$(11) \qquad \frac{Q}{Q} = E_{ef} \left[\frac{E_{es}}{E_{es} - E_{ef}} \right] \frac{t}{P}.$$

Expression (11) allows one to approximate the percentage change in quantity demanded (imports) by the ROW market due to the inclusion of transportation rates in the analysis.

Changes in Prices and Quantities Traded in the Exporter's Domestic Market

Figure 2 shows that price in the exporting country (the United States) is lowered, quantity supplied decreased, and quantity demanded increased when a transportation rate is introduced. The price change can be obtained from (8). P refers to the increase in price faced by the importing country. The price decrease in the exporting country can be expressed as follows. The amount of the tax t is composed of two components, $(P^* - P)$ and $(P - P^\circ)$. By definition, the negative of this latter term, $(P^\circ - P)$, is equal to P°, the change in price in the exporting country. The former term is simply P. Hence,

$$(12) \qquad P^\circ = (P^\circ - P) = (P - t) = \left[\frac{E_{ef}}{E_{es} - E_{ef}} \right] t$$

upon substitution of (8) and rearranging. The negative expression in (12) reflects the price decrease in the exporting country. The percentage change in domestic quantity demanded by domestic consumers with introduction of a weight-based transportation rate follows from the definition of the elasticity of domestic demand:

$$(13) \qquad \frac{Q_{de}}{Q_{de}} = E_{de} \left[\frac{E_{ef}}{E_{es} - E_{ef}} \right] \frac{t}{P}.$$

Using a similar procedure, the change in quantity supplied in the exporter's domestic market, for a weight-based transportation rate, can be expressed as follows:

$$(14) \qquad \frac{Q_{se}}{Q_{se}} = E_{se} \left[\frac{E_{ef}}{E_{es} - E_{ef}} \right] \frac{t}{P}.$$

Effect of Ad Valorem Port User Charge

The purposes of this subsection are the same as in the case of a weight-based user charge. Again, free trade and linear market relationships are assumed.

Changes in Prices and Quantities Traded in the International Market

The starting point of this analysis is given by the excess supply and demand equations as specified in the previous section:

$$(3a) \qquad ES = A + BP_e$$

$$(3b) \qquad ED = G + DP_i\ .$$

Introducing the ad valorem user charge, t, into equation (3a) yields

$$(15) \qquad ES = A + \frac{B}{(1+t)} P_e$$

since the excess supply curve pivots upward on the price axis (Figure 3).

Solving (15) and (3b) for the after-user charge equilibrium price results in

$$(16) \qquad P^* = \frac{G - A}{B - D(1+t)} (1+t).$$

Since

$$(4) \qquad P = \frac{G - A}{B - D},$$

then

$$(17) \qquad \frac{P^*}{P} = \frac{(B - D)(1+t)}{B - D\,(1+t)}.$$

But since $\Delta P = P^* - P$, then

$$(18) \qquad \frac{\Delta P}{P} = \frac{P^* - P}{P} = \frac{P^*}{P} - 1.$$

Substituting (17) into (18) yields

$$\frac{\Delta P}{P} = \frac{(B-D)(1+t)}{B-D\,(1+t)} - 1 \qquad (19)$$

which expressed in elasticity terms yields,

$$\frac{\Delta P}{P} = \frac{E_{es}t}{E_{es} - E_{ef}(1+t)} \qquad (20)$$

which provides an equation to approximate the percentage change in world market prices.

From the definition of the elasticity of U.S. export demand, the percentage change in quantity demanded in the world market is given by

$$\frac{\Delta Q}{Q} = E_{ef}\frac{\Delta P}{P}, \qquad (21)$$

which, upon substitution of (20) and (21), can be reduced to

$$\frac{\Delta Q}{Q} = E_{ef}\left[\frac{E_{es}t}{E_{es} - E_{ef}\,(1+t)}\right]. \qquad (22)$$

Changes in Prices and Quantities Traded in the Exporter's Domestic Market

The change in price given by equation (19) corresponds to a price increase in the importer market (ROW). To obtain the price decrease in the United States, however, it is necessary to isolate ΔP^{o}. In Figure 4, an enlargement of triangle abc (Figure 3) is illustrated. Notice that ΔP^{o} can be expressed trigonometrically as a function of ΔQ and B:

$$\Delta P^{o} = \frac{\Delta Q}{\tan B} \qquad (23)$$

But tan B is the slope of the excess supply function, and thus, $\tan B = E_{es}\,Q/P$, from the definition of E_{es}. Substitution and rearranging yields

$$\frac{\Delta P^{o}}{P} = \frac{1}{E_{es}}\;\frac{\Delta Q}{Q}. \qquad (24)$$

From the definition of the elasticity of U.S. domestic supply,

$$\frac{\Delta Q_{se}}{Q_{se}} = E_{se}\frac{\Delta P^{o}}{P}. \qquad (25)$$

Substituting (22) into (24) and that result into (25) yields

$$\frac{\Delta Q_{se}}{Q_{se}} = \frac{E_{se}E_{ef}}{E_{es}}\left[\frac{E_{es}t}{E_{es} - E_{ef}(1+t)}\right]. \qquad (26)$$

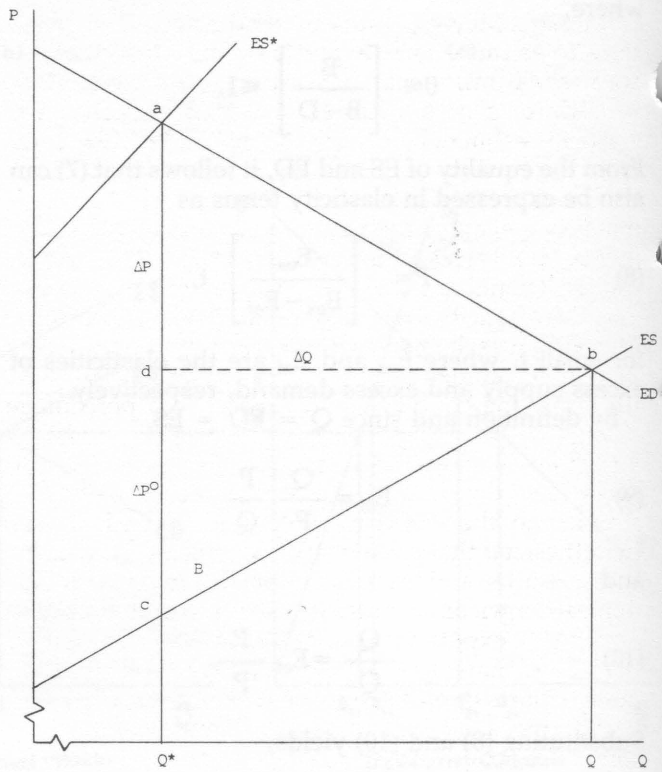

Figure 4. Enlargement of the effects of an ad valorem increase in transportation costs on international trade.

Similarly, for the change in quantity demanded,

$$\frac{\Delta Q_{de}}{Q_{de}} = \frac{E_{ed}E_{ef}}{E_{es}}\left[\frac{E_{es}t}{E_{es} - E_{ef}(1+t)}\right]. \qquad (27)$$

Determination of the effect of port user fees on grain trade at all levels requires the estimation of U.S. export demand and U.S. excess supply elasticities. The procedures used to obtain these elasticities are discussed in the next subsection.

Elasticity Estimation Procedure

Evaluation of the effect of the user charge on grain export flow patterns requires the use of the grain transportation models described in Section III. These models utilize as input data the changes in foreign demand by world subregion or country. Although the mathematical expressions derived above provide an approximate means to estimate percentage changes in quantity demanded by the ROW market, they represent aggregate estimates. Consequently, disaggregated estimates by world subregion must be procured. Moreover, the utilization of such expressions is contingent upon the availability of elasticities for both the U.S. grain export (excess) demand and excess supply functions. A description of the procedures used to obtain these elasticities follows.

Bredahl, Meyers, and Collins developed a procedure to estimate U.S. export demand elasticities for corn, sorghum, wheat, soybeans, and cotton. Their procedure is of interest to this study because the elasticity estimates are derived by adding the individual contributions of seven world subregions or countries to these elasticities. Essentially, their estimates were a function of the exporting countries' excess-supply elasticities, excluding the United States, the importing countries' excess-demand elasticities, and the elasticities of price transmission (E_{pi} or E_{pj}). The latter was defined as the percentage change in the price of a commodity in the jth exporting country (or ith importing country) with respect to a percentage change in the U.S. price. Bredahl, Meyers, and Collins' analysis was carried out under two basic assumptions. First, the United States was treated as a residual supplier to the world markets; and second, it was hypothesized that price insulating policies exerted by both exporter and importer countries to protect their domestic agricultural sectors have a major influence on the U.S. export demand elasticity. The treatment of the United States as a residual supplier implies that (1) grain exports of other countries are not responsive to world prices, (2) prices and volumes exported by competing countries are not simultaneously determined with those of the United States, and (3) U.S. exports and production do respond to world prices of agricultural commodities (Bredahl and Green). The notion of the United States as a residual supplier has been sustained by many economists (McCalla; Harrison; Paarlberg; and Hillman). Bredahl and Green tested these hypotheses and their findings indicate that the treatment of the United States as a residual supplier is justified for commodities such as corn and other coarse grains.

Price-insulating policies which fix domestic prices are commonplace. The notion is that the magnitude of the elasticity of price transmission between a given country and the United States depends upon the extent of price insulation exerted by that country. Under a free trade assumption, which implies absence of trade barriers, the elasticity of price transmission has a value of 1. In contrast, a highly regulated international market would induce near zero elasticities of price transmission.

Bredahl, Meyers, and Collins express the elasticity of U.S. export demand as follows:

$$E_{ef} = \sum_i E_{pi} E_{edi} \frac{Q_{mi}}{Q_{ef}} - \sum_j E_{pj} E_{esj} \frac{Q_{xj}}{Q_{ef}} \quad (28)$$

with

$$E_{edi} = (E_{di} - E_{si}) \frac{Q_{di}}{Q_{mi}} + E_{si} \quad (29)$$

and

$$E_{esj} = (E_{sj} - E_{dj}) \frac{Q_{dj}}{Q_{mi}} + E_j, \quad (30)$$

where:

E_{pi} = elasticity of price transmission of ith importing region and is defined as the response of domestic price in the ith country to a change in U.S. price.

E_{pj} = similar to E_{pi} but for the jth exporting region, other than the United States.

E_{edi} = elasticity of the ith importing region's excess demand.

E_{esj} = elasticity of the jth exporting region's excess supply.

E_{di} = ith importing region's elasticity of domestic demand.

E_{si} = ith importing region's elasticity of domestic supply.

E_{dj} = jth exporting region's elasticity of domestic demand.

E_{sj} = jth exporting region's elasticity of domestic supply.

Q_{mi} = ith region's imports of grain from all countries.

Q_{xj} = jth region's exports of grain to all countries.

Q_{ef} = U.S. grain exports.

Q_{di}, Q_{dj} = quantities of grain demanded in the ith and jth regions, respectively.

Notice that when E_{pi} (the elasticity of price transmission associated with importer countries) approaches zero, E_{ef} (the U.S. export demand elasticity) becomes more inelastic. A similar argument holds for E_{pj} (the elasticity of price transmission of exporter countries). Bredahl, Meyers, and Collins obtained three sets of U.S. export elasticities for the commodities mentioned above, under three different trade assumptions, for seven world regions. Based on analysis of the most common price-insulating policies exerted by both major exporting and importing world regions, values of the respective price transmission elasticity were hypothesized for each region. The first case, labeled as the minimum restricted case, assumed that E_{pi} for the ROW region, which included mostly third world countries was zero. The remaining regions, including ECC-9, Other Western Europe, Eastern Europe, Japan, Russia, and the People's Republic of China, are treated separately based on their own policy situation. The second case, labeled as the maximum restricted case, assumed ROW's elasticity of price transmission as unity; this case was considered by the authors as probably the more realistic. The third case, referred to as the free trade case, assumed E_{pi}'s for all seven regions as unity.

For more current U.S. export demand elasticities for grain and soybeans, a tape by the National Technical Information Service (U.S. Department of Commerce) containing supply and distribution data was used. Data used in this study covers 1977-78 through 1982-83. Elasticity estimates are calculated under the maximum restricted and the free trade cases. The elasticities of price transmission used here are based on

Table 11. U.S. Domestic Supply and Demand Elasticities

Commodity	Supply Elasticity	Demand Elasticity
Corn	0.2	0.40
Sorghum	0.2	0.40
Soybeans	0.2	0.40
Wheat	0.2	0.35

Sources: Paul R. Johnson; Daryll E. Ray and James W. Richardson.

Bredahl, Meyers, and Collins' policy analysis. Elasticity estimates for U.S. domestic supply and demand are based on a historical analysis made by Ray and Richardson and on elasticities used by Johnson (Table 11). The elasticities chosen for this project do not pertain to any specific author or empirical study, rather they fall within the range of elasticities presented by most authors. Domestic supply and demand elasticities for the 25 world regions, specified in the network flow models, are those assumed by Johnson; i.e., supply elasticities of all commodities are assumed 0.2, demand elasticities are assumed -0.2 for wheat and -0.4 for feed grains and soybeans in each world region.

Despite the fact that data from a different time period was used, the reported elasticities (Table 11) differ only slightly from those of Bredahl, Meyers, and Collins, whose estimates are provided on the last row. Table 12 also provides the contribution of each world region to the total U.S. export demand, by commodity. These contributions are used to estimate the changes in foreign demand for 25 world regions specified in the grain transportation models.

Changes in quantity demanded by individual foreign regions are obtained through disaggregation of (11) and (22). In the case of a weight-based user charge, this is done by substituting (28) into (11) as follows:

$$(31) \quad \frac{\Delta Q}{Q} = \left[\sum_i E_{pi} E_{edi} \frac{Q_{mi}}{Q} - \sum_j E_{pj} E_{esj} \frac{Q_{xj}}{Q}\right] * \left[\frac{E_{es}}{E_{es} - \sum_i E_{pi} E_{edi} \frac{Q_{mi}}{Q} + \sum_j E_{pj} E_{esj} \frac{Q_{xj}}{Q}}\right] \frac{t}{P}$$

where Q_{ef} is replaced by Q. Expansion of the summations in (31) to the nth term yields, in abbreviated form:

$$(32) \quad \frac{\Delta Q}{Q} = \frac{\Delta Q_1}{Q} + \frac{\Delta Q_2}{Q} + \ldots + \frac{\Delta Q_n}{Q}$$

where the terms on the right side represent the percentage changes in quantities demanded by individual world subregions.

A similar procedure is used in the case of an ad valorem user charge (not shown). Because of the large number of user charge scenarios, estimates for changes in quantity demanded by foreign region are not reported.

The Elasticity of U.S. Excess Supply

The procedure to estimate the elasticity of U.S. excess supply is derived as follows:

Let

$$(33) \quad Q_{ef} = Q_{se} - Q_{de}$$

differentiation with respect to P yields

$$(34) \quad \frac{dQ_{ef}}{dP} = \frac{dQ_{se}}{dP} - \frac{dQ_{de}}{dP}$$

multiplying by P/Q_{ef} and rearranging terms,

$$(35) \quad \underbrace{\frac{P}{Q_{ef}} \cdot \frac{dQ_{ef}}{dP}}_{E_{es}} = \underbrace{\frac{dQ_{se}}{dP} \cdot \frac{P}{Q_{se}}}_{E_{se}} \cdot \frac{Q_{se}}{Q_{ef}} \cdot \underbrace{\frac{dQ_{de}}{dP} \cdot \frac{P}{Q_{de}}}_{E_{de}} \cdot \frac{Q_{de}}{Q_{ef}}$$

which can be expressed as,

$$(36) \quad E_{es} = E_{se} \frac{Q_{se}}{Q_{ef}} - E_{de} \frac{Q_{de}}{Q_{ef}}$$

division of (33) by Q_{ef} yields,

$$(37) \quad \frac{Q_{ef}}{Q_{ef}} = \frac{Q_{se}}{Q_{ef}} - \frac{Q_{de}}{Q_{ef}} = 1$$

solving (37) for Q_{se}/Q_{ef} and upon substitution into (36),

$$(38) \quad E_{es} = E_{se} + (E_{se} - E_{de}) \frac{Q_{de}}{Q}$$

where Q_{ef} is replaced by Q. Estimated excess supply elasticities for the four commodities are reported in Table 13.

Appendix II. The Grain Transportation Models

The purpose of this section is to provide a brief description of the transportation network flow models used to assess the potential impact of port user fees on grain flow patterns. First, a general description of the grain and soybean network flow models is presented. Second, model data requirements and source of data are discussed. Finally, a discussion relating to the validation of the models is presented.

Table 12. Elasticities of U.S. Grain and Soybean Export Demands[1]

	Wheat		Corn		Sorghum		Soybeans	
	Restricted[2] Trade	Free[3] Trade	Restricted Trade	Free Trade	Restricted Trade	Free Trade	Restricted Trade	Free Trade
Scandinavia	0	0.0667	0	0.0230	0	0.0153	0	0.0159
N.C. Europe	0	0.1484	0	0.0210	0	0.0749	0.1446	0.1446
S.W. Europe	0	0.3016	0	0.1136	0	0.2842	0.1124	0.1124
Islands	0	0.0995	0	0.0029	0	0.0241	0.0221	0.0221
Adriatic	0	0.2090	0	0.0040	0	0.0357	0	0.0044
USSR	0	1.1146	0.0958	0.0958	0	0.2009	0	0.0449
E.B. Europe	0	0.3193	0.0296	0.0296	0	0.3915	0	0.0289
E. Mediterranean	0.0910	0.0910	0.1415	0.1415	0.0676	0.0676	0.0155	0.0155
North Africa	0.0757	0.0757	—[4]	—	0.0083	0.0083	0.0006	0.006
Red Sea	0.0134	0.0134	0.3555	0.3555	0.0126	0.0126	—	—
E. Africa	0.0320	0.0320	0.0911	0.0911	0.1766	0.1766	—	—
W. Africa	0.0142	0.0142	0.4713	0.4713	0.0510	0.0510	—	—
Persian Gulf	0.1134	0.1134	0.0662	0.0662	0.0095	0.0095	0.0030	0.0030
W. Asia	0.6078	0.6078	—	—	0.1069	0.1069	—	—
S.E. Asia	0.0872	0.0872	0.0690	0.0690	0.0673	0.0673	0.0113	0.0113
Taiwan	0.0048	0.0048	0.0532	0.0532	0.0256	0.0256	0.0251	0.0251
Korea	0.0120	0.0120	0.0101	0.0101	0.0341	0.0341	0.0182	0.0182
Japan	0	0.0498	0.3126	0.3126	0.1042	0.1042	0.1019	0.1019
China	0	0.6451	0	0.7214	0	0.6575	0	0.2324
Canada	—	—	—	—	0.0714	0.0714	0.0288	0.0288
Mexico	0.0361	0.0361	0.4727	0.4727	0.1386	0.1386	0.0370	0.0370
W.S. America	0.0316	0.0316	0.0620	0.0620	0.0354	0.0354	0.0071	0.0071
E.S. America	0.1167	0.1167	0.3615	0.3615	0.3083	0.3083	0.4183	0.4183
Caribbean	0.0018	0.0018	—	—	0.0048	0.0048	0.0009	0.0009
Total[6]	1.2377	4.1917	2.5921	3.4780	1.222	2.9063	0.9468	1.2733
Bredahl[7]	1.67	5.50	2.36	2.55	1.31	3.13	0.47	1.12

[1]Estimated under the assumptions that the domestic supply elasticities were 0.2 everywhere. Domestic demand elasticities assumed −0.2 for wheat, and −0.4 for coarse grains and soybeans everywhere. Period 1976-77 to 1981-82.

[2]Elasticity of price transmission assumed equal to zero for countries exerting insulating trade policies, based on Bredahl, Meyers, and Collins' policy analysis.

[3]Elasticities of price transmission assumed unity everywhere.

[4]Region not importing from the United States.

[5]Includes both East and West Mexico.

[6]The United States is assumed to be a residual supplier.

[7]Bredahl, Meyers, and Collins' estimates for 1972-73 to 1975-76.

General Description of Grain Network Flow Models

Seven separate transportation network flow models, five of which were originally developed by Taylor and later updated by Makus, are used in this study to evaluate the domestic and foreign flow patterns of U.S. produced wheat, corn, grain sorghum, and soybeans. Four classes of wheat are analyzed, namely, hard red winter, hard red spring, soft, and durum wheats. Transportation modes include truck, rail, barge, and ocean vessels. Intertemporal considerations are also included in these models through the use of quarterly (3-month periods) domestic and foreign demand data.

The models include surplus domestic production or supplying regions (SR's); domestic grain deficit regions (DR's); 45 river points (RP's) which act as intermodal transfer points; 16 ports which are located on all U.S. coastal areas; and 25 foreign demand regions (FR's). With respect to the modes of transportation, the truck, rail, and barge modes compete directly for domestic grain movements and all mode combinations are allowed. Ocean ships are the only means of transportation for overseas U.S. grain shipments. Figure 5 illustrates the general features of the grain network flow models.

Each of the seven commodity models is solved separately and the flows through each port area are aggregated to identify whether flows exceed capacity or historic volume. In the base model, aggregated flows were less than or equal to historic flows. Thus, there was no need to include constraints.

Table 13. U.S. Excess Supply Elasticities

Commodity	Elasticity
Corn	1.6155
Sorghum	1.3151
Soybeans	1.2934
Wheat	0.5259

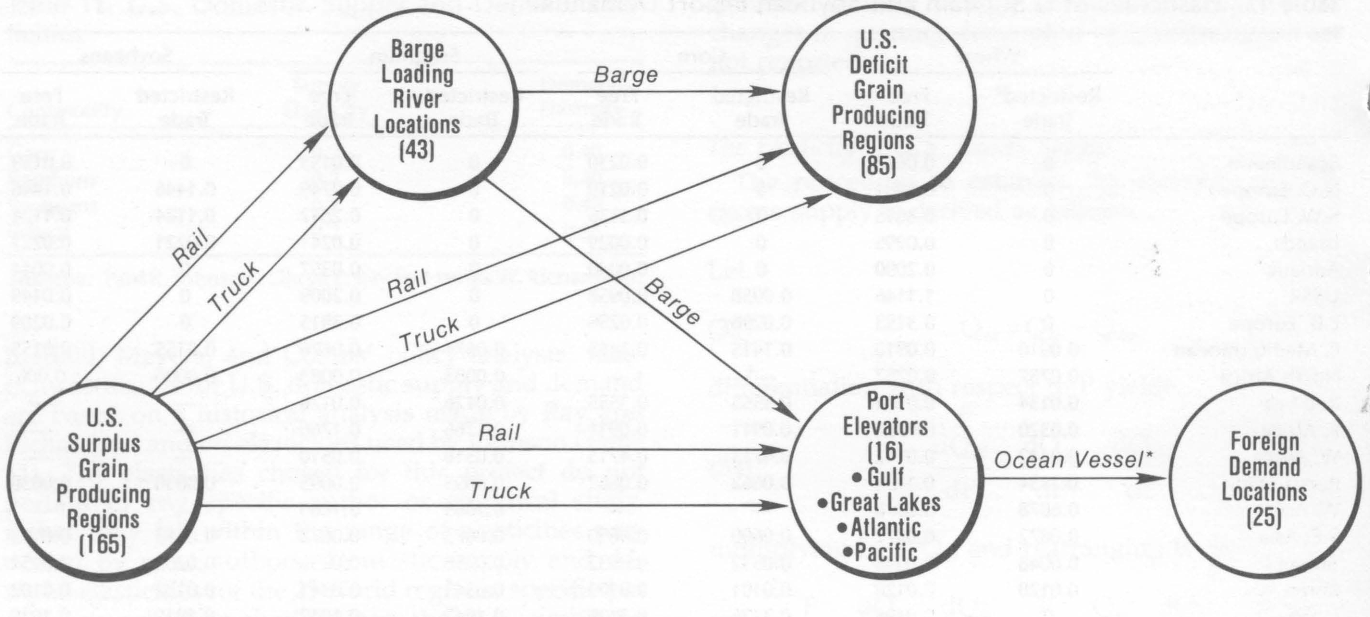

Figure 5. Elements of spatial model.

Figure 6. Model regions.

Data Requirements of Grain Network Flow Models

Two types of data inputs are required by the grain and soybean network flow models: market-related and transportation-related data. Market data refer to quantities supplied and demanded in domestic and foreign markets. Transportation data relate to transfer costs associated with transporting, storing, and handling grain.

Market-Related Data

Grain supply and demand estimates are required for domestic producing regions, domestic consuming regions, and foreign demanding regions. The following sections discuss the data gathering procedures employed to collect market information pertaining to the regions.

U.S. Domestic Surplus and Deficit Regions

To determine the basic structure of the network models, it is necessary to identify the number and size of supply and demand regions as well as their associated quantities supplied and demanded. This requires (1) regional demarcation of surplus and deficit grain producing regions (domestic and foreign), and (2) estimation of quantities to be supplied and received by the various regions. Demarcation of regions is based upon existing geographical delineations. The Crop Reporting District (CRD) is the selected geographical base unit. For purposes of determining unambiguous transportation routes and mode rates, the most centrally located city within a region is chosen as a representative source or destination location.

The model includes 165 grain and soybean producing regions (Figure 6). Some regions have grain and/or soybean surpluses since estimated production exceeds estimated consumption, whereas other regions have estimated deficits. A surplus region's supply is available to meet demand from grain deficit regions or export.

Production estimates are made for each region and were based on projections elaborated by the Economic Research Service of the U.S. Department of Agriculture (1980). U.S. Department of Agriculture projections were procured from the National Interregional Agricultural Projections (NIRAP) model.

Domestic consumption estimates were made for each region and were comprised of (1) human consumption, (2) animal consumption, and (3) seed utilization. Human consumption estimates were obtained from a study made by Hauser at Iowa State University. Hauser used time series analysis to isolate trends in human consumption based upon expectations of population growth and regional milling, processing, and crushing capacities of grains and soybeans. Animal consumption figures were obtained from the NIRAP's livestock and poultry projections. Seed use estimates were obtained through total acreage planted in each state. In some cases, wheat and corn milling demands and soybean processing demands are identified with cities rather than regions. The model includes 85 regions or locations with estimated grain or soybean deficits.

Foreign Importing Regions

Demarcation of foreign importing regions followed a similar procedure as that employed in demarcation of domestic regions. The minimum demarcation unit was a country. Because of their import volume, size, or geographical location, some countries were categorized as world regions themselves; for example, the United Soviet Socialist Republic, Japan, and Taiwan. In other cases, due to geographical proximity, several countries were grouped together; e.g., Scandinavia includes Denmark, Finland, East Germany, Norway, and Sweden. To establish appropriate ocean vessel routes and rates, a single port from the foreign region was chosen as the importing location or port. In general, the selected port was centrally located within the importing region.

Estimates of grain and soybean demand (imports) by foreign region were obtained through trend analysis on historical quantities of U.S. grain exports to specified countries. U.S. exports to the demarcated world regions and average shares of U.S. exports to regions were procured (U.S. Department of Agriculture, *Grain Market News*). Historical shares were used to project U.S. exports to each foreign region. The time series analysis of U.S. exports revealed foreign regions' imports of U.S. grain were seasonal; thus, export estimates to each world subregion were divided into quarters to account for this phenomenon.

Transportation-Related Data

An overview of the procedures employed in collecting, analyzing, and estimating mode rates, and storage and handling costs used as inputs in the transportation network flow models is presented in this subsection. Transportation modes discussed include barge, truck, rail, and ocean vessel.

Barge Rates

The barge mode is extensively used by the grain marketing system, since it represents the least expensive means of grain transportation. However, its utilization is limited to currently developed and maintained waterways such as river channels and port canals. The network flow models comprise (1) the Mississippi waterway system which includes the Mississippi River and its tributaries, (the Illinois, Ohio, Missouri, and Arkansas rivers) and the Columbia-Snake waterway system, which includes the Columbia and Snake Rivers (Figure 7).

Barge and towboat costs are based on budget data from the U.S. Army Corps of Engineers (1983). Costing procedures take into consideration the unique physical characteristics of the various segments in each major waterway system.

Truck Rates

Truck transportation is the most flexible of all inland transportation modes and grains and soybeans rely

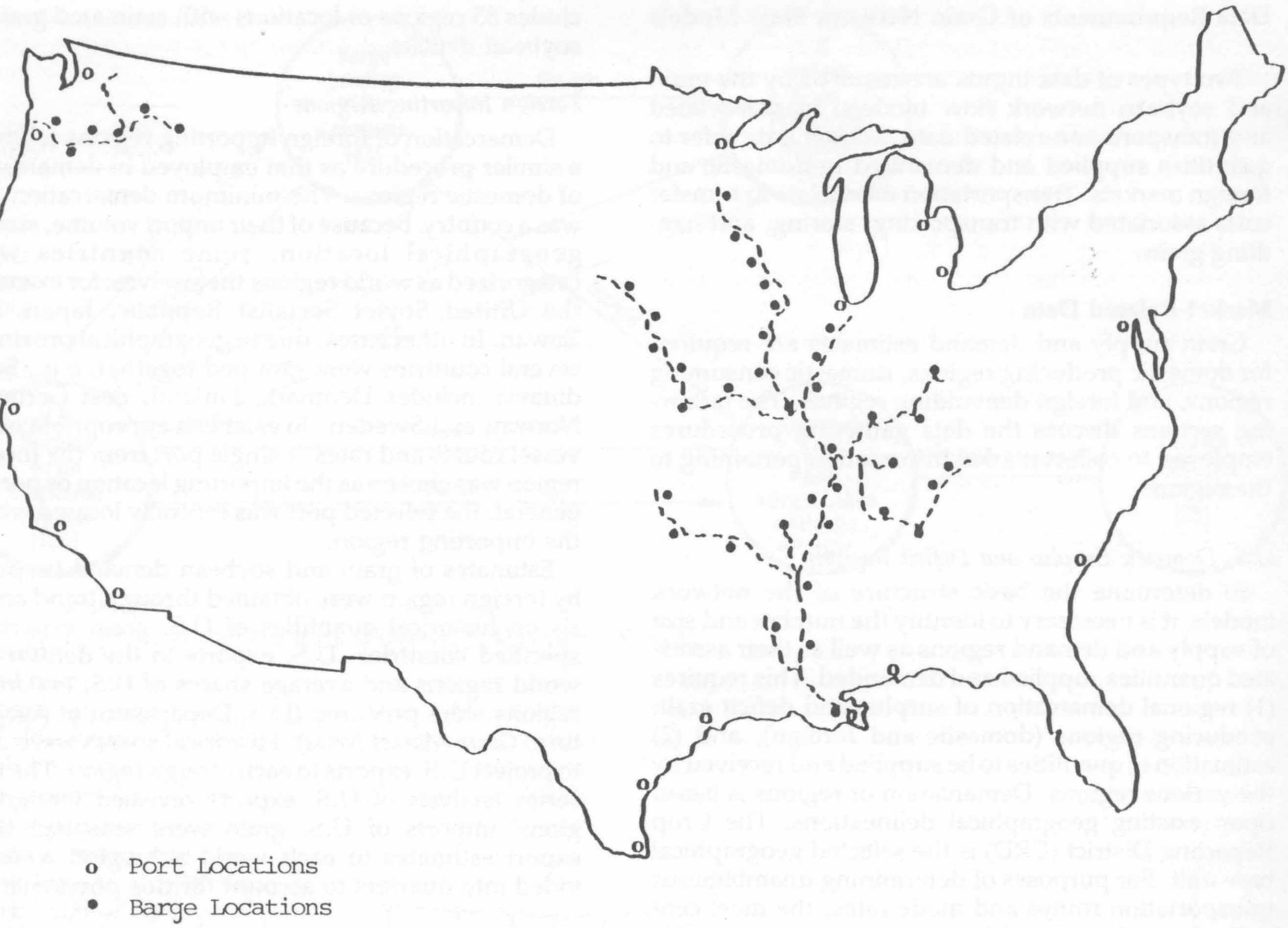

Figure 7. U.S. ports and river locations in the grain transportation models.

heavily on trucks at the assembly stage. Due to its flexibility, truck transportation has a competitive edge over the barge and rail modes for short hauls, with the converse holding for longer hauls.

Based on the established demarcation of grain surplus and deficit regions, a computerized algorithm, developed at Iowa State University, was used by Taylor and Makus to estimate truck rates. The algorithm estimates truck cost equations, on a state-by-state basis, through use of regression analysis. Truck rates are estimated for all possible origin-destination combinations in which the truck mode may be used. Truck rates for movements from grain surplus regions to river points are based on distances between the surplus region and the nearest barge loading location.

Rail Rates

Railroads play an important role in transporting grain and soybean for longer distances of haul. Producing regions far from major waterway systems often move their grain and soybean surplus by rail. In the network models, rail lines link surplus producing regions to barge loading locations and numerous demand locations and ports.

There is difficulty in knowing likely railroad pricing behavior in view of the recent deregulation of the railroad industry. Economics has no unified theory of oligopoly pricing and the recent deregulation experience has been of insufficient duration to make long-run inferences regarding railroad pricing strategy. Several studies, however, have been made in the past few years and found evidence that railrates have declined during the post-Staggers era (Klindworth, et al.; Adams and Anderson). But the economic environment since deregulation has been characterized by declining export sales and large surpluses of transportation equipment; therefore, the observed competition between and within tranportation modes may not be reflective of the long run. A recent study notes that the rate reductions flowing from these competitive tendencies may be reversed once economic recovery takes hold and rail cars and barge surpluses are reduced or eliminated (U.S. Department of Agriculture, 1982a). Economists agree that in a market characterized by few competitors, interdependence is generally recognized and, in the long run, there is a tendency toward tacit ratemaking. Friedlaender states that ". . . the history of collusive pricing in the railroad industry is sufficiently long so that collusion would probably . . . (exist with deregulation)," in which case interrailroad competition would be limited.

For purposes of estimating railroad rates, it is assumed that interrailroad competition is limited and railroads attempt to charge the highest rate that intermodal competition will permit in surplus grain producing regions. The procedure to estimate rates is outlined in an article by Fuller, Makus, and Taylor. In essence, the highest revenue-to-variable cost ratio permitted by intermodal competition is estimated for each surplus producing region. These ratios are estimated for corn, wheat, soybeans, and sorghum. This ratio is then multiplied by the estimated variable costs which link a particular origin-destination combination for purposes of estimating rates.

The rail-rate estimation procedure requires that railroads' variable costs be estimated for each route. Rail costs are based on the Rail Carload Cost scales published by the Interstate Commerce Commission (ICC); while mileages are gathered from several publications, among them is the *Handy Railroad Atlas of the United States* published by the Rand McNally Co.

Railroad variable costs are estimated by use of a computerized algorithm developed at Iowa State University. The algorithm calculates rail rates per bushel costs for both single-car and multiple-car trains. Rail rate estimation is based on five ICC regions and takes into consideration cost parameters associated with covered hopper car weights, commodity, turnaround times, required switching, interest rates, size of shipment, route mileage, average mileage between interchanges, and mileage between yards. The ICC's 1981 cost scales and 1982 update cost ratios are used to estimate variable costs (Interstate Commerce Commission, 1982).

Ocean Shipping Rates

Data on ocean shipping rates were obtained from the U.S. Department of Agriculture for the 1977-83 period. These data are collected and reported by Maritime Research Incorporated and include information on origin, destination, tonnage, rates, and the Julian date of charter. Based on this information, Makus developed estimates for shipping rates from four coastal areas to the 25 world regions.

Storage and Handling Costs

Though storage facilities are found at all stages of the grain marketing channel (on farms, country elevators, subterminals, terminals, and port elevators), storage was assumed to occur in the supplying regions. Reliable data regarding on-farm storage capacity were not available. No storage constraints are, therefore, specified in the models. Cost estimates for storage follow those estimated by Leath, et al. 1982.

Handling costs are those associated with loading and unloading grain. Handling costs are incurred in the supply regions, at transshipment points, and at final destinations. Loading and unloading costs are dependent on the mode of transportation used. Costs included in the model take into consideration the combination of modes used in a particular haul. See Table 14 on estimated handling and storage costs.

Table 14. Summary of Costs by Function and Type of Facility and Weighted Average Costs for All Facilities, by Function, 1981-82

	Country Elevators	River Elevators	Port Elevators	All Elevators
		cents per bushel		
Receiving By:				
Truck	4.796	4.213	4.350	4.697
Rail	n.a.	6.051	3.931	4.629
Water	n.a.	9.354	3.269	3.451
Shipping By:				
Truck	5.071	3.821	0.0	4.984
Rail	6.069	4.907	5.955	5.722
Water	2.352	2.337	2.535	2.487
Annual Storage	32.329	30.649	55.266	33.607

[1]Information provided in memo by Mac Leath.
[2]n.a. = not applicable

Validation of Transportation Models

Model validation is the process of gaining information on the model's ability to yield realistic grain flow patterns. Modeling efforts do not seek to exactly represent reality, since this is virtually impossible for the majority of situations due to cost, time, and data availability constraints. As a result, differences between a given model's outcome and the real-world situation it attempts to emulate will occur. Consequently, model validation seeks to gain insight with regard to these differences. The optimization criterion of the network flow models involves minimization of total transfer cost associated with grain movements. In this regard, the models' solutions may be interpreted as the flow patterns that grain ought to follow in order to achieve this goal.

The quality of the data is of great importance. Measurement and estimation errors are involved in collecting, recording, classifying, aggregating, processing, and reporting data. Mode rates as well as market data are bound to suffer from these errors. In addition, inappropriate aggregation of supply and demand regions may distort flows.

Meaningful comparisons between model-projected and actual flows are difficult since grain production, consumption, and foreign demand change from year to year while the model's values are constants. Further, the model is constructed such that the production, consumption, and foreign demand estimates have a predetermined geographical location; whereas, the actual location of these activities exhibits variation. Additional divergence between actual and model-projected flows may exist because of the highly variable ship rate structures (Fuller, Makus, and Gallimore).

Table 15 includes information on the historical percentage of the U.S. aggregated grain and soybean outflow exiting through U.S. coast areas from 1970 to 1984 and the model-projected flow. Historically, 61.0 to 70.0 percent of U.S. grain and soybean exports have exited Gulf ports: the model projects 65 percent exiting

Table 15. Comparison of Aggregated Historical and Model-Generated Grain and Soybean Export Flows through U.S. Coastal Regions[1]

Year	Gulf	Atlantic	Great Lakes	Pacific
		percent		
1970	65.0	6.0	15.0	14.0
1971	67.0	6.0	17.0	10.0
1972	66.0	10.0	13.0	11.0
1973	67.0	12.0	10.0	11.0
1974	67.0	13.0	8.0	12.0
1975	65.0	14.0	10.0	11.0
1976	67.0	15.0	8.0	10.0
1977	67.0	14.0	10.0	9.0
1978	63.0	12.0	13.0	12.0
1979	61.0	13.0	11.0	15.0
1980	61.0	11.0	9.0	19.0
1981	64.0	11.0	7.0	18.0
1982	68.0	14.0	6.0	12.0
1983	70.0	9.0	5.0	16.0
1984	67.0	8.0	5.0	20.0
Model	65.0	12.0	13.0	10.0

[1]Historical data compiled from U.S. Department of Agriculture, Grain Market News, various issues 1970-84.

this coastal area. The percentage of total exports exiting from the Atlantic coast area has varied between 6.0 and 15.0 percent since 1970, again the model's projection is within this historical range with an estimate of 12 percent. The model-projected flows through Great Lakes and Pacific ports are within the historical ranges but tend to vary from these ports' recent export shares. In particular, the model tends to overestimate recent exports from Great Lakes ports and underestimate outflow from Pacific ports. Much of the increase in exports from Pacific ports is attributable to corn which has recently begun moving from western Corn Belt origins to this port area. Several factors are responsible. To attract business, the Burlington Northern railroad introduced appealing rates between the western Corn Belt and Pacific Northwest ports; ship rates from Pacific ports to Japan, Taiwan, and Korea have, in some recent time periods, declined substantially relative to Gulf rates; and the Japanese importers have become associated with several Pacific coast export houses. These factors are also responsible for diminishing export flows from Great Lake ports. It is difficult to forecast the long run nature of these factors and their impact; accordingly, the model was not manipulated to generate the more recent outcome.

In an effort to validate the employed model, Taylor compared historical grain flow patterns against those obtained from the models. Spearman's correlation coefficients were estimated between model-projected flows and grain flows from a 1977 survey by Leath, et al. Sensitivity analysis was later carried out which showed that the grain network flow models appropriately "tracked" changes in flows that resulted from changes in intermodal rates. Even though differences arose, the model was deemed appropriate to represent the U.S. grain marketing system in 1977. This version of the model was used to evaluate the effect of altering Panama Canal tolls and to identify the likely impact of rail deregulation on export rates (Fuller, Makus, and Gallimore; Fuller, Makus, and Taylor). Makus updated Taylor's models to account for changes in rail and ocean ship rates in order to reflect 1982 conditions. Even though there were some differences between the models' projected flows and actual grain flows, the model was deemed appropriate to investigate the sensitivity of U.S. port areas to changing patterns in foreign grain demands (Makus and Fuller). Various versions of the model have been used to analyze transportation issues and three refereed journal articles have resulted (Fuller, Makus, and Gallimore; Fuller, Makus, and Taylor; Makus and Fuller). These articles provide additional insight into the ability of the model to generate historical flow patterns.

Appendix III. Further Results

Included in this appendix are further results on grain flow patterns. Table 16 presents grain and soybean flows corresponding to what was labeled as the baserun solution. The baserun solution consists of the original model which was calibrated to approximate the U.S. domestic and international marketing system. Grain flow levels in the baserun solution reflect the grain marketing system prior to 1982. Current export levels are about 0.6 billion bushels less than the average for that period.

Tables 17 and 18 report grain flows associated with port user fees which incorporate a 50 percent cost recovery level by the federal government. The format of these tables is identical to that of Tables 9 and 10 which reported grain flows that evaluated port user fees designed to recoupe 100 percent of all involved costs. Grain flows associated with port user fees that recoupe 50 percent of federal expenses proved to be similar to those which arise from a 100 percent recovery level. However, the magnitudes of altered flow patterns are for the most part considerably smaller.

Tables 19 through 32 report altered flow patterns at the individual commodity level. Due to space constraints, individual grain and soybean flow patterns were aggregated by coastal area rather than by port area. The format of these tables is identical to those presented above.

Table 16. Baserun Solution of Spatial Network Flow Models by Commodity.[1]

	Corn	Sorghum	Soybeans	HRW[2] Wheat	HRS[3] Wheat	Soft Wheat	Durum Wheat	Total
				million bushels				
Gulf:								
East Gulf	118.66	0.00	72.84	0.00	0.00	0.00	0.00	191.50
Mississippi River	1,421.78	7.95	475.76	73.42	76.37	94.05	14.61	2,163.93
North Texas	114.30	178.64	5.64	420.41	3.38	0.00	0.94	723.31
South Texas	0.00	71.54	0.00	0.00	0.00	0.00	0.00	71.54
Subtotal	1,654.74	258.13	554.25	493.83	79.75	94.05	15.55	3,150.28
Atlantic:								
North Atlantic	413.18	1.20	86.20	0.00	1.24	40.71	0.00	542.54
South Atlantic	0.00	0.00	38.38	0.00	0.00	1.71	0.00	40.10
Subtotal	413.18	1.20	124.59	0.00	1.24	42.42	0.00	582.64
Greak Lakes:								
Superior-Michigan	250.95	1.62	17.92	31.25	51.57	0.00	49.03	402.34
Huron-Erie	136.75	0.00	69.30	0.00	0.00	46.39	0.00	252.45
Subtotal	387.70	1.62	87.22	31.25	51.57	46.39	49.03	654.79
Pacific:								
Seattle Area	18.00	0.00	0.00	81.92	83.84	15.98	11.41	211.15
Portland Area	0.00	0.00	0.00	13.61	4.29	218.86	0.00	236.76
California	0.00	0.00	0.00	3.15	7.47	4.36	12.00	26.98
Subtotal	18.00	0.00	0.00	98.68	95.60	239.20	23.41	474.88
Total Port Exports	2,473.62	260.95	766.06	623.76	228.15	422.06	87.98	4,862.59
Interior Exports	28.80	0.00	24.32	0.00	0.00	0.00	0.00	53.12
Total Exports	2,502.42	260.95	790.38	623.76	228.15	422.06	87.98	4,915.71

[1]Subtotals and totals may not add up due to rounding.
[2]HRW stands for Hard Red Winter.
[3]HRS stands for Hard Red Spring.

Table 17. Effect on U.S. Port Area Grain and Soybean Flows of a Weight-Based User Fee which Is to Recoupe 50 Percent of Operations and Maintenance Expenses (OM), New Construction Costs (NC), and the Aggregate of These Costs (OMNC)[1]

	Port-Specific Fees						Uniform Fees					
	OM		NC		OMNC		OM		NC		OMNC	
Port Area	Change In Volume[2]	Percent Change[3]	Change In Volume	Percent Change	Change In Volume	Percent Change	Change In Volume	Percent Change	Change In Volume	Percent Change	Change In Volume	Percent Change
Gulf:												
East Gulf	- 0.02	- 0.01	-30.10	-15.72	-30.12	-15.73	- 0.03	-0.01	- 0.06	-0.03	- 0.10	-0.05
Mississippi River	9.68	0.44	44.81	2.07	60.87	2.81	10.64	0.49	9.81	0.45	9.16	0.42
North Texas	- 0.14	0.02	9.99	1.38	11.24	1.55	- 0.21	-0.03	- 0.43	-0.06	- 0.65	-0.09
South Texas	0.00	0.00	0.89	1.24	- 0.03	- 0.04	- 0.01	-0.01	- 0.01	-0.02	- 0.02	-0.03
Total	9.52	0.30	25.59	0.812	41.96	1.33	10.39	0.33	9.30	0.30	8.40	0.27
Atlantic:												
North Atlantic	- 8.44	- 1.56	-53.28	- 9.82	-52.94	- 9.76	- 9.64	-1.78	-10.70	-1.97	-11.54	-2.13
South Atlantic	0.00	0.00	0.01	- 0.02	- 0.01	- 0.04	0.00	0.00	- 0.01	-0.02	- 0.01	-0.03
Total	- 8.44	- 1.45	-53.29	- 9.15	-52.95	- 9.09	- 9.64	-1.65	-10.71	-1.84	-11.55	-1.98
Great Lakes:												
Superior-Michigan	10.69	2.66	18.71	4.65	17.32	4.30	- 0.41	-0.10	- 0.40	-0.10	- 0.39	-0.10
Huron-Erie	-11.14	- 4.41	5.56	2.20	-11.24	- 4.45	- 0.04	-0.02	- 0.08	-0.03	- 0.12	-0.05
Total	- 0.45	- 0.07	24.27	3.71	6.08	0.93	- 0.45	-0.07	- 0.48	-0.07	- 0.51	-0.08
Pacific:												
Seattle Area	50.22	23.78	- 2.24	- 1.06	50.05	23.71	- 2.14	-1.01	- 2.21	-1.05	- 2.27	-1.07
Portland Area	-52.41	-22.14	- 0.07	- 0.03	-52.47	-22.16	- 0.02	-0.01	- 0.04	-0.02	- 0.07	-0.03
California	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	- 2.19	- 0.46	- 2.31	- 0.49	- 2.41	- 0.51	- 2.16	-0.45	- 2.25	-0.47	- 2.34	-0.49
Total Port Exports[4]	- 1.56	- 0.03	- 5.72	- 0.12	- 7.32	- 0.15	- 1.86	-0.04	- 4.14	-0.09	- 6.00	-0.12

[1]Numbers at the coast level may not add up to totals due to rounding.
[2]Million bushels.
[3]Percent change from baserun volume.
[4]Overall reduction in U.S. grain exports resulting from increase in export price due to user charge imposition.

Table 18. Effect on U.S. Port Area Grain and Soybean Flows of an Ad Valorem User Fee Which Is to Recoupe 50 Percent of Operations and Maintenance Expenses (OM), New Construction Costs (NC), and the Aggregate of These Costs (OMNC)[1]

	Port-Specific Fees						Uniform Fees					
	OM		NC		OMNC		OM		NC		OMNC	
Port Area	Change In Volume[2]	Percent Change[3]	Change In Volume	Percent Change	Change In Volume	Percent Change	Change In Volume	Percent Change	Change In Volume	Percent Change	Change In Volume	Percent Change
Gulf:												
East Gulf	- 0.01	- 0.01	-30.05	-15.69	-40.94	-21.38	- 0.02	-0.01	- 0.05	-0.02	- 0.06	-0.03
Mississippi River	10.50	0.48	53.61	2.48	47.21	2.18	10.86	0.50	10.33	0.48	9.93	0.46
North Texas	- 0.52	- 0.07	10.70	1.48	10.47	1.45	- 0.12	0.02	- 0.26	-0.04	- 0.36	-0.05
South Texas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	-0.02
Total	9.97	0.32	34.25	1.09	16.74	0.53	10.72	0.34	10.02	0.32	9.50	0.30
Atlantic:												
North Atlantic	6.66	1.23	-33.68	- 6.21	-34.80	- 6.41	- 9.24	-1.70	- 9.78	-1.80	-10.04	-1.85
South Atlantic	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	6.66	1.14	-33.68	- 6.21	-34.80	- 5.97	- 9.24	-1.59	- 9.78	-1.67	-10.04	-1.72
Great Lakes:												
Superior-Michigan	10.68	2.65	- 0.42	- 0.11	23.16	5.76	- 0.42	-0.11	- 0.43	-0.11	- 0.42	-0.10
Huron-Erie	-25.73	-10.19	- 0.04	- 0.02	- 5.49	- 2.18	- 0.03	-0.01	- 0.04	-0.02	- 0.07	-0.03
Total	-15.05	- 2.30	- 0.46	- 0.07	17.67	2.70	- 0.45	-0.07	- 0.47	-0.07	- 0.49	-0.07
Pacific:												
Seattle Area	50.26	23.80	- 2.14	- 1.01	50.18	23.77	- 2.11	-1.00	- 2.17	-1.03	- 2.21	-1.04
Portland Area	-52.41	-22.13	- 0.03	- 0.01	-52.43	-22.14	- 0.01	-0.01	- 0.03	-0.01	- 0.05	-0.02
California	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	- 2.15	- 0.45	- 2.17	- 0.46	- 2.24	- 0.47	- 2.12	-0.45	- 2.20	-0.46	- 2.26	-0.48
Total Port Exports[4]	- 0.56	- 0.01	- 2.07	- 0.04	- 2.64	- 0.05	- 1.09	-0.02	- 2.44	-0.05	- 3.29	-0.07

[1]Numbers at the coast level may not add up to totals due to rounding.
[2]Million bushels.
[3]Percent change from baserun volume.
[4]Overall reduction in U.S. grain exports resulting from increase in export price due to user charge imposition.

Table 19. Effect on U.S. Port Area Corn of a Weight-Based User Fee Which Is to Recoupe Operations and Maintenance Expenses (OM), New Construction Costs (NC), and the Aggregate of These Costs (OMNC)[1]

	Port-Specific Fees						Uniform Fees					
	OM		NC		OMNC		OM		NC		OMNC	
	Change In Volume[2]	Percent Change[3]	Change In Volume	Percent Change	Change In Volume	Percent Change	Change In Volume	Percent Change	Change In Volume	Percent Change	Change In Volume	Percent Change
					50 Percent Cost Recovery Level							
Gulf	- 0.39	-0.02	22.72	1.37	22.37	1.35	-0.47	-0.03	-1.01	-0.06	-1.50	-0.09
Atlantic	- 0.70	-0.17	-36.37	- 8.07	-34.07	- 8.25	-0.83	-0.20	-1.81	-0.45	-2.68	-0.65
Great Lakes	- 0.00	0.00	6.63	1.71	6.58	1.70	0.00	0.00	-0.01	0.00	-0.01	0.00
Pacific	- 0.00	-0.03	- 0.02	- 0.13	- 0.02	- 0.14	-0.01	-0.04	-0.02	-0.09	-0.02	-0.13
Total[4]	- 1.00	-0.05	- 4.03	- 0.16	- 5.14	- 0.21	1.31	-0.05	-2.91	-0.12	-4.22	-0.17
					100 Percent Cost Recovery Level							
Gulf	-18.06	-1.09	38.03	2.30	24.87	1.50	0.92	-0.06	-2.07	-0.13	-2.98	-0.18
Atlantic	15.88	3.84	-52.54	-12.72	-41.49	-10.04	-1.68	-0.41	-3.69	-0.89	-5.37	-1.30
Great Lakes	- 0.01	-0.00	6.47	1.67	6.39	1.65	-0.01	-0.00	-0.02	-0.00	-0.03	-0.01
Pacific	- 0.01	-0.08	- 0.05	- 0.27	- 0.06	- 0.36	-0.01	-0.08	-0.03	-0.17	-0.05	-0.28
Total[4]	- 2.20	-0.09	- 8.09	- 0.33	-10.30	- 0.42	2.63	-0.11	-5.81	-0.23	-8.43	-0.34

[1]Numbers may not add up to totals due to rounding.
[2]Million bushels.
[3]Percent change from baserun volume.
[4]Overall reduction in U.S. corn exports resulting from increase in export price due to user charge imposition.

Table 20. Effect on U.S. Port Area Corn of an Ad Valorem User Fee Which Is to Recoupe Operations and Maintenance Expenses (OM), New Construction Costs (NC), and the Aggregate of These Costs (OMNC)[1]

	Port-Specific Fees						Uniform Fees					
	OM		NC		OMNC		OM		NC		OMNC	
	Change In Volume[2]	Percent Change[3]	Change In Volume	Percent Change	Change In Volume	Percent Change	Change In Volume	Percent Change	Change In Volume	Percent Change	Change In Volume	Percent Change
					50 Percent Cost Recovery Level							
Gulf	-0.14	-0.01	13.60	0.82	13.30	0.80	-0.24	-0.01	-0.53	-0.03	-0.70	-0.04
Atlantic	-0.22	-0.05	-14.86	-3.60	-14.90	-3.61	-0.43	-0.10	-0.95	-0.23	-1.19	-0.29
Great Lakes	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pacific	0.00	0.00	- 0.01	-0.03	- 0.01	-0.04	0.00	-0.01	-0.01	-0.04	-0.01	-0.05
Total[4]	-0.35	-0.01	- 1.27	-0.05	- 1.16	-0.06	-0.67	-0.03	-1.49	-0.06	-1.91	-0.08
					100 Percent Cost Recovery Level							
Gulf	-0.25	-0.01	23.20	1.40	7.15	0.43	-0.48	-0.03	-1.05	-0.06	-1.54	-0.09
Atlantic	-0.44	-0.10	-25.71	-6.22	-10.35	-2.50	-0.86	-0.21	-1.92	-0.46	-2.76	-0.67
Great Lakes	-0.00	-0.00	- 0.01	-0.00	- 0.01	0.00	0.00	0.00	-0.01	0.00	-0.01	0.00
Pacific	-0.00	-0.00	- 0.01	-0.08	- 0.02	-0.09	0.01	-0.04	-0.02	-0.09	-0.02	0.13
Total[4]	-0.69	-0.03	- 2.54	-0.10	- 3.23	-0.13	-1.357	-0.05	-3.00	-0.12	-4.34	-0.17

[1]Numbers may not add up to totals due to rounding.
[2]Million bushels.
[3]Percent change from baserun volume.
[4]Overall reduction in U.S. corn exports resulting from increase in export price due to user charge imposition.

Table 21. Effect on U.S. Port Area Sorghum of a Weight-Based User Fee Which Is to Recoupe Operations and Maintenance Expenses (OM), New Construction Costs (NC), and the Aggregate of These Costs (OMNC)[1]

	Port-Specific Fees						Uniform Fees					
	OM		NC		OMNC		OM		NC		OMNC	
	Change In Volume[2]	Percent Change[3]	Change In Volume	Percent Change	Change In Volume	Percent Change	Change In Volume	Percent Change	Change In Volume	Percent Change	Change In Volume	Percent Change
50 Percent Cost Recovery Level												
Gulf	-0.12	-0.04	-0.42	-0.16	-0.54	-0.21	-0.14	-0.05	-0.30	-0.11	-0.44	-0.17
Atlantic	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Great Lakes	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pacific	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total[4]	-0.12	-0.04	-0.42	-0.16	-0.54	-0.21	-0.14	-0.05	-0.30	-0.11	-0.44	-0.17
100 Percent Cost Recovery Level												
Gulf	-0.23	-0.09	-0.84	-0.32	-1.06	-0.41	-0.27	-0.10	-0.60	-0.23	-0.87	-0.33
Atlantic	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Great Lakes	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pacific	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total[4]	-0.23	-0.09	-0.84	-0.32	-1.06	-0.41	-0.27	-0.10	-0.60	-0.23	-0.87	-0.33

[1]Numbers may not add up to totals due to rounding.
[2]Million bushels.
[3]Percent change from baserun volume.
[4]Overall reduction in U.S. sorghum exports resulting from increase in export price due to user charge imposition.

Table 22. Effect on U.S. Port Area Sorghum of an Ad Valorem User Fee Which Is to Recoupe Operations and Maintenance Expenses (OM), New Construction Costs (NC), and the Aggregate of These Costs (OMNC)[1]

	Port-Specific Fees						Uniform Fees					
	OM		NC		OMNC		OM		NC		OMNC	
	Change In Volume[2]	Percent Change[3]	Change In Volume	Percent Change	Change In Volume	Percent Change	Change In Volume	Percent Change	Change In Volume	Percent Change	Change In Volume	Percent Change
50 Percent Cost Recovery Level												
Gulf	-0.04	-0.02	-0.14	-0.05	-0.17	-0.07	-0.07	-0.03	-0.16	-0.06	-0.23	-0.09
Atlantic	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Great Lakes	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pacific	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total[4]	-0.04	-0.02	-0.14	-0.05	-0.17	-0.07	-0.07	-0.03	-0.16	-0.06	-0.23	-0.09
100 Percent Cost Recovery Level												
Gulf	-0.08	-0.03	-0.26	-0.10	-0.34	-0.13	-0.14	-0.06	-0.31	-0.12	-0.46	-0.18
Atlantic	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Great Lakes	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pacific	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total[4]	-0.08	-0.03	-0.26	-0.10	-1.34	-0.13	-0.14	-0.06	-0.31	-0.12	-0.46	-0.18

[1]Numbers may not add up to totals due to rounding.
[2]Million bushels.
[3]Percent change from baserun volume.
[4]Overall reduction in U.S. sorghum exports resulting from increase in export price due to user charge imposition.

Table 23. Effect on U.S. Port Area Soybeans of a Weight-Based User Fee Which Is to Recoupe Operations and Maintenance Expenses (OM), New Construction Costs (NC), and the Aggregate of These Costs (OMNC)[1]

	Port-Specific Fees						Uniform Fees					
	OM		NC		OMNC		OM		NC		OMNC	
	Change In Volume[2]	Percent Change[3]	Change In Volume	Percent Change	Change In Volume	Percent Change	Change In Volume	Percent Change	Change In Volume	Percent Change	Change In Volume	Percent Change
	50 Percent Cost Recovery Level											
Gulf	- 0.13	- 0.02	1.87	0.34	5.91	1.07	-0.15	-0.03	-0.32	-0.06	-0.45	-0.08
Atlantic	- 0.01	- 0.01	- 6.49	- 5.21	-6.50	-5.22	-0.01	-0.01	-0.02	-0.01	-0.03	-0.02
Great Lakes	0.00	0.00	4.16	4.77	-0.02	-0.02	0.00	0.00	-0.01	-0.01	-0.01	-0.01
Pacific	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total[4]	- 0.14	- 0.02	- 0.47	- 0.06	-0.61	-0.08	-0.16	-0.02	-0.35	-0.05	-0.50	-0.07
	100 Percent Cost Recovery Level											
Gulf	- 0.25	- 0.04	36.79	6.64	5.35	0.97	-0.29	-0.05	-0.61	-0.11	-0.90	-0.16
Atlantic	14.60	11.72	-41.89	-33.62	-6.54	-5.25	-0.02	-0.01	-0.05	-0.04	-0.07	-0.06
Great Lakes	-14.62	-16.76	4.15	4.75	-0.03	-0.03	-0.03	-0.01	-0.02	-0.02	-0.02	-0.02
Pacific	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total[4]	- 0.27	- 0.04	- 0.96	- 0.12	-1.21	-0.16	-0.31	-0.04	-0.68	-0.09	-0.99	-0.13

[1]Numbers may not add up to totals due to rounding.
[2]Million bushels.
[3]Percent change from baserun volume.
[4]Overall reduction in U.S. soybean exports resulting from increase in export price due to user charge imposition.

Table 24. Effect on U.S. Port Area Soybeans of an Ad Valorem User Fee Which Is to Recoupe Operations and Maintenance Expenses (OM), New Construction Costs (NC), and the Aggregate of These Costs (OMNC)[1]

	Port-Specific Fees						Uniform Fees					
	OM		NC		OMNC		OM		NC		OMNC	
	Change In Volume[2]	Percent Change[3]	Change In Volume	Percent Change	Change In Volume	Percent Change	Change In Volume	Percent Change	Change In Volume	Percent Change	Change In Volume	Percent Change
	50 Percent Cost Recovery Level											
Gulf	- 0.07	- 0.01	6.16	1.11	1.92	-0.35	-0.16	-0.03	-0.35	-0.06	-0.50	-0.09
Atlantic	14.61	11.72	-6.48	-5.20	-6.49	-5.21	-0.01	-0.01	-0.02	-0.02	-0.03	-0.03
Great Lakes	-14.61	-16.76	-0.01	-0.01	4.16	4.77	0.00	0.00	-0.01	-0.01	-0.01	-0.01
Pacific	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total[4]	- 0.08	- 0.01	-0.32	-0.04	-0.40	-0.05	-0.17	0.02	-0.38	-0.05	-0.54	-0.07
	100 Percent Cost Recovery Level											
Gulf	- 0.16	- 0.03	5.89	1.06	1.56	0.28	-0.32	-0.06	-0.67	-0.12	-0.99	-0.18
Atlantic	14.60	11.72	-6.50	-5.22	-6.52	-5.23	-0.02	-0.01	-0.06	-0.04	-0.08	-0.06
Great Lakes	-14.61	-16.76	-0.02	-0.02	4.15	4.76	-0.01	-0.01	-0.02	-0.02	-0.02	-0.03
Pacific	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total[4]	- 0.17	- 0.02	-0.63	-0.08	0.81	-0.10	-0.34	-0.04	-0.75	-0.10	-1.09	-0.14

[1]Numbers may not add up to totals due to rounding.
[2]Million bushels.
[3]Percent change from baserun volume.
[4]Overall reduction in U.S. soybean exports resulting from increase in export price due to user charge imposition.

Table 25. Effect on U.S. Port Area Hard Red Winter Wheat of a Weight-Based User Fee Which Is to Recoupe Operations and Maintenance Expenses (OM), New Construction Costs (NC), and the Aggregate of These Costs (OMNC)[1]

	Port-Specific Fees						Uniform Fees					
	OM		NC		OMNC		OM		NC		OMNC	
	Change In Volume[2]	Percent Change[3]	Change In Volume	Percent Change	Change In Volume	Percent Change	Change In Volume	Percent Change	Change In Volume	Percent Change	Change In Volume	Percent Change
	50 Percent Cost Recovery Level											
Gulf	-0.04	-0.01	-0.37	-0.07	-0.42	-0.09	-0.11	-0.02	-0.25	-0.05	-0.36	-0.07
Atlantic	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Great Lakes	0.00	0.00	-0.01	-0.02	-0.01	-0.02	0.00	0.00	-0.01	-0.02	-0.01	-0.02
Pacific	-0.06	-0.06	0.00	0.00	-0.06	-0.06	-0.01	-0.01	-0.02	-0.02	-0.03	-0.03
Total[4]	-0.10	-0.02	-0.37	-0.06	-0.49	-0.08	-0.12	-0.02	-0.27	-0.04	-0.40	-0.06
	100 Percent Cost Recovery Level											
Gulf	-0.15	-0.03	-0.75	-0.15	-0.90	-0.18	-0.23	-0.05	-0.50	-0.10	-0.72	-0.15
Atlantic	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Great Lakes	-0.01	-0.02	-0.01	0.03	-0.01	-0.04	-0.01	-0.02	-0.01	-0.02	-0.01	-0.03
Pacific	-0.06	-0.06	-0.01	0.01	-0.07	-0.07	-0.02	-0.02	-0.05	-0.05	-0.06	-0.07
Total[4]	-0.21	-0.03	-0.77	-0.12	-0.98	-0.16	-0.25	-0.04	-0.55	-0.09	-0.80	-0.13

[1]Numbers may not add up to totals due to rounding.
[2]Million bushels.
[3]Percent change from baserun volume.
[4]Overall reduction in U.S. hard red winter wheat exports resulting from increase in export price due to user charge imposition.

Table 26. Effect on U.S. Port Area Hard Red Winter Wheat of an Ad Valorem User Fee Which Is to Recoupe Operations and Maintenance Expenses (OM), New Construction Costs (NC), and the Aggregate of These Costs (OMNC)[1]

	Port-Specific Fees						Uniform Fees					
	OM		NC		OMNC		OM		NC		OMNC	
	Change In Volume[2]	Percent Change[3]	Change In Volume	Percent Change	Change In Volume	Percent Change	Change In Volume	Percent Change	Change In Volume	Percent Change	Change In Volume	Percent Change
	50 Percent Cost Recovery Level											
Gulf	0.01	0.00	-0.15	-0.03	-0.16	-0.03	-0.08	-0.02	-0.17	-0.03	-0.26	-0.05
Atlantic	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Great Lakes	0.00	0.00	0.00	-0.01	-0.01	-0.02	0.00	0.00	-0.01	-0.02	-0.01	-0.02
Pacific	-0.06	-0.06	0.00	0.00	-0.06	-0.06	0.00	0.00	-0.01	-0.01	-0.02	-0.02
Total[4]	-0.04	-0.01	-0.15	-0.02	-0.21	-0.03	-0.08	-0.01	-0.19	-0.03	-0.28	-0.04
	100 Percent Cost Recovery Level											
Gulf	-0.03	-0.01	-0.32	-0.06	-0.35	-0.07	-0.15	-0.03	-0.35	-0.07	-0.51	-0.10
Atlantic	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Great Lakes	0.00	0.00	-0.01	-0.02	-0.01	-0.02	0.00	0.00	-0.01	-0.02	-0.01	-0.02
Pacific	-0.06	-0.06	0.00	0.00	-0.06	-0.06	-0.01	-0.01	-0.03	-0.03	-0.05	-0.05
Total[4]	-0.09	-0.01	-0.33	-0.05	-0.41	-0.07	-0.17	-0.03	-0.38	-0.06	-0.57	-0.09

[1]Numbers may not add up to totals due to rounding.
[2]Million bushels.
[3]Percent change from baserun volume.
[4]Overall reduction in U.S. hard red winter wheat exports resulting from increase in export price due to user charge imposition.

Table 27. Effect on U.S. Port Area Hard Red Spring Wheat of a Weight-Based User Fee Which Is to Recoupe Operations and Maintenance Expenses (OM), New Construction Costs (NC), and the Aggregate of These Costs (OMNC)[1]

	Port-Specific Fees						Uniform Fees					
	OM		NC		OMNC		OM		NC		OMNC	
	Change In Volume[2]	Percent Change[3]	Change In Volume	Percent Change	Change In Volume	Percent Change	Change In Volume	Percent Change	Change In Volume	Percent Change	Change In Volume	Percent Change
50 Percent Cost Recovery Level												
Gulf	-0.02	-0.03	-8.40	-10.53	-0.14	-0.18	-0.03	-0.04	-0.08	-0.10	-0.11	-0.14
Atlantic	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Great Lakes	0.00	0.00	8.28	16.06	-0.02	-0.03	0.00	0.00	-0.01	-0.02	-0.01	-0.03
Pacific	-0.01	-0.01	0.03	0.03	-0.02	-0.02	-0.01	-0.01	-0.02	-0.02	-0.03	-0.03
Total[4]	-0.03	-0.01	-0.14	- 0.06	-0.18	-0.08	-0.04	-0.02	-0.10	-0.04	-0.15	-0.07
100 Percent Cost Recovery Level												
Gulf	-0.05	-0.07	-8.49	-10.65	-0.26	-0.33	-0.07	-0.08	-0.15	-0.19	-0.22	-0.27
Atlantic	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Great Lakes	-0.01	-0.01	8.25	16.00	-0.03	-0.06	-0.01	-0.02	-0.02	-0.04	-0.03	-0.05
Pacific	-0.02	-0.02	-0.05	- 0.05	-0.07	-0.07	-0.02	-0.02	-0.03	-0.03	-0.05	-0.04
Total[4]	-0.07	-0.03	-0.29	- 0.13	-0.36	-0.16	-0.09	-0.04	-0.21	-0.09	-0.30	-0.13

[1]Numbers may not add up to totals due to rounding.
[2]Million bushels.
[3]Percent change from baserun volume.
[4]Overall reduction in U.S. hard red spring wheat exports resulting from increase in export price due to user charge imposition.

Table 28. Effect on U.S. Port Area Hard Red Spring Wheat of an Ad Valorem User Fee Which Is to Recoupe Operations and Maintenance Expenses (OM), New Construction Costs (NC), and the Aggregate of These Costs (OMNC)[1]

	Port-Specific Fees						Uniform Fees					
	OM		NC		OMNC		OM		NC		OMNC	
	Change In Volume[2]	Percent Change[3]	Change In Volume	Percent Change	Change In Volume	Percent Change	Change In Volume	Percent Change	Change In Volume	Percent Change	Change In Volume	Percent Change
50 Percent Cost Recovery Level												
Gulf	-0.01	-0.01	-0.04	-0.05	-8.36	-10.48	-0.01	-0.02	-0.05	-0.06	-0.08	-0.10
Atlantic	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Great Lakes	0.00	0.00	-0.01	-0.01	8.30	-16.10	0.00	0.00	-0.01	-0.01	-0.01	-0.02
Pacific	0.00	0.00	-0.01	-0.01	-0.01	- 0.02	0.01	-0.01	-0.02	-0.02	-0.02	-0.02
Total[4]	-0.01	-0.01	-0.06	-0.03	-0.07	- 0.03	0.03	-0.01	-0.07	-0.03	-0.10	-0.04
100 Percent Cost Recovery Level												
Gulf	-0.02	-0.03	-0.09	-0.11	-8.41	-10.55	-0.05	-0.06	-0.10	-0.13	-0.15	-0.19
Atlantic	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Great Lakes	0.00	0.00	-0.01	-0.02	8.28	16.06	0.01	-0.01	-0.01	-0.02	-0.02	-0.04
Pacific	-0.01	-0.01	-0.03	-0.03	-0.03	- 0.03	0.02	-0.02	-0.03	-0.03	-0.04	-0.04
Total[4]	-0.03	-0.01	-0.13	-0.06	-0.16	- 0.07	0.07	-0.03	-0.14	-0.06	-0.21	-0.09

[1]Numbers may not add up to totals due to rounding.
[2]Million bushels.
[3]Percent change from baserun volume.
[4]Overall reduction in U.S. hard red spring wheat exports resulting from increase in export price due to user charge imposition.

Table 29. Effect on U.S. Port Area Soft Wheat of a Weight-Based User Fee Which Is to Recoupe Operations and Maintenance Expenses (OM), New Construction Costs (NC), and the Aggregate of These Costs (OMNC)[1]

	Port-Specific Fees						Uniform Fees					
	OM		NC		OMNC		OM		NC		OMNC	
	Change In Volume[2]	Percent Change[3]	Change In Volume	Percent Change	Change In Volume	Percent Change	Change In Volume	Percent Change	Change In Volume	Percent Change	Change In Volume	Percent Change
50 Percent Cost Recovery Level												
Gulf	7.72	8.21	7.70	8.18	12.29	13.07	8.79	9.34	8.77	9.32	8.76	9.32
Atlantic	-7.73	-18.23	-13.44	-31.67	-12.38	-29.19	-8.80	-20.75	-8.82	-20.79	-8.84	-20.83
Great Lakes	-0.01	- 0.01	5.65	12.18	- 0.02	- 0.05	-0.01	- 0.01	-0.01	- 0.03	-0.02	- 0.04
Pacific	-0.06	- 0.02	0.20	- 0.08	- 0.24	- 0.10	-0.07	- 0.03	-0.13	- 0.06	-0.19	- 0.08
Total[4]	-0.08	- 0.02	- 0.28	- 0.07	- 0.35	- 0.08	-0.09	- 0.02	-0.20	- 0.05	-0.29	- 0.07
100 Percent Cost Recovery Level												
Gulf	7.70	8.19	7.66	8.15	12.26	13.04	8.77	9.32	8.75	9.30	8.74	9.29
Atlantic	-7.75	-18.26	-13.48	-31.77	-12.44	-29.32	-8.82	-20.78	-8.85	-20.87	-8.88	-20.94
Great Lakes	-0.01	- 0.02	5.64	12.16	- 0.04	- 0.10	-0.02	- 0.03	-0.02	- 0.05	-0.04	- 0.08
Pacific	-0.10	- 0.04	- 0.38	- 0.16	- 0.49	- 0.20	-0.12	- 0.05	-0.27	- 0.11	-0.40	- 0.17
Total[4]	-0.15	- 0.04	- 0.56	- 0.13	- 0.71	- 0.17	-0.18	- 0.04	-0.40	- 0.10	-0.58	- 0.14

[1]Numbers may not add up to totals due to rounding.
[2]Million bushels.
[3]Percent change from baserun volume.
[4]Overall reduction in U.S. soft wheat exports resulting from increase in export price due to user charge imposition.

Table 30. Effect on U.S. Port Area Soft Wheat of an Ad Valorem User Fee Which Is to Recoupe Operations and Maintenance Expenses (OM), New Construction Costs (NC), and the Aggregate of These Costs (OMNC)[1]

	Port-Specific Fees						Uniform Fees					
	OM		NC		OMNC		OM		NC		OMNC	
	Change In Volume[2]	Percent Change[3]	Change In Volume	Percent Change	Change In Volume	Percent Change	Change In Volume	Percent Change	Change In Volume	Percent Change	Change In Volume	Percent Change
50 Percent Cost Recovery Level												
Gulf	7.72	8.21	12.32	13.10	7.71	8.19	8.79	9.34	8.78	9.33	8.77	9.32
Atlantic	-7.73	-18.22	-12.34	-29.08	-13.42	-31.63	-8.80	-20.74	-8.82	-20.78	-8.82	-20.80
Great Lakes	0.00	0.00	- 0.01	- 0.02	5.65	12.18	-0.01	- 0.01	-0.01	- 0.02	-0.01	- 0.03
Pacific	-0.02	- 0.01	- 0.09	- 0.04	- 0.10	- 0.04	-0.04	- 0.02	-0.10	- 0.04	-0.14	- 0.06
Total[4]	-0.03	- 0.01	- 0.12	- 0.03	- 0.16	- 0.04	-0.05	- 0.01	-0.15	- 0.03	-0.21	- 0.05
100 Percent Cost Recovery Level												
Gulf	7.72	8.21	12.30	13.08	7.69	8.18	8.78	9.33	8.76	9.32	8.75	9.30
Atlantic	-7.73	-18.22	-12.36	-29.14	-13.44	-31.68	-8.81	-20.77	-8.84	-20.83	-8.86	-20.88
Great Lakes	-0.01	- 0.01	- 0.02	- 0.03	5.65	12.18	-0.01	- 0.02	0.02	- 0.04	-0.03	- 0.06
Pacific	-0.05	- 0.02	- 0.17	- 0.07	- 0.21	- 0.09	-0.09	- 0.04	-0.19	- 0.08	-0.28	- 0.12
Total[4]	-0.06	- 0.02	- 0.24	- 0.06	- 0.31	- 0.07	-0.13	- 0.03	-0.29	- 0.07	-0.41	- 0.10

[1]Numbers may not add up to totals due to rounding.
[2]Million bushels.
[3]Percent change from baserun volume.
[4]Overall reduction in U.S. soft wheat exports resulting from increase in export price due to user charge imposition.

Table 31. Effect on U.S. Port Area Durum Wheat of a Weight-Based User Fee Which Is to Recoupe Operations and Maintenance Expenses (OM), New Construction Costs (NC), and the Aggregate of These Costs (OMNC)[1]

	Port-Specific Fees						Uniform Fees					
	OM		NC		OMNC		OM		NC		OMNC	
	Change In Volume[2]	Percent Change[3]	Change In Volume	Percent Change	Change In Volume	Percent Change	Change In Volume	Percent Change	Change In Volume	Percent Change	Change In Volume	Percent Change
50 Percent Cost Recovery Level												
Gulf	2.50	16.06	2.50	16.06	2.50	16.06	2.50	16.06	2.50	16.06	2.50	16.06
Atlantic	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Great Lakes	-0.44	- 0.89	-0.44	- 0.89	-0.44	- 0.90	-0.44	- 0.89	-0.44	- 0.89	-0.44	- 0.89
Pacific	-2.07	- 8.82	-2.07	- 8.83	-2.07	- 8.84	2.06	- 8.82	2.07	- 3.83	2.07	- 8.83
Total[4]	0.00	- 0.00	-0.01	- 0.01	-0.02	- 0.02	-0.00	- 0.00	-0.01	- 0.01	-0.01	- 0.01
100 Percent Cost Recovery Level												
Gulf	2.50	16.06	2.49	16.01	2.49	16.01	2.50	16.06	2.49	16.02	-2.49	16.01
Atlantic	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Great Lakes	-0.44	- 0.89	-0.45	- 0.91	-0.45	- 0.92	-0.44	- 0.89	-0.44	- 0.90	-0.45	- 0.91
Pacific	-2.07	- 8.83	-2.07	- 8.86	-2.07	- 8.86	-2.07	- 8.84	-2.07	- 8.85	-2.07	- 8.86
Total[4]	-0.01	- 0.01	-0.03	- 0.04	-0.04	- 0.04	-0.01	- 0.01	-0.02	- 0.03	-0.03	- 0.04

[1]Numbers may not add up to totals due to rounding.
[2]Million bushels.
[3]Percent change from baserun volume.
[4]Overall reduction in U.S. durum wheat exports resulting from increase in export price due to user charge imposition.

Table 32. Effect on U.S. Port Area Durum Wheat of an Ad Valorem User Fee Which Is to Recoupe Operations and Maintenance Expenses (OM), New Construction Costs (NC), and the Aggregate of These Costs (OMNC)[1]

	Port-Specific Fees						Uniform Fees					
	OM		NC		OMNC		OM		NC		OMNC	
	Change In Volume[2]	Percent Change[3]	Change In Volume	Percent Change	Change In Volume	Percent Change	Change In Volume	Percent Change	Change In Volume	Percent Change	Change In Volume	Percent Change
50 Percent Cost Recovery Level												
Gulf	2.50	16.07	2.50	16.06	2.50	16.06	2.50	16.06	2.50	16.06	2.50	16.06
Atlantic	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Great Lakes	-0.44	- 0.89	-0.44	- 0.89	-0.44	- 0.89	-0.44	- 0.89	-0.44	- 0.89	-0.44	- 0.89
Pacific	2.06	- 8.82	2.06	- 8.82	2.07	- 8.83	-2.06	- 8.82	-2.07	- 8.83	-2.07	- 8.83
Total[4]	0.00	0.00	-0.01	- 0.01	-0.01	- 0.01	0.00	0.00	-0.01	- 0.01	-0.01	- 0.01
100 Percent Cost Recovery Level												
Gulf	2.50	16.06	2.50	16.06	2.50	16.06	2.50	16.06	2.50	16.06	2.50	16.02
Atlantic	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Great Lakes	-0.44	- 0.89	-0.44	- 0.90	-0.44	- 0.90	-0.44	- 0.90	-0.44	- 0.90	-0.44	- 0.91
Pacific	-2.07	- 8.82	-2.07	- 8.83	-2.07	- 8.84	-2.07	- 8.82	-2.07	- 8.84	-2.07	- 8.85
Total[4]	-0.00	- 0.01	-0.10	- 0.01	-0.01	- 0.02	-0.01	- 0.01	-0.01	- 0.01	-0.03	- 0.02

[1]Numbers may not add up to totals due to rounding.
[2]Million bushels.
[3]Percent change from baserun volume.
[4]Overall reduction in U.S. durum wheat exports resulting from increase in export price due to user charge imposition.

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1M—3-87