

THE ECONOMIC EFFECTS OF LEVYING A HARBOR USER CHARGE ON WATERBORNE COMMERCE

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Introduction

There has been a long-standing interest in imposing user fees on waterborne traffic (see, e.g., Charles River Associates, 1970; Heggie, 1974; Walters, 1975; Anderson et al., 1977a, 1977b; Imakita, 1978; Walton, 1979; Salzano, 1981; Tomassoni, 1981). Since October 1980 the U.S. federal government has collected a fee in the form of a tax on vessel fuels from vessels using the inland waterways. Within the last two sessions of Congress, both members of administration and individual members of Congress have made serious legislative initiatives to impose charges on commercial vessels moving in the channels of the deep water ports on the United States' coasts and Great Lakes. One of the purposes of such proposals is to generate revenues of over \$300 million, the amount the U.S. Army Corps of Engineers expends annually on deep water harbor maintenance.

Except for inconsequential tonnage duties on vessels engaged in foreign trade, which have been in effect since the 19th century, foreign and domestic vessels have moved in and out of the U.S. deep water port system without significant federal fees.¹ Instituting the new charge at coastal and Great Lakes ports would be a discrete break with the past, potentially affecting an enormous quantity of domestic and international commerce. The Corps of Engineers estimates that in 1979 there moved through U.S. ports 633 million tons of imports, 360 million tons of exports, and 448 million tons of domestic coastal and

Great Lakes shipments. Total deep water commerce in that year amounted to more than 1.4 billion tons.

To the extent that any U.S. waterborne commerce would be affected by a user charge, the impacts created by such a charge would extend well beyond the change in the quantities of the goods moving through U.S. ports. Not only would the shipping industry carrying the goods be affected by these changes, but also the port activities, industries producing or consuming the shipped goods, and the numerous suppliers of the other goods and services used by all of these industries in their production processes.

The objective of this paper is to investigate the range and magnitude of these impacts. Toward this end, the analysis focuses on the changes that might have occurred in 1979 had the federal government then instituted a nationwide uniform charge of \$0.25 per ton on cargo—exports, imports and unloadings of domestic shipments—moved through U.S. deepwater ports. While this particular levy is not prescribed by any of the legislative proposals, it is approximately the charge that would be needed to cover the operation and maintenance costs incurred by the U.S. Army Corps of Engineers for U.S. deepwater coastal and Great Lakes ports. The results illustrate the potential impacts that can result from the imposition of a charge on deepwater foreign and domestic commerce.

Methodology

The impacts on economic activities resulting from the imposition of a port user fee were estimated in this study from three different perspectives: impacts on activities directly associated with ports and within the hinterlands of the ports; impacts on activities located within particular geographically defined port areas; and impacts on particular economic sectors on a nationwide basis.

It is to be stressed that the analysis presented is an *impact* analysis, not an *evaluation*

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analysis. The former attempts to measure the changes in selected variables resulting from a particular initiative while the latter is designed to assess the desirability of the initiative by weighing the various changes in terms of goals or objectives, explicitly recognizing in the process the opportunity costs of the resources utilized in the implementation of the initiative (Waters 1976).

Port/Shipping and Hinterland Impacts

In the study, a distinction is drawn between "port/shipping" economic activities and port-dependent or "hinterland" activities. In the first instance, the impact of the harbor user fee is measured in terms of the economic impact originating in the port and shipping industries. Given the increases in prices of exports and imports caused by the user fee, coefficients of price elasticities of demand for various commodities were used to translate the price increases into reduced demands for the exports and imports of particular commodities. The resulting reductions in trade flows have a direct impact on port/shipping activities which is subsequently translated into reduced indirect and induced demands on the nation's production. (The *indirect* impact in this case consists of the changes in all activities supporting port/shipping activities through technical relationships, i.e. sales/purchases of intermediate commodities. The *induced* impact is composed of changes in activities attributable to reduced consumption resulting from lower incomes). The total impact of the reduced port activity on production is estimated via a national input-output table as

$$\Delta X_p = (I - A)^{-1} \Delta PA \quad (1)$$

where ΔX_p is the vector of changes in gross outputs of all sectors in the economy due to the reduction, ΔPA in port/shipping activity, and $(I - A)^{-1}$ is the customary Leontief inverse of the input-output model (closed with respect to household consumption).

A second set of impacts is transmitted through the aggregate of hinterland industries that produce exports, that use imports for which there are no readily available domestic substitutes, and that produce commodities which serve as import replacements. Decreases in exports result in reduced business transactions by the export-producing industries, with consequent indirect and induced effects of sup-

pliers and income earners employed in those industries. The decline in gross outputs, ΔX_E , due to a reduction in exports, ΔEX , is estimated as

$$\Delta X_E = (I - A)^{-1} \Delta EX \quad (2)$$

To the extent that decreased imports are replaced by domestic production, the sales of the domestic industries producing such products will increase. The potential impact in such cases—i.e., the change in gross outputs, ΔX_C —can be estimated as

$$\Delta X_C = (I - A)^{-1} \Delta CM \quad (3)$$

where ΔCM is the change in competitive imports.

Finally, decreases in imports for which there are no substitute U.S. products will result in restricted levels of production in those industries for which the imported products are necessary inputs. In such cases it is assumed, in accordance with the fixed production requirements of the input-output model, that the percent reduction of the gross output of the industry in question is equal to the percent reduction in non-competitive imports. The reduction in gross outputs, ΔX_N , due to decreases in sector outputs, ΔX , directly attributable to reduction in non-competitive imports is thus estimated as

$$\Delta X_N = \overline{(I - A)^{-1}} \overline{\Delta X} \quad (4)$$

where $(I - A)^{-1}$ is a matrix in which each column entry r_{ij} has been divided by r_{jj} in order to transform the inverse matrix into one which is appropriately applied to changes in gross outputs rather than changes in final demands (Davis 1983).

The total change in gross outputs, ΔX_T , resulting from the imposition of a user charge on waterborne traffic can now be estimated as

$$\Delta X_T = \Delta X_p + \Delta X_E + \Delta X_C + \Delta X_N \quad (5)$$

Geographic Impacts

A second perspective for considering the impacts that arise is the approximate geographic distribution of those impacts. In this analysis, the deep water ports are grouped into six areas, the North Atlantic, South Atlantic, Gulf of Mexico, California (including Hawaii), Pacific Northwest (including Alaska) and the Great

Lakes. For each of these areas, the study estimates the impacts arising because of any decrease in traffic handled by the area's port/shipping industry and the impacts affecting the "hinterland industries" serving the area.

In the results reported below, the geographic area of the "port/shipping industry" utilizing a particular port is not strictly defined. The more appropriate interpretation of the empirical results is that they are the impacts imposed on the port/shipping industry in the particular port area and the suppliers supporting that area's port/shipping servicing system. Similarly, the hinterland, supplying exports or consuming imports moving through a particular port area, is not strictly locationally delineated by our six geographic divisions and could well encompass a substantial part of the total spatial economy for any particular commodity.

Sector Impacts

Finally, the impacts on both the "port/shipping industry" and the "hinterland industries" can be disaggregated according to more specific industry/product sectors. This helps to define more precisely the industry breakdown of the economic effects that ultimately result after transmission of the impacts through the system is complete. In the following discussion, the impacts are traced through 30 industry/product sectors. These 30 sectors are aggregations of the original 476 sector breakdown of the economy that makes up the input-output model used to trace and calculate the impacts set in motion as a result of the user fee.

It is important to note, however, that the impacts estimated for each of the above categories by equations (1)–(5) omit some important considerations. The analysis takes into account only those changes that take place in the volume of imports, exports and domestic commerce in response to the initial charge per ton of cargo. The charge, however, would probably have cumulative effects. That is, to the extent that commodities bearing the charge are inputs to other commodities, the prices of the latter, as well as those of commodities using the latter as inputs, can be expected to rise. In turn, these price increases may come to affect the volume of trade. For example, to the extent that any increase in the price of phosphates, stemming from the levying of the charge on domestic deepwater movements of phosphates, results in higher grain prices at the farm, ex-

ports of grain can be expected to decline accordingly. Similarly, industries producing commodities in competition with imports might find that the advantage bestowed on them by the charge on imports is actually less than first appears because the prices of some of their inputs may be increased as a result of the charge.

A second major omission is the economic effect of the government's use of the revenues generated by the user charge. However, the use of these funds is a major fiscal policy question with quite different results arising from each of the several options that might be followed for their disposition. Investigating that very wide range of possible outcomes is clearly outside the scope of this work.

Additionally, no attempt was made in this study to estimate the multiplier effects of reduced waterborne commerce other than the direct, indirect and induced effects discussed above in regard to equations (1) to (5). No attempt was made, for example, to take into account the impact of reduced capital investment in, say, port and carrier equipment that might result from a decline in waterborne traffic. Similarly, it can be expected that significant decreases in the sales of suppliers would lead to cutbacks in investment in plant and equipment. These reduced volumes of capital investment could be expected, in turn, to lead to additional rounds of decreased sales and incomes, generating a downward investment multiplier effect.

Finally, any decrease in U.S. imports constitutes decreased sales and foreign exchange earnings by the foreign suppliers of the imported goods. These lower sales and exchange earnings would lead to lower incomes for the foreign supplying countries. Because foreign demand for U.S. goods is determined in large measure by foreign incomes, demands for U.S. exports could be expected to decline further, initiating a trade multiplier effect. To the extent that these latter two multiplier effects are significant, the estimates of the impacts in this analysis can be judged to be conservative.

The Data

The base year of the analysis is 1979, the most recent year for which the necessary data on waterborne commerce were available. It was also a year in which there were neither

extraordinary factors affecting this commerce, nor macroeconomic conditions which might significantly distort the results of the analysis.

The data on 1979 deepwater commerce were obtained from the U.S. Bureau of the Census and the U.S. Maritime Administration. The Bureau of Census annually publishes a summary derived from Customs reports of imports arriving by water transportation at the various customs districts. These imports are identified by country of origin and the commodity codes of the Tariff Schedules of the United States (U.S. Bureau of Census, 1979a). The Bureau also publishes an annual summary of exports moving by water out of the same customs districts, identified by country of destination and specific export commodity codes (U.S. Bureau of Census, 1979b). Both imports and exports are reported by weight and value.

The Maritime Administration utilizes for its reports the data on waterborne commerce assembled each year by the U.S. Army Corps of Engineers, covering separately the domestic coastal and Great Lakes movements (U.S. Department of the Army, 1979). These data are reported by weight only for both shipping and receiving ports and are identified by a commodity code specially developed for the waterborne commerce statistical series. These data were processed into the framework of the input-output model used in the analysis by mapping the series' commodity codes into the appropriate I-O sector definitions. Further processing was undertaken to develop tables of imports, exports, and domestic shipments and receipts for each of the six port areas as well as national totals.

Given the tonnage flows and values tabulated as described above, it was possible to develop unit values for both imports and exports at each port area. These values were then used with price elasticity coefficients (Buckler and Almon 1972, Baldwin 1976) to calculate the changes in the tonnages that would move through each port area as a result of the increase in commodity prices caused by the user charge.

These elasticities are a crucial element of the analysis and the estimates used are particularly appropriate to the study in that they were originally constructed for the commodity classification of the U.S. input-output model. The estimation process was undertaken as a part of the U.S. Department of Labor's efforts to

assess the effects of alternative provisions in trade agreement negotiations and the results are based on commodity data consistent with those of the record of port traffic used in this study. As a further measure, additional efforts were undertaken to confirm the reasonableness of the elasticity values relative to other such estimates made for major tonnage commodities such as grain and fuels (Bushnell et al. 1984). It was assumed in the present study that the user charge would be passed on by carriers and shippers to the ultimate users of the commodities, who would make their full long-run adjustments to the new price.

The construction of economic impact estimates utilizing the above waterborne commerce data is based upon the 476 sector model of the U.S. economy in 1972, developed by the Bureau of Economic Analysis (BEA) in the U.S. Department of Commerce (1979a). This model was independently updated to reflect 1977 industry technology. The specific version of the model augments the original BEA model with a set of six, more detailed waterborne transportation activities developed in a later study by the BEA (1979b), and a set of more detailed mining and minerals sectors developed for the U.S. Bureau of Mines (Lofting and Davis 1982). Price adjustments were applied to the model calculations to state the results in terms of 1979 dollars (Evans 1955).

Empirical Results

The estimate of the economic impacts of the \$0.25 charge per ton of waterborne commerce is presented in this section from the three different perspectives: impacts on national port/shipping and hinterland economic activities; impacts on broadly defined regions of the U.S.; and impacts on individual national economic sectors. From each of the three perspectives, the impact estimates are measured in terms of changes in quantities of cargo shipped, sales, employment, income, tax revenue, customs duties, and the balance of trade.

Estimates of the changes in sales, employment, income and tax revenue were derived directly from the input-output model calculations, utilizing the appropriate multipliers for each measure. The estimates of the changes in customs duties collections and the balance of trade were based on the changes in quantities of cargo shipped, the average duty collected on

each import, and the F.A.S. value of each import and export as reported by the Bureau of the Census. All impacts are calculated on the basis of fixed technical coefficients, thus excluding consideration of structural changes in the economy (such as technological changes in the transportation sectors) in response to the charge.

National Port/Shipping and Hinterland Impacts

The overall national impacts of a \$0.25 per ton charge in 1979 are shown in the last three lines of Table 1. Given the decline in traffic of almost 10 million short tons of cargo in response to the charge, the levy would have generated revenues of \$337 million. However, the charge would have also brought about declines in employment of more than 10,000 jobs and in incomes of approximately \$260

million. Income and indirect business tax revenues at the federal, state and local levels would have decreased by almost \$67 million and the decline in federal customs duties collections would have been more than \$12 million. Finally, the commodity balance of trade would have decreased by almost \$56 million.

Of these aggregate effects, those originating in the direct impacts on the port/shipping industry account for less than 25 percent of the total loss in direct business sales. However, the total decreases in employment, income and tax payments resulting from the initial impact on the port/shipping industry account for 30 percent or more of the total decline in those measures. This is because of the differences in the manner and magnitude of the propagation throughout the economy of the direct sales effects on the port/shipping and hinterland industries. For example, the \$39.1 million (Table

Table 1

Economic Effects of a User Charge on U.S. Deep Water Commerce
ALL FOREIGN & DOMESTIC COMMERCE, TOTAL U.S., 1979
(1979 Dollars)
User Charge = \$.25 per ton of Imports, Exports, Domestic Unloadings

SOURCE	Direct Sales \$1000	Employ- ment Jobs	Income \$1000	Taxes \$1000	Duties \$1000	User Charge \$1000	Cargo 1000ST	Commodity Balance \$1000
FOREIGN TRADE EFFECTS								
Comparable Imports								
Port/Shipping Effects	-5771	-451	-10339	-2704	-10949	60132	-2492	79808
Hinterland Effect	92209	5576	152240	41470	—	—	—	—
Total	86438	5125	141901	38766	-10949	60132	-2492	79808
Noncomparable Imports								
Port/Shipping Effects	-1639	-127	-2927	-764	-1198	88692	-143	19279
Hinterland Effects	-63372	-2136	-71586	-20369	—	—	—	—
Total	-65011	-2263	-74513	-21133	-1198	88692	-143	19279
Exports								
Port/Shipping Effects	-9597	-746	-17140	-4476	—	88928	-2060	-154905
Hinterland Effects	-154905	-10286	-263506	-68059	—	—	—	—
Total	-164501	-11032	-280646	-72535	—	88928	-2060	-154905
Total Foreign Trade								
Port/Shipping Effects	-17006	-1324	-30406	-7944	-12147	237755	-4695	-55816
Hinterland Effects	-126066	-6846	-182852	-46958	—	—	—	—
Total	-143072	-8170	-213258	-54902	-12147	237755	-4695	-55816
DOMESTIC COMMERCE EFFECTS								
Port/Shipping Effects	-22122	-1943	-46787	-12231	—	99092	-4817	—
TOTAL FOREIGN & DOMESTIC TRADE								
Port/Shipping Effects	-39128	-3267	-77193	-20175	-12147	336847	-9512	-55816
Hinterland Effects	-126066	-6846	-182852	-46958	—	—	—	—
Total	-165194	-10113	-260045	-67133	-12147	336847	-9512	-55816

1) of direct sales losses in the port/shipping industry results in a total decline of \$191.8 million (Table 5a) in business sales when the indirect and induced effects of the \$39.1 million direct sales decrease are taken into account. Similarly, the loss in direct sales by hinterland industries of \$126.1 million (Table 1) results in a total of direct, indirect, and induced business sales losses of \$423.9 million (Table 5b).

As can be seen from columns 1-3 in Table 1(a), these effects are not large compared to the overall size of the economy. At \$0.25, the user fee program, like most individual government programs, is not quantitatively substantial. However, it is important to consider the "response" (i.e., impacts) being produced per unit of "stimulus" (i.e., user charge) being injected into the system. The measures in column 4 of Table 1(a) are among the principal program criteria that should be taken into account in gauging the merits of a user charge, its magnitude, and the timing of its implementation.

These figures indicate that per dollar of revenue collected by the user charge on all types of deep water commerce, income would decline in 1979 by \$0.77, federal, state and local income and indirect business taxes would decline by nearly \$0.20, customs duties would decline by nearly \$0.04 and the commodity balance of trade would decline a further \$0.17. In addition, per million dollars of collections, employment would decline by 30 jobs and deepwater commerce would decrease by more than 28,000 tons.

It should also be noted that these figures pertaining to sales, employment, income and taxes are net of the gains registered in the hinterland industries (see Table 1) due to the substitution of domestic production for the now more expensive imports. The full extent of dislocation in the economy is thus not immediately evident from the net figures. For example, greater economic dislocation can be expected from, say, the simultaneous loss of 30

Table 1(a)

National Context & Relative Program Impacts of the User Charge
ALL FOREIGN & DOMESTIC COMMERCE

Measure	1979 Nat'l Value w/o user chge (million)	Change w/user chge (million)	Change/ 1979 Value	Change/ \$ million Rev.
Waterborn Commerce (ST)	1356.9	-9.5	-.0070	-28,200
Employment (jobs)	78.8*	(-.0101)	-.0001	-30
Income (\$)	1749111.0*	-260.0	-.0001	-772,000
Taxes (\$)	446733.2*	-67.1	-.0002	-199,300
Duties (\$)	7202.0**	-12.1	-.0017	-36,000
Waterborne Commodity Balance (\$)	-45725.0	-55.8	.0012	-165,700
Direct Sales (\$)	3575769.0*	-165.2	@	-490,400

@ Less than .00005

*Input-Output Model Basis

**Fiscal year 1979

jobs and the gain of 20 in the economy, as opposed to a gross loss of 10 jobs with no offsetting gains.

Regional Impacts

Table 2 shows the geographic or regional distribution of the net impacts recorded in the last three lines of Table 1. This distribution has a number of notable features. Perhaps first among these is the asymmetry of the distribution. The bottom one-third of Table 2 shows that of the total impacts on employment, income and tax payments, half or more fall upon the port area of the Gulf of Mexico and the hinterland industries serving it. The Great Lakes and Pacific Northwest port areas follow, at some distance.

The aggregation of all the impacts obscures the variations across regions of the different types of traffic (imports, exports, domestic shipments/receipts), as well as the industrial composition of the impacts. For example, when

the port/shipping impacts are separated from the hinterland impacts, the port/shipping industry in the Great Lakes port area experiences the greatest decline in employment, income, and tax payments. It is followed by the Gulf of Mexico and the North Atlantic areas. However, regarding hinterland industry impacts, the Gulf area's declines in employment, income and tax payments are by far the largest in absolute terms. The Pacific Northwest and Great Lakes port areas follow, with the North Atlantic fairly close behind them.

The North Atlantic and Gulf areas would experience the largest declines in customs duties collections while their positions are reversed in terms of user charge collections. Of special note is the result that the North Atlantic and South Atlantic areas would show a net gain in the commodity balance of foreign trade moving through those areas.

Tables 3 and 4 elaborate on the geographic distribution of the total impacts shown in

Table 2

Economic Effects of a User Charge on U.S. Deep Water Commerce
ALL FOREIGN & DOMESTIC COMMERCE, 1979, BY PORT AREA
(1979 Dollars)
User Charge = \$.25 per ton of Imports, Exports, Domestic Unloadings

INDUSTRY/AREA	Direct Sales \$1000	Employ- ment Jobs	Income \$1000	Taxes \$1000	Duties \$1000	User Charge \$1000	Cargo 1000ST	Commodity Balance \$1000
Port/Shipping Industry								
North Atlantic	-8329	-677	-15869	-4147	-4017	85164	-1946	10910
South Atlantic	-1468	-121	-2841	-743	-1151	17763	-237	2508
Gulf of Mexico	-9493	-771	-18065	-4721	-3964	124282	-1478	-41021
California	-3179	-268	-6373	-1666	-1067	33525	-414	-683
Pacific Northwest	-4319	-358	-8465	-2212	-780	22942	-614	-16603
Great Lakes	-12339	-1073	-25577	-6685	-1169	53162	-4822	-10924
Total	-39128	-3267	-77193	-20175	-12147	336847	-9512	-55816
Hinterland Industry								
North Atlantic	-4631	-646	-12605	-2608	—	—	—	—
South Atlantic	1585	-25	944	366	—	—	—	—
Gulf of Mexico	-91488	-4229	-122463	-32341	—	—	—	—
California	-3899	-86	-3053	-946	—	—	—	—
Pacific Northwest	-18116	-1172	-29053	-7353	—	—	—	—
Great Lakes	-9517	-688	-16621	-4076	—	—	—	—
Total	-126066	-6846	-182852	-46958	—	—	—	—
Total								
North Atlantic	-12960	-1323	-28474	-6755	-4017	85164	-1946	10910
South Atlantic	117	-146	-1897	-377	-1151	17763	-237	2508
Gulf of Mexico	-100981	-5000	-140528	-37062	-3964	124282	-1478	-41021
California	-7078	-354	-9426	-2612	-1067	33525	-414	-683
Pacific Northwest	-22435	-1530	-37518	-9565	-780	22942	-614	-16603
Great Lakes	-21856	-1761	-42198	-10761	-1169	53162	-4822	-10924
Total	-165194	-10113	-260045	-67133	-12147	336847	-9512	-55816

Table 2. Table 3 shows the effects that the projected decline in imports would have across the port areas. Table 4 displays the effects that would result from decreases in exports.

Imports. From Table 3 it can be seen that in tonnage terms the Gulf of Mexico is the largest importing port area. However, the import mix of the North Atlantic port area is apparently more responsive to the \$0.25 per ton charge so that the North Atlantic experiences the greater traffic decline in imports. Consequently, the employment, income and tax payments of the North Atlantic port/shipping industry would decline by larger amounts than would the Gulf. While the Gulf has the greater revenue collections from the charge, the North Atlantic area would increase its positive commodity trade balance by a larger amount because of its significantly decreased import flows.

The hinterland industry effect, however, is quite different. Because the North Atlantic port area imports commodities for which there are domestically produced replacements, pro-

ducers of those goods in the "North Atlantic hinterland" would register increases in sales, employment, income, and tax payments. While the Great Lakes area port/shipping industry was a distant third in the loss of jobs and income as a result of the decline in waterborne import traffic, it ranks second in terms of the sales, employment and income gains by the hinterland industries producing substitutes for these imports.

Also highly notable in the case of import impacts, the "hinterland industries" of the Gulf of Mexico area show a decline in gross output (sales), income payments and tax collections as a result of the decrease in the imports moving through its ports. As can be seen in a finer industry/product breakdown of imports, this consequence in the Gulf port area is due primarily to the cut in imports of crude oil which results in lower production of petroleum products and chemicals in that area. However, because of the difference between (a) employee requirements of the crude petroleum and

Table 3

Economic Effects of a User Charge on U.S. Deep Water Commerce
CHANGES IN IMPORTS, 1979, BY PORT AREA
(1979 Dollars)

User Charge = \$.25 per ton of Imports, Exports, Domestic Unloadings

INDUSTRY/AREA	Direct Sales \$1000	Employ- ment Jobs	Income \$1000	Taxes \$1000	Duties \$1000	User Charge \$1000	Cargo 1000ST	Commodity Balance \$1000
Port/Shipping Industry								
North Atlantic	-2839	-221	-5080	-1328	-4017	44640	-1194	37949
South Atlantic	-535	-42	-957	-250	-1151	7757	-125	7682
Gulf of Mexico	-2517	-196	-4506	-1178	-3964	74917	-636	32048
California	-503	-39	-902	-236	-1067	9887	-126	8832
Pacific Northwest	-326	-26	-584	-153	-780	5427	-241	5011
Great Lakes	-690	-54	-1236	-323	-1169	6198	-313	7564
Total	-7410	-578	-13265	-3468	-12148	148826	-2635	99086
Hinterland Industry								
North Atlantic	22408	1381	38203	10520	—	—	—	—
South Atlantic	6759	369	10653	2866	—	—	—	—
Gulf of Mexico	-18419	212	-4733	-1979	—	—	—	—
California	5616	544	12820	3284	—	—	—	—
Pacific Northwest	3501	334	7835	1980	—	—	—	—
Great Lakes	8971	600	15874	4430	—	—	—	—
Total	28836	3440	80652	21100	—	—	—	—
Total								
North Atlantic	19569	1160	33123	9192	-4017	44640	-1194	37949
South Atlantic	6224	327	9696	2616	-1151	7757	-125	7682
Gulf of Mexico	-20936	16	-9239	-3157	-3964	79917	-636	32048
California	5113	505	11918	3048	-1067	9887	-126	8832
Pacific Northwest	3175	308	7251	1827	-780	5427	-241	5011
Great Lakes	8281	546	14638	4107	-1169	6198	-313	7564
Total	21426	2862	67388	17632	-12148	148826	-2635	99086

related hinterland industries and (b) employee requirements of the industries producing substitutes for other imported commodities, and because of the mix of its import decreases, the Gulf area would experience a net increase in employment.

Exports. Table 4 shows the geographic distribution of the effects from the decline in exports resulting from the \$0.25 per ton charge. While the distribution is somewhat different from that exhibited by the decrease in imports, the effects are straightforward. Of the areas delineated for this study, the Gulf of Mexico exports, by far, the greatest tonnage. It would, therefore, experience the largest economic effects among the areas as a consequence of the

\$0.25 charge on exports. Both its port/shipping industry and the hinterland industries supplying its exports would show the greatest decline in sales, employment and income.

Paradoxically, the Gulf would not experience the greatest decline in export tonnage shipped. The amounts exported through the Great Lakes port system would decline more than those of any other area. However, because of the nature of the products shipped and the characteristics of the Great Lakes port/shipping industry compared to those in the other areas, the absolute loss of jobs and income on the Lakes would not be as great as in the Gulf, the North Atlantic, and the Pacific Northwest.

Table 4

Economic Effects of a User Charge on U.S. Deep Water Commerce
CHANGES IN EXPORTS, 1979, BY PORT AREA
(1979 Dollars)

User Charge = \$.25 per ton of Imports, Exports, Domestic Unloadings

INDUSTRY/AREA	Direct Sales \$1000	Employ- ment Jobs	Income \$1000	Taxes \$1000	Duties \$1000	User Charge \$1000	Cargo 1000ST	Commodity Balance \$1000
Port/Shipping Industry								
North Atlantic	-2341	-182	-4182	-1092	—	19180	-337	-27038
South Atlantic	-237	-18	-423	-111	—	2715	-26	-5174
Gulf of Mexico	-3456	-268	-6173	-1612	—	37623	-618	-73071
California	-462	-36	-824	-215	—	5707	-77	-9515
Pacific Northwest	-1599	-124	-2857	-746	—	11714	-277	-21615
Great Lakes	-1501	-117	-2680	-700	—	11988	-724	-18486
Total	-9596	-746	-17140	-4476	—	88928	-2060	-154905
Hinterland Industry								
North Atlantic	-27038	-2027	-50810	-13128	—	—	—	—
South Atlantic	-5174	-394	-9709	-2501	—	—	—	—
Gulf of Mexico	-73071	-4441	-117729	-30362	—	—	—	—
California	-9515	-630	-15873	-4231	—	—	—	—
Pacific Northwest	-21615	-1506	-36887	-9333	—	—	—	—
Great Lakes	-18488	-1288	-32494	-8506	—	—	—	—
Total	-154905	-10286	-263506	-68059	—	—	—	—
Total								
North Atlantic	-29379	-2209	-54992	-14220	—	19180	-337	-27038
South Atlantic	-5411	-412	-10132	-2612	—	2715	-26	-5174
Gulf of Mexico	-76527	-4709	-123902	-31974	—	37623	-618	-73071
California	-9977	-666	-16697	-4446	—	5707	-77	-9515
Pacific Northwest	-23214	-1630	-39744	-10079	—	11714	-277	-21615
Great Lakes	-19989	-1405	-35174	-9206	—	11988	-724	-18486
Total	-164501	-11032	-280646	-72535	—	88928	-2060	-154905

Industrial Sector Impacts

Tables 5(a) and 5(b) show the impacts that the \$0.25 per ton charge would ultimately have on the various sectors of the economy. The 30 sectors shown in the table are aggregations of the original 476 sectors of the input-output model.

Within the effects on the port/shipping industry (Table 5(a)), the largest direct impact of

the charge falls upon the Deep Sea and Great Lakes water transportation sectors, composed primarily of the carriers. The insurance sector also experiences a decline in direct sales as a result of the decrease in the separate commodity insurance that would be taken out by shippers. However, as the effects of these cutbacks in sales are transmitted throughout the economy,

Table 5(a)

Economic Effects of a User Charge on U.S. Deep Water Commerce
ALL COMMERCE, TOTAL U.S., 1979 BY INDUSTRY/PRODUCT SECTOR
(1979 Dollars)
User Charge = \$.25 per ton of Imports, Exports, Domestic Unloadings

Port/Shipping Effects

INDUSTRY/ PRODUCT	Direct \$1000	+Indirect \$1000	+Induced \$1000	Employment Persons	Income \$1000	Taxes \$1000	Duties \$1000	Tonnage K Tons
Food and Feed Grains	0.0	-22.92	-803.16	-13.20	-394.04	-66.57	0.63	-473.04
Oil Bearing Crops	0.0	-9.22	-202.87	-2.15	-118.00	-19.76	0.0	-48.37
Agriculture nec.								
Forestry, Fisheries	0.0	-144.72	-3932.57	-78.12	-1196.02	-242.99	-17.11	-7.97
Metal Ores	0.0	-127.13	-298.67	-3.37	-126.80	-39.04	-2497.04	-1358.03
Coal	0.0	-169.02	-566.21	-6.71	-292.11	-58.81	-152.34	-566.26
Crude Petroleum & Natural Gas	0.0	-4305.09	-7102.59	-29.43	-4078.20	-863.61	-910.83	-236.22
Minerals nec.	0.0	-41.96	-153.29	-1.92	-84.25	-18.22	-2751.93	-5376.71
Construction	0.0	-1225.28	-2878.49	-41.65	-1631.85	-313.22	0.0	0.0
Food and Tobacco Products	0.0	-209.33	-8237.85	-60.54	-1805.09	-665.44	-377.87	-77.70
Textiles and Apparel	0.0	-267.60	-3684.99	-95.31	-1138.92	-227.29	-47.21	-0.30
Wood, Lumber and Furniture	0.0	-221.31	-1252.87	-25.62	-421.70	-83.02	-355.80	-142.58
Paper and Publishing	0.0	-687.13	-3865.32	-62.47	-1527.70	-298.13	-93.63	-17.46
Chemicals, Plastics, Drugs, Paint, Rub'r	0.0	-949.68	-4929.59	-50.11	-1691.08	-360.79	-306.52	-75.75
Petroleum Refining	0.0	-6488.91	-10071.84	-12.21	-815.14	-518.87	-2902.25	-986.56
Leather and Footwear	0.0	-5.97	-456.81	-12.87	-163.06	-34.68	27.60	-0.10
Glass, Stone and Clay	0.0	-135.14	-644.70	-12.18	-302.91	-60.82	-527.00	-110.38
Metals Manufacturing	0.0	-2574.14	-5987.76	-66.32	-2007.47	-416.14	-941.87	-30.86
Machinery and Appliances nec.	0.0	-1531.44	-3943.75	-66.69	-1698.98	-333.42	-60.27	-2.81
Shipbuilding & Boatbuilding	0.0	-1877.70	-1968.12	-48.90	-762.63	-159.85	-2.01	-0.01
Transportation Equipment	0.0	-273.21	-3649.04	-31.32	-1067.73	-221.07	-135.31	-0.89
Instruments & Misc. Mfg.	0.0	-402.88	-1482.09	-30.53	-611.66	-120.80	-39.70	-0.20
Transportation, Com- munication, Utilities	0.0	-3657.07	-11322.76	-177.64	-6005.97	-1567.06	0.0	0.0
Insurance	-116.65	-1793.78	-4386.42	-102.36	-1777.33	-522.37	0.0	0.0
Trade, Finance & Services nec.	0.0	-8253.09	-48693.09	-1468.69	-28466.07	-8844.44	0.0	0.0
Ordnance, Gov't Enter- prises, Dummy Ind.	0.0	-4264.76	-6302.59	-154.91	-1413.90	-284.19	-0.03	0.0
Deep Sea Foreign Trans.	-16889.64	-16889.64	-16906.94	-102.66	-5281.51	-1151.11	0.0	0.0
Deep Sea Domestic Trans.	-11973.46	-11946.78	-11966.04	-41.82	-4457.10	-971.46	0.0	0.0
Great Lakes Trans.	-10148.48	-10134.48	-10137.42	-50.84	-3923.38	-855.10	0.0	0.0
Inland & Local Trans.	0.0	-655.09	-666.82	-54.00	-205.81	-44.86	0.0	0.0
Water Trans. Services	0.0	-15267.32	-15329.54	-362.87	-3727.94	-812.55	0.0	0.0
Total (inc. Directly Allocated)	-39128.22	-94531.13	-191819.56	-3267.37	-77193.44	-20175.36	-12146.81	-9511.91

local water transportation and water transportation services—i.e., deepwater port services such as tugs, dock operations, stevedoring and chandlery—show significant indirect sales losses, as do the trade, finance and other services sectors. Because of the significant fuel cost component of shipping operations, crude

petroleum and petroleum refining sectors are also among those which experience the larger indirect impacts.

The total effects on sales are spread even more widely when the induced feedback, created by cuts in household consumption in response to lower incomes, works its way

Table 5(b)

Economic Effects of a User Charge on U.S. Deep Water Commerce
ALL COMMERCE, TOTAL U.S., 1979 BY INDUSTRY/PRODUCT SECTOR
(1979 Dollars)

User Charge = \$.25 per ton of Imports, Exports, Domestic Unloadings

Hinterland Effects

INDUSTRY/ PRODUCT	Direct \$1000	+ Indirect \$1000	+ Induced \$1000	Employment Persons	Income \$1000	Taxes \$1000	Charges \$1000	Exp. Bal. \$1000
Food and Feed Grains	-46813.2	-51733.3	-53059.3	-871.8	-26031.7	-4397.6	27394.3	-56333.5
Oil Bearing Crops	-11539.5	-16345.3	-16673.6	-177.0	-9698.1	-1624.0	5725.9	-11976.0
Agriculture nec.								
Forestry, Fisheries	-1913.6	-11751.8	-18187.9	-390.3	-6514.6	-1261.7	2077.1	-2944.6
Metal Ores	15807.4	17148.1	16861.6	166.5	6965.8	2171.0	35133.3	13168.6
Coal	-9066.3	-10653.2	-11319.7	-134.4	-5829.4	-1173.6	23593.4	-19445.9
Crude Petroleum & Natural Gas	1670.3	-27617.1	-30980.2	-129.2	-17372.6	-3676.6	19916.7	19912.6
Minerals nec.	4025.0	2433.8	2248.7	44.3	1812.0	357.3	22561.7	-2614.9
Construction	0.0	-4797.2	-7525.6	-108.9	-4266.3	-818.9	61.7	0.0
Food and Tobacco Products	-9986.9	-12785.4	-26427.8	-155.1	-4720.5	-1645.8	10560.0	-11720.2
Textiles and Apparel	564.4	251.4	-5557.0	-137.7	-1673.4	-334.3	509.0	399.4
Wood, Lumber and Furniture	-6874.7	-9353.9	-11101.1	-159.0	-3219.7	-606.5	8819.1	-8791.8
Paper and Publishing	-3783.0	-6506.8	-11883.5	-161.5	-4454.1	-870.3	2390.3	-4576.9
Chemicals, Plastics, Drugs, Paint, Rub'r	-10391.7	-26940.3	-33597.5	-269.6	-11449.8	-2374.8	11218.4	-8894.1
Petroleum Refining	-32957.5	-42658.3	-46721.7	-55.2	-3763.2	-2399.8	147568.8	23817.1
Leather and Footwear	415.6	520.9	-245.6	-5.9	-84.4	-18.1	134.6	348.6
Glass, Stone and Clay	3317.4	3092.5	2233.1	19.6	1034.2	211.8	3747.1	2654.4
Metals Manufacturing	10837.5	10518.8	4792.2	22.1	1194.9	273.4	7308.0	9299.5
Machinery and Appliances nec.	342.5	-2059.7	-6108.1	-95.8	-2617.2	-508.8	1842.4	70.0
Shipbuilding & Boatbuilding	10.4	-225.0	-378.1	-8.5	-135.9	-28.6	20.6	7.2
Transportation Equipment	1716.8	1429.1	-4307.4	-38.2	-1320.8	-274.0	1459.0	1453.6
Instruments & Misc. Mfg.	454.0	187.4	-1642.7	-31.5	-716.9	-141.6	329.6	349.8
Transportation, Com- munications,								
Utilities	-19350.4	-31136.9	-43986.0	-763.9	-23503.0	-5748.5	71.8	0.0
Insurance	0.0	-1761.5	-6159.8	-143.7	-2495.9	-733.6	14.2	0.0
Trade, Finance & Services nec.	-10248.9	-37168.3	-105634.6	-2976.6	-60788.5	-20657.2	349.6	0.0
Ordnance, Gov't Enter- prises, Dummy Ind.	-1.3	-1498.0	-4943.7	-236.4	-2013.9	-419.5	3399.1	-1.8
Deep Sea Foreign Trans.	0.0	0.0	-29.5	-0.2	-9.2	-2.0	0.9	0.0
Deep Sea Domestic Trans.	-860.7	-858.4	-891.1	-3.1	-331.9	-72.3	0.7	0.0
Great Lakes Trans.	-250.6	-250.3	-255.3	-1.3	-98.8	-21.5	0.1	0.0
Inland & Local Trans.	-1191.8	-1222.7	-1242.7	-15.1	-453.6	-98.9	0.4	0.0
Water Trans. Services	0.0	-1122.3	-1228.2	-29.1	-298.7	-65.1	1.1	0.0
Total (inc. Directly Allocated)	-126065.9	-262860.5	-423942.8	-6846.1	-182851.9	-46958.2	336846.9	-55816.3

through the system. The initial impacts of the decline in port traffic are experienced most directly by the deep water transportation sectors. However, when the *full* set of effects has been estimated, the largest absolute losses in employment and income are shown in the wholesale and retail trade, finance and services sectors, reflecting the extent of these sectors' contributions to the production and distribution of goods and services in the economy.

Among the hinterland industries (Table 5(b)), the net effects of the impacts generated by the \$0.25 per ton charge are distributed quite unevenly and in some instances in opposite directions. The first column in the table shows the net direct effects on the various sectors from the changes in imports and exports resulting from the charge.

Again, in the 30-sector aggregation, shown in Table 5(b), of the original 476-sector breakdown, the sector composed of trade, finances and other services would experience the largest decrease in employment, income and tax payments as the full impacts work through the system (column 3). The agricultural sectors, petroleum and chemical sectors, and coal mining also experience declines. These declines are small, however, relative to the magnitudes of the national output, employment and income totals for the individual industries. Only in the cases of the water transportation sectors do the percentage losses approach one percent or more of the original national levels of sector employment and income.

Conclusions

This analysis demonstrates quite clearly that levying a charge on waterborne imports and exports and on coastal and Great Lakes deepwater unloadings does not result simply in a straightforward increase in government revenues. The analysis shows that the imposition of a user charge can be expected to cause (1) declines in the sales transactions of the carrier, port, and supporting industries supplying the deepwater transportation services, and (2) a variety of adjustments in the sales of those hinterland industries which produce goods that are exported and those which consume or displace goods that are imported. On balance, it was shown that the port/shipping industry and the hinterland industries would experience declines in sales, employment, and income. It

was also shown that, as a result, customs duties collections would decrease, as would federal, state and local income and indirect business tax collections. Additionally, there would be an initial decline in the commodity balance of trade (the estimated decrease in the value of U.S. exports exceeds the estimated decrease in the value of imports). The ultimate advisability of such a levy, its magnitude, and its timing depend on the importance attached to the additional revenues collected by the user charge relative to the importance of the changes effected in the measures of economic performance.

FOOTNOTES

¹The tonnage is a levy per net registered ton of a foreign trade vessel upon each entry it makes into any U.S. port, up to five in any one year. Light money charges are similarly levied upon the net registered tonnage of foreign trade vessels but is so called because it is supposedly compensation for maintenance of navigation aids. In fiscal year 1982, total tonnage tax and light money collections by Customs were approximately \$14 million. (Communication from the Bureau of Customs).

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