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Executive Summary

The inland waterways system in the United States is made up of over 25,000 miles of lakes, rivers, and canals as well as the locks and dams that allow ships to traverse them. The system reaches from the ocean into 35 states, to points as far inland as Oklahoma. In 1997, the last year for which comprehensive data are available, over 1,110 million tons of cargo were carried over the nation's inland waterways. In addition to this, thousands of passengers were carried on river cruise vessels, and countless individuals used the waterway system for recreational pursuits.

The federal government imposed a fuel tax on the system in 1978. The rate of the tax had risen from 4 cents per gallon to over 24 cents per gallon by 1997. In FY 1997, the tax generated $108 million in revenue for the federal government which was earmarked for the Inland Waterways Trust Fund.

Some proponents of excise taxes view the inland waterways tax as a user fee; but the justifications most often cited for user fees do not apply to the inland waterways tax. There are no negative externalities to account for, the market is not dominated by a monopoly supplier or monopsony buyer, and the tax is collected from only certain users of the system. Therefore, the imposition of the inland waterways tax simply leads to a reduction in demand for waterborne transportation services, and either reduces interstate trade and commerce, or moves that trade to truck and rail modes. There appear to be no offsetting benefits.

Empirical analysis finds that for a nominal increase of one cent in the tax rate there would be a 15,000 ton drop in cargo volumes. This leads to unintended consequences such as increased air pollution, higher energy use, and more traffic accidents.

Introduction

The inland waterways system in the United States is made up of over 25,000 miles of lakes, rivers, and canals as well as the infrastructure needed for ships to traverse them. The system reaches from the ocean into 35 states, to points as far inland as Oklahoma.[1]

In 1997, the last year for which comprehensive data are available, over 1,110 million tons of cargo were carried over the nation's inland waterways. In addition to this, thousands of passengers were carried on river cruise vessels, and countless individuals used the waterway system for recreational pursuits.

The most common way to transport commercial products on the rivers and canals is by tow—consisting of a towboat and one or more barges. Barges can be specialized to carry dry or liquid cargoes, as well as heavy machinery or "project" cargoes. In addition, limited amounts of general cargo is carried over the nation's inland waterway system either in containers or in special LASH barges.[2]

According to the Army Corps of Engineers (COE), water transportation is the most efficient and cost effective way for transporting large amounts of goods from one place to another. For example, one standard 1,500-ton barge can transport as much wheat as 15 rail cars or 58 tractor trailer trucks (COE: 1998). In addition, barges are much more energy efficient than other means of transportation and create less air pollution per ton mile carried.

In 1978, Congress passed the first excise tax on users of the nation's inland waterway system—a fuel tax that went into effect in October 1980. At that time, the rate was 4 cents per gallon; however, it has risen steadily and now exceeds 24 cents per gallon. In FY 1997, the tax generated $108 million in revenues for the federal government which was earmarked toward the Inland Waterways Trust Fund.

While excise taxes are relatively easy for governments to impose, they may not represent sound economic policy. In fact, the imposition of an excise tax has a number of implications for the economy, some of them expected, and others unexpected. Excise taxes can introduce inefficiencies into the economic marketplace and reduce net consumer benefits. In addition, these taxes may modify consumer (and business) decisions, discouraging them from certain (often more optimal) activities while encouraging others.

This paper will build on government studies of the costs and benefits of the nation's inland waterways system, as well as an extensive literature on tax policy to determine the impact of the Inland Waterways Trust Fund tax on shipping, on energy consumption, commodity prices and pollution.

[1] See Appendix A for a map of the principal waterways of the inland waterway system, reprinted from www.mvr.usace.army.mil/navdata/ww90.gif. This site presents other useful maps, including www.mvr.usace.army.mil/navdata/w-way4.gif and www.mvr.usace.army.mil/navdata/waterway.gif.

[2] Lighter Aboard Ship (LASH) barges are specialized unitary cargo vessels which ply the inland waterways and are then loaded onto ocean freighters.

Literature Review

The United States Government promotes the use of the nation's inland waterway system through the Department of Transportation's Maritime Administration (MARAD). At the same time, it imposes specialized excise taxes on certain users of the system.

Generally speaking, output and economic well-being or utility are maximized when economic decisions are guided by prices and are free from distorting influences. In other words, the highest output levels occur when prices guide individuals' purchasing decisions. According to McGowan, both market imperfections and government policies—such as excise taxes—can distort the price signals guiding both producers and consumers (McGowan: 1987). Faced with a full array of options, consumers will maximize their utility through their purchasing decisions. When an excise tax is introduced and passed forward either through higher prices or lower output, consumers will generally reduce their purchases of the taxed good and either increase their rate of saving or increase their purchases of other substitute products. Thus when a tax is imposed on the waterborne transportation sector, shippers will substitute rail, truck or air transport (McGowan: 1997)

This substitution effect may not always occur. According to a report by the US Chamber of Commerce presented by McGowan (1987), taxes imposed on inelastically demanded products such as cigarettes, beverage alcohol or gasoline reduce the consumption of other products, resulting in losses across a broad economic sector.

Proponents of excise taxes often argue that they can have a positive effect by eliminating market imperfections or by discouraging behavior which may impose negative externalities or "social costs." While this may be one reason to impose certain specific taxes, there are many problems associated with such a system. In the case of the inland waterways tax, such an argument would be particularly inappropriate.

A report produced by the Maritime Administration (MARAD) finds that the inland waterway system produces a number of positive externalities or "social benefits." These range from lower energy consumption to reduced pollution, congestion and accident rates (MARAD: 1994).

According to MARAD, the companies that make up the barge and towing industry have a reputation for strong environmental stewardship. This is enhanced by the energy-efficient nature of the system which results in significantly less air pollution than alternative transportation means. In fact, according to MARAD, air pollution resulting from water transport is far less than truck and is comparable to, or less than, rail for the same volume and distance shipped. For example, in transporting one million tons of cargo over the same distance, diesel trucks would produce 26,500,000 cubic feet of emissions, rail 7,440,000 cubic feet and water just 5,600,000 cubic feet (MARAD: 1994).

Waterborne commerce also reduces the number of accidents on the nation's transportation system. Water transport has the fewest numbers of incidents, fatalities and injuries of any surface mode. One study reported by the COE found that in the State of Minnesota alone, shifting all of the cargo carried over the inland waterway system to trucks would increase accidents nearly 6,000 percent per year. A shift to rail transport would increase accidents by 290 percent (COE: 1998). The nature of water transport, with slower speeds, and less vibration when compared to other modes reduces the number of chemical spills—many of which involve hazardous chemicals.

The inland waterway system also serves as a means of flood control for the nation's river valleys and coastal areas. According to the National Waterways Association, in 1994, this flood control system prevented $17 billion in property damages (Waterways: 1998).

The inland waterway system relies on nature for its right-of-ways and for the most part has little impact on congested urban areas. On the other hand, the other surface modes of transportation compete with non-transportation uses of land, and lead to more congestion on the road and rail networks. One study by the Port Authority of New York and New Jersey found that the regional port system—much of which consists of inland waterways and barge transport—eliminates as many as 2,800 trains per year from the metropolitan region,[3] and approximately 1 million interstate truck trips (Dunham: 1995). The COE reported that the inland waterway system in Minnesota alone reduced the number of heavy trucks on the road by 1,333 per day (COE: 1998).

In addition to the positive externalities provided by the inland waterway system, there are a number of private benefits that result from the use of waterborne transportation. Energy is one of the principal component costs of the provision of transportation services. According to MARAD, in 1991, 65 percent of all petroleum products in the form of either distillate or residual fuel were consumed by the commercial freight transportation sector. Fuel consumption and the associated costs are significantly lower per ton-mile for shipping by barge than by any other mode.

According to MARAD, a barge can carry one ton of cargo about 514 miles on a gallon of fuel. The same ton would travel only 202 miles by train and just 59 miles on a truck (MARAD: 1994). These lower costs can be translated directly into lower consumer prices. One study of the New York region found that the existence of the seaport and waterborne transportation infrastructure reduced consumer costs in the region by as much as $475.8 million when compared to the next lowest cost option (Dunham: 1995). This figure, of course, assumed that alternative capacity would be available to handle the increased cargo volumes.

With all of these positive benefits emanating from the inland waterways system, it seems strange that the federal government would impose an excise tax on its operations. One public finance principle that may apply is that the tax serves as a form of payment by individuals for the benefits that they receive from the government in maintaining the system. This "benefits" principle was the original basis for the gasoline and diesel fuels excises as the revenues were "earmarked" and deposited into the Highway Trust Fund. In theory, charging users for specific services provided by the government is sound tax policy. However, it is difficult to see how the principles that guide user fees apply to government-run transportation "trust funds" (McGowan: 1997).

[3] This would require over 139,750 rail cars.

The Case for User Fees

Generally speaking, the economy of the United States runs on market principles. However, there are cases where the most reasonable approach is large-scale public investment. In those cases there are no market prices, and another mechanism must be developed to pay for the provision of the product.

Many government-provided services such as national defense, public education, fire protection or access to courts are paid for out of general tax revenues. Other services may be produced by the government but benefit a smaller segment of society. Services such as building inspections, on-street parking, or maintenance of national parks may fall into this category. These types of services are generally funded through user fees—which are charges imposed by a government entity for providing current services or for the sale of products in connection with general government activities.

In a recent publication, the National Conference of State Legislatures (NCSL) developed a list of five principles to guide governments considering the imposition of a user charge (NCSL: 1999). Modified to reflect the federal nature of the inland waterways system, they are:

♦ User charges may be appropriate when government is performing a service that narrowly benefits an individual taxpayer, or for certain government activities that compete directly with private sector providers.

♦ User charges may be appropriate to provide market-based incentives to encourage or discourage the use of public resources.

♦ Policymakers need to consider the impact on low- and moderate-income citizens of shifting reliance from broad-based taxes to user fees.

♦ User charges may not be appropriate to fund services when governments have a constitutional obligation to provide those services to all citizens.

♦ User charges should cover the cost of the services provided. They should not be used to generate excess revenues that are diverted to unrelated programs or services.

Considering these five principles, clearly the first two speak to the decision process determining whether a user fee is appropriate or not. The latter three of the five principles are intended to guide policymakers in setting the amount and structure of a user fee, once it has been determined that a user fee is appropriate.

In examining the inland waterways system, and the inland waterways tax, it is clear that the first two principles are not satisfied. The inland waterways system benefits a large number of taxpayers—not only those using barges for commerce. The system provides flood control, water for irrigation, habitat for wildlife and recreational opportunities. None of the users of these benefits pay the inland waterways tax. Thus, the tax violates the first principle.

The inland waterways system is not constrained, so there is no reason to discourage its use. In fact, the government has stated that increased use of the system would be appreciated (MARAD: 1994). There is no failure of the market to develop a price mechanism to ration users and so the tax fails on the second principle.

Aside from such constraints, a user fee may also be needed under the second NCSL principle if market imperfections are distorting prices and government tax policies can serve as a corrective measure. This is often the case were there are monopoly producers or monopsony purchasers. There are currently thousands of firms operating over 34,050 vessels, tow boats and barges on the nation's rivers, lakes and canals (COE: 1996). These firms carry cargo for a large number of customers in a wide variety of industries, so the probability of market imperfections is not high. In addition to the inland waterways tax, there are 116 user fees, taxes or assessments specifically levied on the maritime industry (AAPA: 1993).

Therefore, the reasons cited by proponents of excise taxes do not apply to the inland waterways tax. There are no negative externalities to be accounted for, the market is not dominated by a monopoly supplier or monopsony buyer, and those paying the tax are not the only beneficiaries of the system.

The remaining principles do generally apply in the case of the inland waterways tax. The amount collected since the tax went into effect, approximately $1.1 billion (OMB: 1999), is just about what has been appropriated for the inland waterways obligations incurred by the Corps of Engineers (FPSi: 1999). See Table 1.

Table 1
Inland Waterways Tax Collections vs. Corps of Engineers Obligations, 1982–1999
($Thousands)

Year	Collections	Appropriations
1982	$ 20,399	–
1983	29,925	–
1984	28,846	–
1985	38,530	–
1986	40,357	–
1987	40,302	$ 34,000
1988	48,334	71,000
1989	48,054	69,000
1990	47,020	121,000
1991	62,820	147,000
1992	60,483	113,000
1993	69,866	88,000
1994	78,615	52,000
1995	88,416	88,000
1996	103,000	80,000
1997	108,000	84,000
1998	96,000	82,000
1999	116,000	73,000
Totals	$1,124,967	$1,102,000

In addition, there is no constitutional obligation to provide for an inland waterways system, and there is no significant negative impact on low-income people from the use of the system for commercial purposes.

Even though these three principles are satisfied, these principles only guide policy makers in the design of a user fee once it has been determined that such a fee is necessary or appropriate under the first two principles. As noted above, the inland waterways tax does not satisfy the first two NCSL principles—the inland waterways system does not exclusively benefit the taxpayers and there is no need for a user charge to proxy market-based incentives. In other words, the tax is not appropriate, but if it were appropriate, then it could be said to be well designed.

The imposition of the inland waterways tax leads to a reduction in demand for waterborne transportation services, a reduction of interstate trade and commerce, or a move to truck and rail modes. The following analysis will examine the impact of the tax and the perverse effects that may result from it.

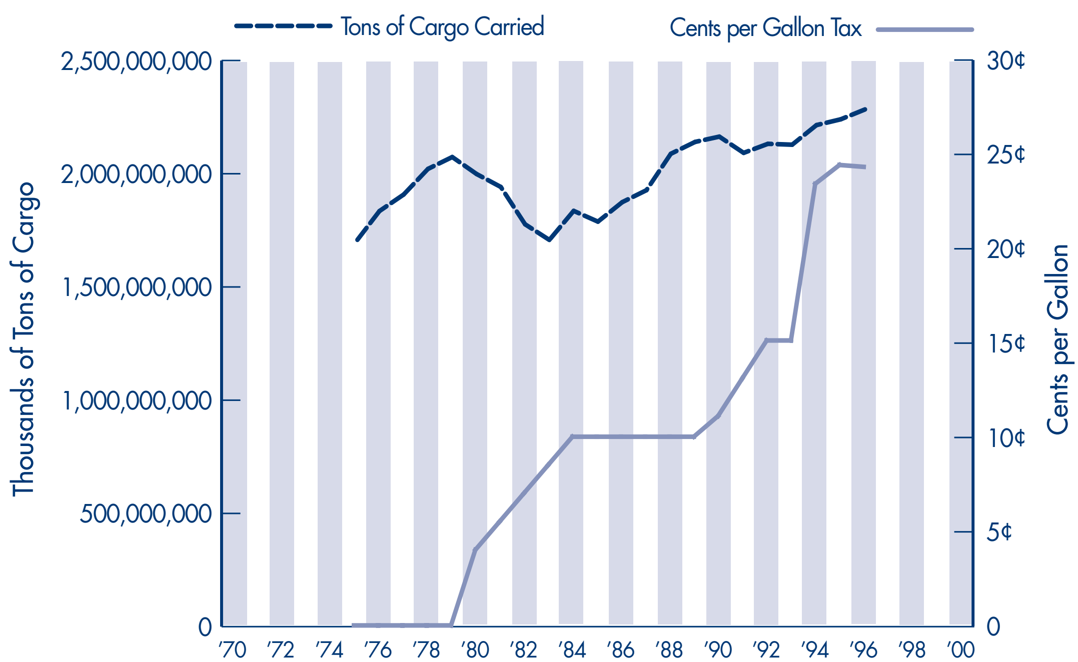
Hypothesis

The volume of cargo transported on the inland waterways system serves as a proxy for demand (D). Actual demand will be either the number of vessels moving over the system, or ton-miles carried. However, an accurate data series of either is unavailable.

The volume of cargo being moved over the system is related to a number of exogenous factors. The most important of these are: Total domestic output (Y), the weather (W), and net exports (X–M). Since the inland waterways system is mainly used to transport bulk cargoes such as fuel, grain and sand, volumes are extremely variable and dependent on the demand for electricity and raw materials. This demand is modeled using total domestic output or GDP. Since grain is a major commodity transported on the system, and since most of this is dependent on the export market, net exports are another important factor to be included in the model.

Finally, the weather should be an important factor influencing the amount of cargo transported over the system. Not only is the amount of rainfall important (both too much or too little rain can make parts of the system unusable during part of the year) but also, cold weather increases the demand for fuel such as oil and coal in the mid-western part of the country. A weather variable (W) is developed that is a function of deviation from the average rainfall in Pittsburgh, Minneapolis, Tulsa, Chicago and Kansas City.[4] Equation 1 shows

Figure 1
Cargo Carried on the Inland Waterways vs. Tax on Fuel
1975–1996



[4] This data was obtained from the National Climatic Data Center, http://www.ncdc.noaa.gov

the construction of the weather variable.

Equation 1

$$W = \frac{S\,(P - \bar{P})}{5}$$

Like users of any normal good, transportation companies that utilize the inland waterways system will reduce their consumption when prices rise. The tax on energy serves as a proxy for the price of using the system. As the energy tax rises, it is likely that either system-wide cargo volumes or the number of vessels (or both) will fall. Therefore, the use of the inland waterways system is a function of a number of variables. Equation 2 below presents a testable set of variables.

Equation 2

$$D = f\,(Y, X, W, T)$$

It is hypothesized that as T rises, D will fall. In addition, the value of D should rise as Y, (X–M), and W increase.

Data and Methods

The above hypothesis will be tested using data from the federal government for the period 1975–1996 (see Figure 1). During this 20-year period, the inland waterways tax was raised by over 500 percent in nominal terms. Cargo volumes over the system (D) fluctuated from between 1.7 billion and nearly 2.3 billion tons. Figure 1 graphically depicts both the cargo tonnage and the tax rate (COE: 1999).

The data was analyzed using ordinary least squares multiple regression techniques, controlling for inflation by adjusting the values by CPI-U. In order to determine if the tax variable was relevant, the equation was initially run without the tax variable. A second regression equation included the tax variable. The tax variable was NOT adjusted for inflation in order to determine if the magnitude of the tax was a factor in the volume of cargo shipped. Finally, a third equation was run using the tax variable also adjusted for inflation. The regressions were run using Microsoft's Excel 97 software.

Analysis

The results of the regression equations are presented in Appendix B. As the figures show, most of the variability in cargo tonnage can be explained by changes in GDP and the value of US exports. According to regression equation 1, nearly 87 percent of the variance is explained by these two variables, both of which are significant at the .05 confidence level, and both of which have the expected sign.

Interestingly, the weather variable is insignificant at the .05 level. We tried a number of different derivations of the weather proxy, including differing the cities used, using the absolute value of rainfall, and constructing an index to determine the degree of drought,[5] but all were insignificant. This variable was, therefore, removed from the analysis in regression equation 2.

When the tax variable is added to the equation, the R^2 rises substantially, to over 0.96, indicating that the variable adds explanatory power to the equation. Again, the sign is as expected (negative) and the t-statistic indicates that it is significant at the .01 level. This indicates that for a nominal increase of one cent in the tax rate there would be a 15,000-ton drop in cargo volumes. Since each barge carries about 1,500 tons of cargo, this indicates that a one-cent increase in the tax would reduce the number of barges on the system by 10. The inflation adjusted value is shown as regression equation 4 (see Appendix B). It is also negative and significant.

Taking the result from equation 3—that a nominal increase of the tax of one cent would reduce the cargo carried on the system by 15,000 tons, we can easily see that there are negative consequences associated with the tax.

For example, assuming that the milage for carrying the shifted cargo by either rail or

[5] Standardized precipitation index.

truck would be approximately the same as by barge, this tax increase could lead to an additional 4,550 trucks traveling on the nation's highways (or an additional 3,120 rail cars or some combination of the two). Taking the highway example as an extreme, the one-cent increase in the inland waterways tax could lead to an increase in carbon monoxide emissions of 17 pounds per 1,000 miles that the cargo is moved, an increase in hydrocarbon emissions of 5.4 pounds per 1,000 miles, and an increase in nitrous oxide emissions of 96.4 pounds per 1,000 miles (COE: 1998).

The additional air pollution is produced because trucks and rail are much less energy efficient than barge tows. Were the cargo diverted by the hypothetical one-cent tax increase to be shifted from barge to truck, an additional 225,000 gallons of fuel would be consumed (DOT: 1994). According to the Department of Transportation, the use of energy by the different modes of transportation has become an increasing concern in setting transportation policy, and as much as 65 percent of the fuel consumed in the country was used by the commercial freight sector.[6]

Conclusions

The amount of literature on the benefits and costs of the inland waterways system is limited—and for the most part polemic. However, according to government sources (DOT: 1994), use of the inland waterways system leads to a number of positive externalities including increased national energy efficiency, less pollution, reduced congestion in cities and on the nation's highways and less personal injury accidents and hazardous spills.

The imposition of the inland waterways tax, rather than being a market enhancing mechanism or even a user fee, reduces the amount of cargo carried over the inland waterway system—shifting the volumes to either truck or rail. The tax shifts approximately 15,000 tons per penny which equates to an additional 4,550 trucks traveling on the nation's highways (or an additional 3,120 rail cars or some combination of the two). This seems to be incongruent with the policies being promoted by the Department of Transportation and other federal agencies, and illustrates the perverse nature of the inland waterways tax and of excise taxes in general.

[6] 1991 figures.

Appendix A: Principal Waterways of the Inland Waterways System

Appendix B: Regression Results

Equation	Regression Results	R^2	F-Statistic
1) Includes Weather Variable	D = 793,285.18 – 22,388.8(W) + 44.48(Y) + 1,774.45(M) (4.061)** (–1.023) (2.549)* (4.404)**	87.02	40.24 **
2) No Tax, No Weather	D = 816,425.72 + 40.837(Y) + 1,914.65(M) (3.829)** (2.388)* (5.047)**	86.27	59.699**
3) Nominal Tax	D = 64,003.15 + 82.253(Y) + 2,738.11(M) – 15,003.19(T) (0.4098) (7.583)** (11.726)** (–7.010)**	96.32	157.03**
4) Real Tax	D = 258,244.1 + 76.432(Y) + 2,314.52(M) – 17,228.57(Tr) (1.662) (6.570)** (9.955)** (–6.081)**	95.55	127.49**

* Statistic Significant at .05
** Statistic Significant at .01

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